

# Recognition and Management of Sporting Emergencies: an Introduction

PY-4019  
Impairment  
and Disability

## Sports Group

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15/04/13



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# Chpt 1: Introduction

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Welcome to our course on sports physiotherapy. We have chosen to look at the immediate sporting event. This is a vital component of work for anyone looking to get involved with an athlete or sports team. The physiotherapists' role can widely vary; from working as part of an advanced medical team to being the sole health professional at an event. Working with or without the support of doctors and paramedics, sporting events present situations far different from anything we have learned so far in college. Concussions, open fractures, spinal cord injury and sudden cardiac death must all be dealt with rapidly but effectively by a health professional. The first person to the scene will take charge of the management so it is imperative that physiotherapists be well versed. Time is invaluable and as such preparation is crucial. Decisions can affect lives, future careers and often impact the outcome of the sporting event itself. The aim of this course is provide the basic essentials necessary for a physiotherapist to be competent and confident within their role at a sporting event.

This course will take the format of a 3 hour presentation. The session will be filled with group work, case studies, quizzes, demonstrations and discussions to help facilitate the student physiotherapist in the achieve of the learning outcomes of our course. The content of the course will focus minimally on raw data, definitions and sheer information. Instead, our aim is to impart a deeper understanding of the application of different strategies. We will discuss the complexities of dealing with these intricate situations and illustrate certain issues and ideas that can be related to a much wider scope. It is rarely a case of A versus B in these situations, and even when guidelines exist, there can be debate over their interpretation. Our course is designed to give a better idea of how to remain calm, consider all the relevant issues, and ensure a high standard of care in the immediate sport setting. To supplement our teaching, we are providing this booklet as a useful resource. Whereas our course has an application focus, this booklet provides the facts, evidence and all other information required to understand, identify and most importantly, manage, a wide range of common and life-altering injuries. This will provide a source for background

knowledge regarding the injuries that a physiotherapist will need to be aware of so as to work in a sporting environment.

Our learning goals for those attending our course are:

- To know how to prepare for a sporting event.
- To be able to screen for and manage life-threatening and emergency situations within sports.
- To prepare for the practicalities and barriers that arise in a real-life emergency situation.
- To establish a basic understanding of law in physiotherapy and how it may be applied.
- To discuss and become aware of some of the ethical issues that may arise when working as a sports physiotherapist.
- To provide a model for decision making in difficult situations.
- To encourage meta-cognition and the identification of further knowledge and skills which must be developed when working in this environment.

Furthermore, we hope this booklet will provide allow participants in the course to

- Have a knowledge of most common and life-threatening situations in sport.
- Identify these situations.
- Manage these situations appropriately.
- Know what research, evidence and guidelines are available for these management strategies.

# Chpt 2: Pre Game Preparation

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## *Introduction*

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The importance of pre match preparation for the physiotherapist cannot be underestimated. In emergencies it is important that the physiotherapist know the location of the nearest AED, how far away the nearest A and E department is, what equipment is on hand etc. As such, pre match preparation is essential.

This preparation can be split into 4 separate entities, which can be easily memorised using the mnemonic P.R.E.P

**P**ersonnel-other health care professionals on site

**R**ules-sports specific rules for entering the field of play

**E**nvironment-both immediate environment (grounds) and wider (nearest A and E etc)

**P**layer history-PMHx

## *Personnel*

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You may or may not be the only health care professional on site. It is important to know what help is on hand. At larger events paramedic assistance will most likely be on-hand. At local level, you may be the only person present with any medical knowledge. The presence/absence of other health care personnel at an event may impact upon your clinical decision making. It is therefore important that prior to supervising an event, you enquire as to who will be on hand.

## *Rules*

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Each individual sport has its own rules for allowing non-athletes to enter the field of play. The physiotherapist should familiarise themselves with these depending on which sports they intend to act as a physiotherapist for. These rules can generally be found in the sport's official rule book, of which a copy can usually be obtained online on the sports' international federation page. Some of which are listed below:

### **The 2012 GAA Official Guide**

Play should not be stopped for any injured player except in exceptional circumstances-for example in the event of a player requiring on field treatment or removal from the field of play. All other injuries should be treated off the field. (GAA 2012)

### **The International Rugby Board**

The team physician and other non-playing team members can only enter the field of play with permission from the referee. They further state that these members may enter the field as play continues only if the referee has given permission. Otherwise they are unable to do so until the ball is dead. (IRB 2012)

### **International Basketball Federation**

Officials may stop play for injured players. However, a doctor may enter the court without permission if they judge an injured player to require immediate medical treatment (FIBA 2012). There is much similarity between guidelines for different sports regarding entering the field of play, however these are readily available, and the physiotherapist should familiarise themselves with these prior to working any events.

## ***Environment***

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Preparation in relation to the environment can be broadly divided into the immediate environment and the wider environment.

### **Immediate environment**

Including weather, ongoing match and interference by others present. Though these aspects cannot be controlled it is important that the physiotherapist recognises that these may interfere with their treatment. It is also important that the physiotherapist recognises that the injured player cannot be the only factor considered at a sporting event.

## Wider environment

### Equipment

The contents of the team clinician's bag will vary depending on the type of sport, the equipment which is readily available and the clinician's preference (Brunker and Kahn 2006).

#### General

- Towels
  - Cotton tip applicators
  - Gloves, sterile/nonsterile
  - Ice and Zip Line Bags, OR Instant Ice Packs
  - Heat Pack
  - Other medication (e.g., topical antibiotics, anti-inflammatory,
- antibiotics, antihistamine, antiemetic, glucagon, aspirin, cortisone, oral glucose)
  - Oral fluid replacement
  - Wattle Bottle
  - Scissors
  - Suncream
  - Foam or Bubblewrap

#### Extremities

- Tape: Kinesiotape, Zinc Oxide (Leukotape – brand name of zinc oxide, more effective but much more expensive)
- Pre-Tape Spray
- Cutter or Shears
- Elastic bandages:
- Tubigrip
- Sling
- Splints and braces

#### Head and Neck/Neurological

- Cervical collar for immobilization
- Face mask removal tool (for sports with helmets)
- Flashlight
- Nasal packing material (e.g. tampons)

#### Skin

- Alcohol swabs and povidone iodine swabs
- Bandages and gauze

- Blister care materials
- Razor and shaving cream
- Saline
- Skin lubricant (vaseline)
- Steristrips

### Optional

- Blood pressure cuff
- Stethoscope
- Oxygen (additional specific training required)
- Mini Foam Roller
- Pocket Mask for CPR
- AED
- Blanket

A labeled travel kit should contain unused syringes, blood glucose meters, lancets, test strips, alcohol swabs, insulin, insulin pump with supplies (if needed), glucagon emergency kit, and ketone testing supplies (Harris et al 2012)

(AAOS 2012)

### Access to services

It is important to be aware of:

- Access to an ambulance or a hospital
- Do the local medical centre do stitches?
- Access to nearest dentist

The significance of this knowledge is highlighted when we compare the differences between the scenarios below:

#### Scenario 1

A player is lying on the ground and requires spinal immobilisation and transport to the nearest A and E. You have limited experience in handling potential spinal cord injury patients and the hospital is only 5 minutes away. Do you move the patient or wait for more experienced personnel to arrive?

#### Scenario 2

A player is lying on the ground and requires spinal immobilisation and transport to the nearest A and E. It is snowing and the patient has already been lying on the ground for 5 minutes. Though you are comfortable in your ability to handle spinal cord injury patients you are the only person present with the required knowledge and you require the assistance of at least 4 others to safely move the player. The



paramedics are 30 minutes away. You notice he is shivering and very pale. Do you move the patient or wait for more experienced personnel to arrive?

### *Player Past Medical History*

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It is important to be familiar with the player's past medical history in the same way as one should be familiar with any patient's. Therefore, we have included an example of a screening questionnaire in Appendix A. Any illnesses you should be aware of such as asthma or diabetes are screened for in the questionnaire. The physiotherapist can then familiarise themselves with the players' PMHx and keep a record of this information on file. These should be updated regularly.

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# Chpt 3: Sudden Cardiac Death

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## Introduction

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Sudden cardiac death (SCD) is a terrifying event. It is the leading cause of death in young athletes (Kramer *et al* 2010). The speed of onset and lack of symptoms prior to occurrence make it a nightmare for health professionals. Current medical management is by way of a 2-pronged approach:

- Primary management: Screening to identify those at risk.
- Secondary management: Immediate treatment after a cardiac incident has occurred.

## Incidence

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- Reports range from 1 in 65,000 to 1 in 200,000 death annually in team based sports in America.
- In Italy, 2.3 deaths annually per 100,000, 2.1 relating to cardiovascular diseases.
- 50% of all are sudden and unexpected.

(Kramer *et al* 2010)

## Presentation

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Rapid sustained ventricular tachycardia or ventricular fibrillation presents with rapidly impaired tissue perfusion and loss of consciousness as a result of inadequate cardiac output, leading to SCD if not quickly and successfully resolved.

Other symptoms include:

- Sudden collapse
- No breathing
- No pulse

Other signs and symptoms preceding SCD include:

- Fatigue
- Fainting
- Black outs
- Dizziness
- Chestpain
- Shortness of breath
- Weakness
- Palpitations
- Vomiting

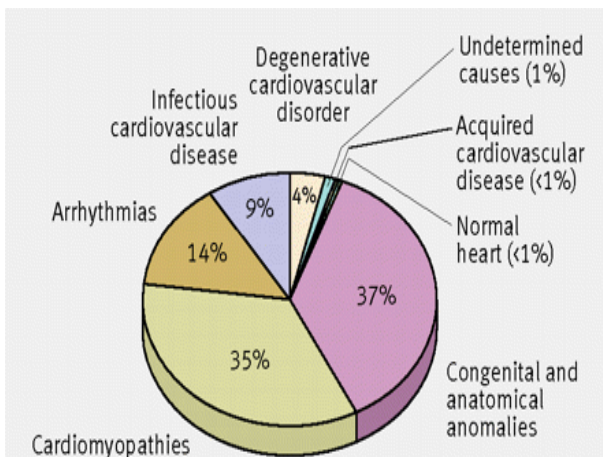
However, SCD often occurs without any warning. Sudden onset cardiac arrest may be the presenting symptom, even in those with no apparent heart disease. The initial mechanism of sudden cardiac arrest may or may not be related to arrhythmia (ACC/AHA/ESC 2006).

## Causes

**Table 3.1: Causes of sudden cardiac death (Pugh et al 2012)**

**Table 2 Causes of sudden cardiac death (SCD)**

Condition	Prevalence	Description	Investigations of choice
Hypertrophic cardiomyopathy	1 in 500 (general population)	Autosomal dominant condition. Left ventricular hypertrophy and/or septal hypertrophy. Symptoms of syncope, cardiac failure, ventricular arrhythmias and sudden death.	ECG, 2D echocardiography.
Anomalous origin of the coronary arteries		Variant site of origin of the right or left coronary artery, most commonly the left coronary artery from the right aortic sinus.	Cardiac computerised tomography.
Commotio Cordis		Blunt trauma to anterior chest wall causing ventricular fibrillation if within small time window on T-wave upstroke.	ECG, echocardiogram, cardiac computerised tomography
Myocarditis		Inflammation of myocardium. Enlargement of heart and disruption of cellular architecture. Most common cause is viral infection.	ECG, cardiac MRI, endomyocardial biopsy
Long QT syndrome	1 in 2500 (general population)	Autosomal dominant condition. Delayed repolarisation of cardiac myocytes gives the characteristic ECG appearance of prolonged QT interval. Long QT syndrome type 1 commonly causes SCD on exertion. Long QT syndrome type 2 is associated with SCD during times of autonomic arousal and stress such as loud noises. Long QT syndrome type 3 is associated with SCD during periods of rest and bradycardia.	ECG
Short QT syndrome		Gain in function of cardiac myocyte potassium channels leads to the characteristic ECG appearance of short QT interval.	ECG
Wolff–Parkinson–White	1 in 500	Ventricular pre-excitation (Delta waves), anterograde conduction of atrial fibrillation causes ventricular fibrillation and SCD.	ECG
Brugada syndrome	1 in 674	Autosomal dominant condition primarily affecting men. Presents mainly in adulthood with syncope and SCD. High mortality rate.	ECG
Arrhythmogenic right ventricular cardiomyopathy	1 in 5000 (general population)	Lipofibromatous infiltration and dysfunction of the right ventricle. Exertional pre-syncope, syncope and SCD. Most common presentation is with sustained ventricular tachycardia. T-wave inversion in V1–V3, prolonged QT interval and Epsilon waves.	ECG, cardiac MRI
Catecholaminergic polymorphic ventricular tachycardia		Abnormal intracellular calcium levels as a result of ryanodine receptor defects leads to ventricular tachycardia or ventricular fibrillation on exertion.	Exercise testing
Marfan's syndrome	1 in 5000 (general population)	Arrhythmias on exercise testing are the mainstay of diagnosis. Autosomal dominant connective tissue disorder. Commonest cause of SCD in athletes with Marfan's syndrome is aortic rupture due to weakness of the aortic wall.	Physical examination, echocardiography, ophthalmology



Limited understanding suggests that the risk of these genetic or otherwise developed abnormalities is exacerbated when intense training and competition is imposed (Wilson and Drezner 2012).

**Fig 3.1: Pie chart representing common causes of sudden cardiac death (Papadakis et al 2008)**

### **Screening**

- The International Olympics committee, FIFA, American college of cardiology/American heart association and the European heart society all recommend pre-participation screening (Wilson and Drezner 2012).
  - In the US, history and physical examination have been the standard screening tool for SCD.
  - However, considerable evidence suggests this method is unreliable with a poor sensitivity leaving athletes with undetected underlying pathologies (Asif and Drezner 2012).
  - The addition of an ECG significantly increases the sensitivity of cardiac screening significantly.
  - There are 2 major concerns with regard to the widespread use of ECG: cost and false positive results.

### **Cost**

A cost-effectiveness study by Wheeler *et al* (2010) found the addition of ECG to pre-participation screening to add 2.06 life-years with a cost of \$89 per athlete. Compared to no screening, ECG and pre-participation screening saved 2.6 life-years at a cost of \$189 per athlete. They concluded that an ECG plus subjective screen may be cost-effective. An ECG may cost as little as \$10. However, expenses can rise to \$2000 for further investigations in those who require it following finding from the initial ECG.

### False Positive Results

When initially tested, ECGs were found to give a 25% false positive rate. This could lead to athletes being excluded from sport due to a false diagnosis with no underlying pathology (Drezner *et al* 2012).

However, a recent study has shown that providing physicians with standardised ECG criteria can increase sensitivity (from 89 to 94%) and specificity (from 70 to 91%) leaving only a 9% false positive rate (Drezner *et al* 2012). Further studies have shown false positive rates as low as 2-5% (Drezner *et al* 2012).

- Whether ECG screening becomes routine or not, it is vital that we as health professionals have a knowledge of both sides of the debate on cardiac screening. This will allow us to provide an unbiased opinion if requested by an athlete if paying for a private ECG test is necessary (Morse and Funk 2012).

### Sporting Eligibility

**Table 1** Bethesda Conference #36 (BC#36) and European Society of Cardiology recommendations for participation in competitive sport

Condition	Bethesda Conference #36	European Society of Cardiology
Hypertrophic cardiomyopathy	Exclude athletes with probable or definitive clinical diagnosis from all competitive sport. Genotype-positive/phenotype-negative athletes may still compete.	Exclude athletes with probable or definitive clinical diagnosis from all competitive sport. Exclude genotype-positive/phenotype-negative individuals from competitive sport.
Anomalous origin of the coronary arteries	Exclude from competitive sport. Participation in all sports 3 months after successful operation would be permitted for an athlete without ischaemia, ventricular or tachyarrhythmia, or dysfunction during maximal exercise testing.	—
Commotio Cordis	Eligibility for returning to competitive sport in survivors is a matter of individual clinical judgement. Survivors must undergo a thorough cardiovascular work up including 12-lead ECG, ambulatory Holter monitoring and echocardiography.	—
Myocarditis	Exclude from all competitive sport. Convalescent period of 6 months. Athletes may return to competition when tests normalise.	Same as BC#36.
Long QT syndrome	Exclude any athlete with previous cardiac arrest or syncope episode from competitive sport. Asymptomatic patients restricted to competition in low-intensity sport. Genotype-positive/phenotype-negative athletes may still compete.	Exclude any athlete with clinical or genotype diagnosis from competitive sport.
Short QT syndrome	Exclude from all competitive sport except those of low intensity.	—
Wolff—Parkinson—White	Athletes without structural heart disease, without a history of palpitations or without tachycardia can participate in all competitive sports. In athletes with symptoms, electrophysiological study and ablation are recommended. Return to competitive sport is allowed after corrective ablation provided ECG has normalised.	Same as BC#36
Brugada syndrome	Exclude from all competitive sport except those of low intensity.	Exclude from all competitive sport.
Arrhythmogenic right ventricular cardiomyopathy	Exclude athletes with probable or definitive diagnosis from competitive sport.	Same as BC#36.
Catecholaminergic polymorphic ventricular tachycardia	Exclude all patients with clinical diagnosis from competitive sport. Genotype-positive/phenotype-negative patients may still compete in low-intensity sport.	Exclude all patients with clinical diagnosis from competitive sport. Genotype-positive/phenotype-negative patients are also excluded.
Marfan's syndrome	Athletes with Marfan's can compete in low-intensity competitive sport provided they do not have evidence of aortic root dilatation, moderate-to-severe mitral regurgitation or family history of dissection or SCD in an MFS relative.	Exclude athletes with full phenotype from all competitive sport. Athletes with a partial phenotype and negative family history may compete in all sports provided they attend yearly follow-up.

SCD, sudden cardiac death; MFS, Marfan's syndrome.

**Table 3.2: ESC Recommendations for participation in competitive sport (Pugh *et al* 2012)**

## *Grey Zone Athletes*

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- Sports physicians and cardiologists generally adopt a conservative approach to athletes with mild abnormalities suggestive but not definitive of cardiac myopathy.
- Includes cardiac symptom education, close observation and careful annual follow up.
- This management strategy is also provided to the athlete's family, coaching staff, team medical professional and sporting organisation with the athlete's permission. The decision regarding sporting eligibility is further influenced by athlete's past or present symptoms or cardiac disease, and family history of cardiac disease, as both are risk factors for SCD (Wilson and Drezner 2012).

## *What to Do If SCD is suspected*

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Practical management of sudden cardiac arrest on the football field:

- Prompt recognition of sudden cardiac arrest (SCA).
- SCA should be assumed in any collapsed and unresponsive athlete.
- Seizure-like activity, and abnormal breathing or gasping must be accepted as SCA until proven otherwise.
- Early activation of the emergency medical response system and call for additional rescuer assistance.
- Early CPR.
- If unresponsive and not breathing normally, begin Hands-Only (compression only) CPR—push hard, push fast.
- C–A–B (chest compressions–airway–breathing).
- Immediate retrieval of the AED or manual defibrillator.
- Application of the AED or manual defibrillator as soon as possible—while CPR continues. Stop CPR only for rhythm analysis and shock delivery if indicated.
- If no shock is delivered, CPR and life support measures should be continued until the player becomes responsive or a non-cardiac aetiology can be clearly established.

- If a shock is delivered, immediately continue CPR for 2 minutes, then allow AED to reanalyse the rhythm. On the discretion of the senior clinician on scene, transport of the SCA victim to a hospital facility capable of advanced cardiac life support, realising that effective CPR should be continued en route. Upon return of spontaneous circulation, while still in coma, rapid cooling (induced hypothermia) for SCA victims with VF arrest has been shown to improve survival and decrease neurological complications. See the below flow chart for a simple diagrammatic representation of these steps.

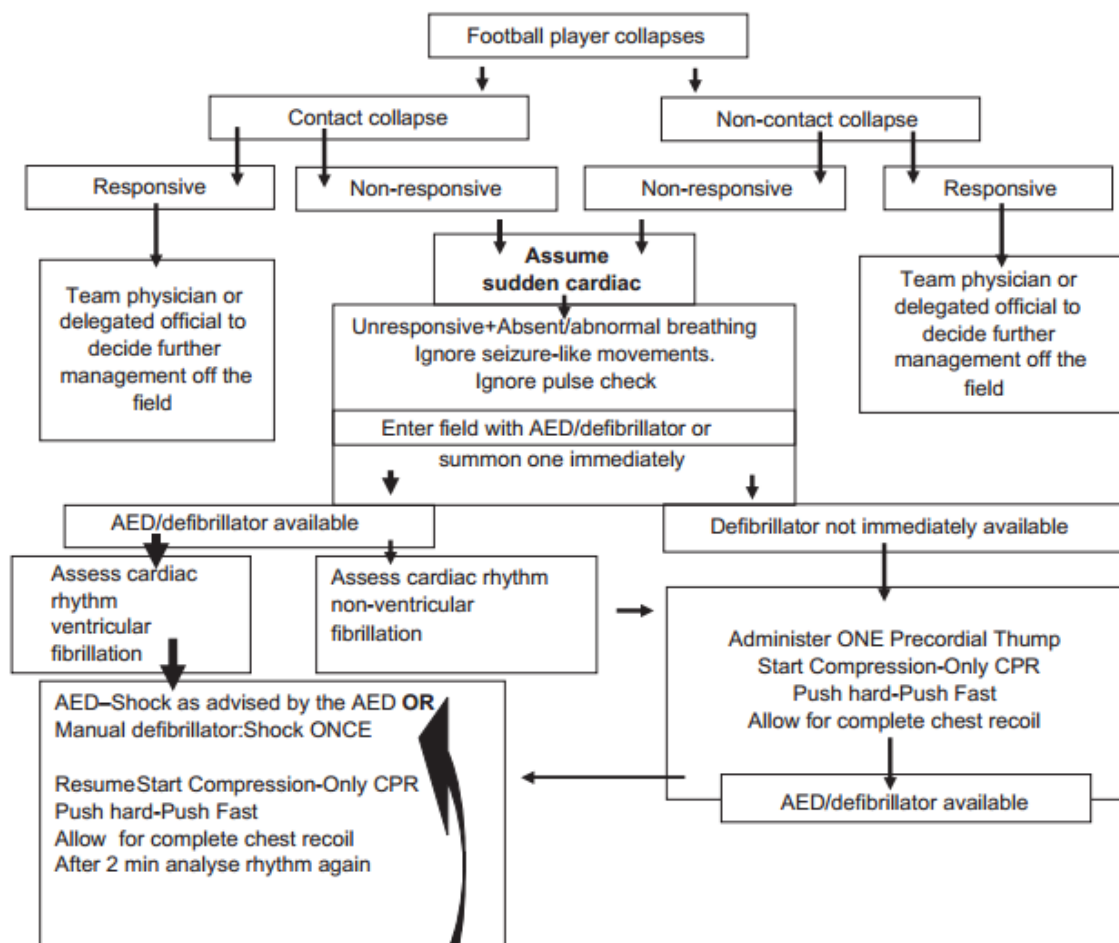
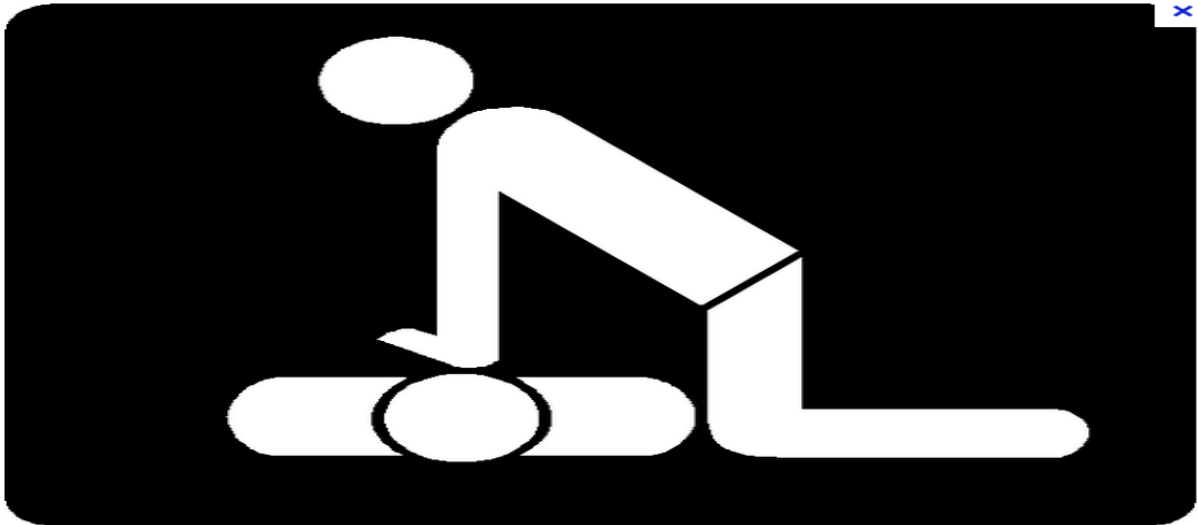


Fig 3.2. Flow chart for suspected sudden cardiac death (Kramer et al 2010)

## Guidelines for Resuscitation



1. Ensure the scene is safe and put on gloves.
2. Check for response (tap shoulders and shout). Call for help. Dial or ask someone to dial 112 or 999 and ask for an ambulance. Send someone for an AED device.
3. **C** -Check for normal breathing (less than 10 seconds). If no normal breathing, expose chest and start CPR – 30 chest compressions (at a rate of at least 100 per second)
4. **A** – Open Airway (head tilt and chin lift)
5. **B** - Breathing – If not breathing, give 2 breaths (one each second), pinch the nose, mouth to mouth or use pocket mask
6. Continue with CPR at a ratio of 30 compressions to 2 breaths until AED arrives.
7. Check for pacemakers, patches etc. before applying AED pads, in the correct place.
8. Switch on the AED and follow machine's commands. If shock is advised, make sure nobody is touching the patient.
9. Continue to follow the AED voice prompts until the ambulance arrives.
10. If breathing returns place the casualty in the recovery position and monitor closely.

(American Heart Association 2010)



## At a Glance (Kramer *et al* 2010)

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- Every team and venue hosting football training or competition should have a written emergency response plan for SCA.
- Potential responders to SCA on the field should be regularly trained in CPR and AED use, and demonstrate skills proficiency in this regard.
- Potential Responders should review prior to the match the location of the AED and details of the emergency response plan.
- Do not delay, time is crucial.
- Make sure you are aware of closest AED before any sporting event.
- May be a myoclonic like jerk in over 50% of SCD, often confused with epilepsy.
- If a player collapses without contact, assume it is SCD until ruled out.
- AED will assess for ventricular fibrillation before shocking, thereby ensuring someone who DOES NOT need a shock will not be shocked.
- Only after SCD is ruled out can you begin treating as epilepsy.
- Ensure 112/999 is called by someone else as soon as SCD is suspected.

## Examination of the Evidence:

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Drezner et al 2012	Non-randomised trial	Level 2	To determine the accuracy of ECG interpretation in athletes among different physician specialties, with and without use of a standised ECG criteria tool.	At baseline, the number of ECGs correctly interpreted was PC residents 73%, PC attendings 73%, SM physicians 78% and ciologists 85%. With use of the ECG criteria tool, every group significantly improved their accuracy (p<0.0001): PC residents 92%, PC attendings 90%, SM physicians 91% and ciologists 96%. Specificity improved from 70% to 91%, sensitivity improved from 89% to 94%	Well designed study with blinding of the participants and no pre-existing variables that may have skewed the results. Recent study that used up to date equipment.  Limitations: Small sample size No way of knowing if the tool was being used correctly.
Kramer et al 2010	Review	Level 5	To review the management of sudden cardiac arrest on the football field in order to inform healthcare professionals	Recommendations: A defibrillator should be on the sideline of the football field during a match.  Hands-only (CPR) is recommended as the initial on-field CPR technique for first responders, until defibrillation can be undertaken.  Defibrillation from potential hypertrophic cardiomyopathy, may require defibrillation sooner than the usual 3–5 min to be successful.  A player who collapses without contact must be considered a cardiac arrest until proved otherwise.	Difficult to carry out trials on management of a sudden cardiac arrest for ethical reasons, because potentially lifesaving intervention cannot be denied to anyone.  It has a large number of recent references, the vast majority of which are in the last 10 years.  Provides management flow chart that may be useful for healthcare professionals.

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Papadakis et al 2008	Clinical review	Level 5	Provides a factual overview of preparticipation screening	Discussion of common practices in preparticipation screening, the limitations of 12 lead electrocardiography, the psychological and economic impact of preparticipation screening.	No RCTs available due to the ethical and technical challenges that would be involved in carrying these out. This automatically decreases the level of evidence provided by this paper despite the fact that only the highest quality prospective or retrospective observational articles and consensus reports were included. Useful-provides additional educational resources as well as information for non-specialists and educational resources for patients. It also outlines unanswered questions and further research in this area.
Wilson and Drezner 2012	Expert Opinion	Level 5	Comment on the implementation of cardiac screening programmes for detecting the risk of sudden cardiac death in athletes.	Discussion of conservative approaches adopted by sports physicians and cardiologists for athletes with mild cardiac abnormalities (consisting of cardiac symptom education, close observation and consistent annual follow-up). Discussion of new directions and current practices in cardiac screening.	Authors opinion.

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Pugh et al 2012	Narrative review	Level 5	To review the incidence, cause, etiology and management implications of SCD, as layed out in consensus documents produced by the European Society of Cardiology and the 36 <sup>th</sup> Bethesda	Discussion of same.	Good summary of 2 of the key papers related to SCD. Provides clear recommendations on participation in sport and screening.

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# Chpt 4: Asthma

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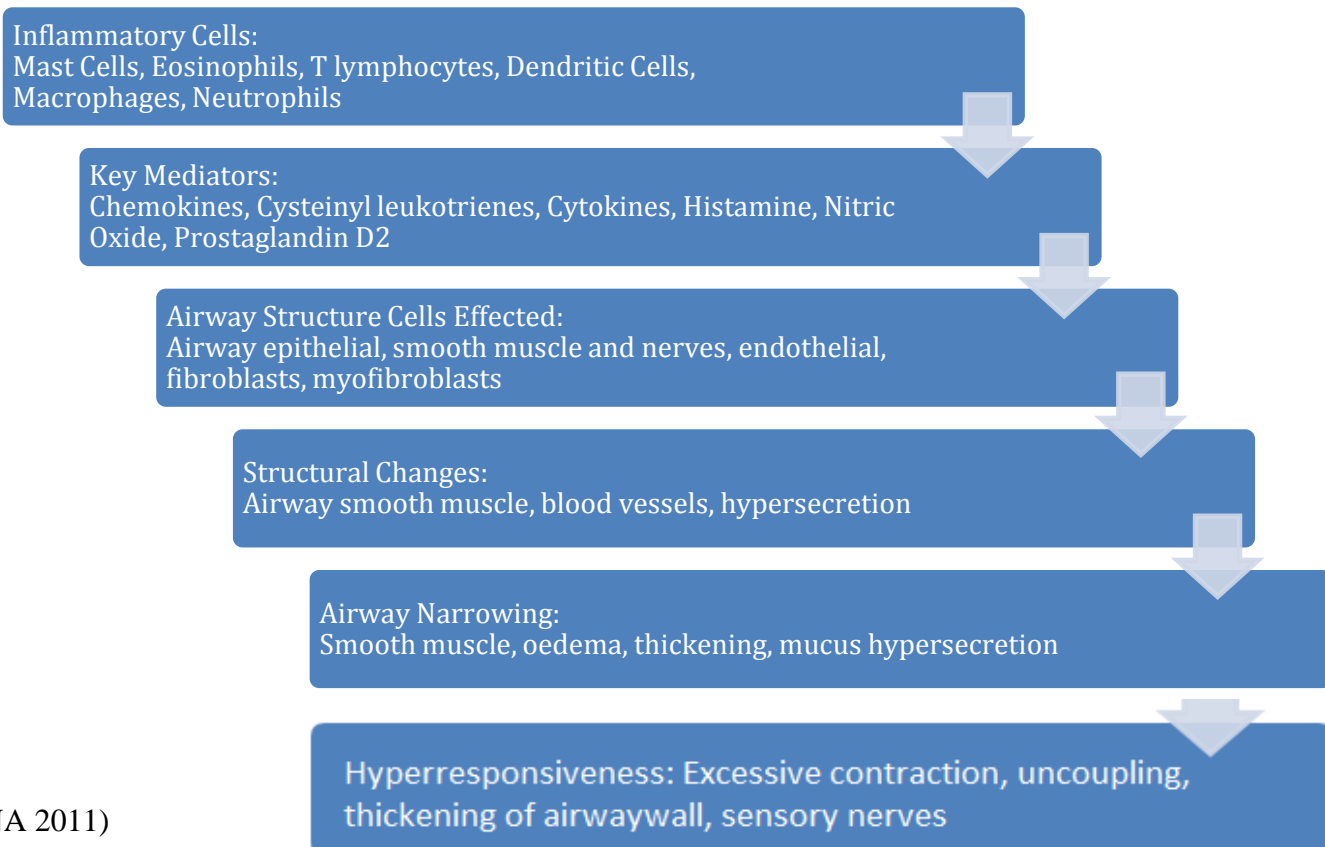
## *Introduction*

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Asthma is a worldwide problem which affects an estimated 300 million people worldwide. The financial burden is substantial with poorly controlled asthma and emergency treatment being significantly more costly. Furthermore, it can account for an estimated 250,000 deaths worldwide annually (GINA 2011). In fact, 1 patient dies from asthma every week in Ireland alone (HSE National Asthma Programme 2012). It is common in children from a young age. While symptoms can improve with age, they may persist through adulthood. Symptoms are often responsive to environmental factors, such as high pollen, and bronchospasm can be induced post exercise. Therefore, it is imperative that a physiotherapist at a sporting event has an understanding of the basic mechanism of asthma, and how to respond to an attack.

## *Pathology*

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(GINA 2011)

<b>HOST FACTORS</b> Genetic, e.g., Genes pre-disposing to atopy Genes pre-disposing to airway hyperresponsiveness Obesity Sex
<b>ENVIRONMENTAL FACTORS</b> Allergens Indoor: Domestic mites, furred animals (dogs, cats, mice), cockroach allergen, fungi, molds, yeasts Outdoor: Pollens, fungi, molds, yeasts Infections (predominantly viral) Occupational sensitizers Tobacco smoke Passive smoking Active smoking Outdoor/Indoor Air Pollution Diet

*Fig 4.1: Factors influencing the development and expression of asthma (GINA 2011)*

### Risk factors for developing fatal asthma

- Previous near fatal asthma
- Previous admission/A+E visit with asthma, especially if within past 12 months.
- Requirement of more than 3 classes of asthma medication
- Heavy use of short acting  $\beta_2$ -agonists

Other issues having an adverse effect on asthma include:

- Non adherence with regular asthma therapy
- Failure to attend for regular follow up after an exacerbation
- Self-discharge from hospital following an exacerbation
- Psychological issues
- Drug/Alcohol abuse
- Obesity

- Learning difficulties
- Social Issues

(HSE National Asthma Programme 2012)

### *Levels of Severity*

<b>Level of Severity</b>	<b>Life threatening</b>	<b>Severe</b>	<b>Moderate</b>	<b>Mild</b>
<b>Life threatening features</b>		No life threatening features	No life threatening features	No life threatening features
<b>Peak Flow Rate (PEF)</b>	PEF < 33% best or predicted	PEF 33–50% best or predicted	PEF between 50-75% best or predicted	Greater than 75% best or predicted
<b>Oxygen Saturation SpO2</b>	SpO2 <92%	SpO2 >92%	Greater than 92%	Greater than 92%
<b>Speech</b>	Unable to talk - Exhausted, confusion, or coma	Cannot complete sentence in one breath Respiration	Talks in phrases, and prefers to sit,	Talks in sentences and can lie down
<b>Respiratory Examination</b>	Poor respiratory effort, silent chest, cyanosis	Rate>25 breaths/min	Loud wheeze and Respiratory rate less than 25 breaths/min	Mild wheeze and respirations less than 25 B/min
<b>Pulse</b>	Bradycardia, arrhythmia,	Pulse Rate > 110 beats/min	Mild tachycardia but less than 110 b/min,	Pulse is less than 100 b/min
<b>BP</b>	Hypotension	Normal	Normal	Normal

*Table 4.1: Asthma Levels of severity for Adults*

(HSE National Asthma Programme 2012)



## Inhalers

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- Beta-2 Agonists
    - Bind to B2 receptors (sympathetic receptors in airway smooth muscle)
    - Leads to a complex chain of events → Increase in cyclic AMP
    - This opens ion channels and leads to bronchodilation
    - Short-acting (SABA) – Salbutamol, Salamol, Ventolin
      - Typically begin working in 5-15 minutes
      - Last approx. 3-6 hours
    - Long-acting (LABA) – Salmeterol, Seretide
      - Last up to 12 hours
      - Slower to take effect
  - Anticholinergic
    - Acetylcholine activates muscarinic receptors
    - These receptors stimulate the Parasympathetic nervous system via the Vagus nerve
    - PNS leads to bronchoconstriction
    - Anticholinergics block acetylcholine's effect and thus prevents bronchoconstriction
    - Short-acting (SAMA) –Atrovent, ipratropium
    - Long-acting (LAMA) – Spirivia, tiotropium
  - Steroids
    - Reduce airway inflammation
    - Eg. Beclazone, Pulmicort, Flixotide
  - Combination
    - Combining Beta-2 agonists and anticholinergics increases effect size
    - Combining inhalers with steroids can also improve effect size
- (SIGN 2012, GINA 2011)
- Common short acting Inhaler: Ventolin (Short acting Beta-2 agonist, meter-Dosed Inhaler)



## Inhaler Technique

MDI Technique
• Remove cap
• Shake inhaler
• Breathe out
• Put mouthpiece in the mouth
• Slowly breathe in, press the canister and continue to inhale deeply and forcefully
• Hold breathe for 10 seconds or as long as possible then breath out slowly
• To take a 2 <sup>nd</sup> dose repeat previous steps
• Replace cap

*Table 4.2 Inhaler Technique  
(Lavorini et al 2007; Armour et al 2011)*

## What to do in The Event of An Asthma Attack

### \*5 minute rule\*

- Take reliever immediately
- Sit down and loosen tight clothing
- Attacks may be frightening and it is important to stay calm
- If no immediate improvement - continue to take reliever every minute for 5 minutes (two puffs MDI)
- If not improved in 5 minutes, if emergency symptoms are produced or if in any doubt call 112/999
- Continue to use reliever until help arrives/symptoms improve
- Always dial 999/112 if:
  - Symptoms persist
  - No immediate improvement in symptoms after initial treatment or within 5 minutes after treatment



*"Excuse me, can you help me?  
- I'm a little puffin."*

- Too breathless or exhausted to talk
  - Lips turn blue
  - Or if in doubt
- Most deaths from asthma occur before admission to hospital.

(HSE National Asthma Programme 2012)

### *Exercise-Induced Asthma*

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#### **Definitions:**

- “Transient narrowing of the airways that follows vigorous exercise in a dry environment”
- “A reduction in forced expiratory volume in one second (FEV1) of 10% or more from the value measured before exercise”

(National Asthma Council Australia 2006)

#### **Epidemiology**

- Exercise-induced asthma occurs in around 50–65% of people with asthma who are being treated with inhaled corticosteroids (National Asthma Council Australia 2006).
- There is level B evidence that from multiple case-control, cohort and cross-sectional studies that top athletes are at an increased risk of asthma, especially in endurance sports (Carlsen *et al* 2008 a).

However, exercise induced asthma (EIA) is frequently over AND under diagnosed. It is vital to screen for the following symptom:

“Do you feel more breathless/wheezy/symptomatic five to ten minutes after you stop exercise than during exercise?”

- People without asthma will also get short of breath if they exercise hard enough, but the symptoms subside rapidly when they stop.
- In someone with exercise-induced asthma/exercise induced bronchoconstriction, the **symptoms get worse** for the next 5 to 10 minutes before spontaneous recovery occurs over the next 30 minutes.

(National Asthma Council Australia 2006)

## Pathology

Chronic asthma is characterised by inflammation of bronchial mucosa and submucosa and hyper responsiveness to various inhaled stimulants (Storms 2003). The pathogenesis of EIA is poorly understood, but two main mechanisms have been proposed:

1. **Hyperosmolarity:** Water loss from the airway surface liquid leads to hyperosmolarity within the cell and hypertonicity of the smooth airway muscle. This could also lead to the release of pro-inflammatory mediators and creating bronchoconstriction.
2. **Airway rewarming theory:** Hyperventilation creates cooling of the airways. After exercise, this airway rewarms leading to dilation of blood vessels, hyperemia of the airway lining, fluid exudation from the blood vessels into the submucosa and subsequent mediator release and bronchoconstriction.

(Storms 2003)

## Management of EIA

### **Medical Management:**

- EIA without other clinical manifestations of asthma may be best controlled by the use of short-acting inhaled b2-agonists taken 10–15 min before exercise (grade of recommendation: A).
- EIA combined with other asthma symptoms may best be controlled by anti-inflammatory treatment either alone or in combination with reliever treatment. Inhaled corticosteroids in low-to-moderate doses are the preferred treatment (Grade A).
- In certain circumstances (i.e. in asthmatic athletes with obvious EIA, but not satisfying the requirements set up by WADA and/or IOC Medical Commission for using inhaled corticosteroids) long acting alone may be tried, but should be clearly followed up for assessment of treatment effect (Grade B).
- Without complete control with inhaled corticosteroids either adding:
  - short-acting inhaled b2-agonists (Grade A) before exercise
  - long-acting inhaled b2 -agonists may be tried (Grade A)
  - A long acting (LA) can be tried in addition to inhaled corticosteroids (Grade A).

- Be aware of the possibility of developing tolerance to inhaled b2-agonists used on a regular basis (Grade B), and the reports of nonresponse in some to patients to LA (Grade B).
- In some patients, the combination of inhaled corticosteroids, long-acting inhaled b2-agonists and LA may be needed to control exercise-related symptoms.
- In addition, sodium cromoglycate or nedocromil sodium (Grade A) or ipratropium bromide (Grade B) may be tried for EIA after individual assessment, either alone or in addition with other treatments.

(Carlsen et al 2008 b)

**Exercise:**

- Being physically fit can increase the intensity of exercise required to provoke exercise-induced asthma, although exercise-induced asthma can still occur (Level A).
- Asthma severity, as reflected by exercise-induced asthma, is not altered by training, but the threshold for respiratory symptoms can increase. This means that after training, the person is likely to:
  - Have less exercise-induced asthma
  - Be less breathless
  - Be less anxious about activity
  - Feel good
  - Be less dependent on treatment
  - Lose less time from school

(National Asthma Council Australia 2006)

- A special warm up of 15mins at 60% VO<sub>2</sub> max before formal exercise can partial reduce the effects of EIA. This beneficial effect may be due to improved delivery of water to the airway surface by the bronchial circulation.

(Storms 2003)

**Breathing Techniques:**

- Cochrane review by Holloway and Ram in 2004 was unable to draw conclusions on the effectiveness of breathing techniques for EIA. However, it did note trends for improvement, especially in quality of life (QoL).

- The Buteyko technique (BBT) is a breathing technique based upon the principle that EIA is directly linked to hyperventilation. As such this technique attempts to breath at lower rates.
- Several small RCTs have shown some positive results of BBT on medication use, symptoms and QoL (Bruton and Lewith 2005).
- A recent systemic review with meta-analysis showed equal evidence of benefit for yoga, BBT and physiotherapist led breathing techniques over controls in QoL. BBT was found to reduce B2 agonist use in most studies, while several found improvements in QoL (Burgess *et al* 2011).
- As such this is a promising technique. However, further, higher quality RCTs are required to determine more solid conclusions.

### *Examination of Evidence*

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The GINA is a global initiative designed to make recommendations on the management of asthma based on the best available evidence. Their committee performs a rigorous review of the literature before publishing their guidelines. The locally relevant policies developed by the HSE are determined by the National Asthma Programme. They are endorsed by the Irish Thoracic Society and are based on the GINA guidelines and current evidence. The SIGN guidelines and The Asthma Management Handbook (National Asthma Council Australia 2006) are evidence-based practice graded guidelines based on systemic reviews. Carlsen et al a) and b) are publications by a joint Task Force of the European respiratory society and the European academy of allergy and clinical immunology. They also produced the report with graded recommendations based on a thorough literature review. Below are tables critically appraising key articles used in this text:

<b>Study</b>	<b>Study Type</b>	<b>Level of Evidenc</b>	<b>Purpose</b>	<b>Results</b>	<b>Comments</b>
Lavorini et al 2008	Systematic Review	Level 1	To review current literature evaluating incorrect use of dry powder inhalers (DPI) by patients with asthma or COPD and to highlight the most common errors in inhaler technique	Depending on inhaler type and assessment method between 4-94% of patients used their inhalers incorrectly. Most common errors were: failure to exhale before actuation, inadequate breath hold after inhalation, incorrect positioning of inhaler, incorrect rotation sequence and failure to carry-out a forceful and deep inhalation. Verbal instruction, technique ax and reassessment are needed for patients to perform proper inhaler technique	Very thorough search strategy employed-included publications in English, Spanish, Portuguese, French, Italian and German. Aswell as a manual search of 15 of the most popular journals. 50 articles were included for review. The majority of included articles had large sample sizes-on average 523 participants. The literature search may not have been exhaustive as PubMed, Science Direct and Scopus databases were not searched.
Armour et al 2011	Cross-sectional study	Level 2	To identify a population of community pharmacy-goers at risk for poor asthma outcomes and to identify factors associated with poor asthma control.	77% of participants had poor asthma control. Depending on inhaler type only between 17-28% of participants used their inhaler correctly. Patients who smoked, had poor inhaler technique or poor adherence, were more likely to have poor asthma control. Community pharmacists were able to identify patients at risk of having poor asthma control. This highlights an opportunity to provide timely intervention to those at risk of poor control.	Large scale study with 570 participants across 96 pharmacies. Did not include patients under 18yrs.

Study	Study Type	Level of Evidenc	Purpose	Results	Comments
Carlsen et al 2008 a)	Systematic Review	Level 2	To analyse changes in asthma prevalence, bronchial hyperresponsiveness and allergies in elite athletes, to review the specific pathogenetic features of these conditions and make recommendations for their diagnosis	Asthma and bronchial hyperresponsiveness prevalences have risen significantly, particularly in endurance athletes-as shown by changes in epidemiological data. Mechanisms for the development of asthma and bronchial hyperresponsiveness are outlined. Criteria for the diagnosis of asthma and exercise induced asthma in the athlete are outlined.	Provided levels of evidence using the sign criteria and graded recommendations given. Search limited to inclusion of Medline database.
Carlsen et al 2008b)	Cross-sectional study	Level 2	To review recommended treatment of exercise-induced asthma, respiratory and allergic disorders in sports, to review the evidence on possible improvement of performance in sports by asthma drugs and to make recommendations for their treatment.	Recommendations for treatment of exercise induced asthma and bronchial hyperresponsiveness are outlined. Lack of evidence of treatment effects of asthmatic drugs on exercised induced asthma and bronchial hyperresponsiveness specific to athletes. Concluded that there is a lack of improvement in athletic performance following use of inhaled beta2-agonists.	Levels of evidence and grades of recommendation provided for all recommendations. Literature included mostly based on systematic review by Larson <i>et al</i> 2005. Search limited to inclusion of Medline database
Storms and William 2003	Review	Level 5	To review the recent literature on exercise-induced asthma (EIA) and summarize the pathogenesis, diagnosis, and treatment of this condition to allow healthcare professionals recognise and appropriately manage EIE.	There are 2 theories about the pathophysiology: 1) the hyperosmolar theory 2) the airway rewarming theory Diagnosis Can be straightforward but exercise testing or eucapnic voluntary ventilation testing may be needed Treatment usually involves inhaled beta agonist and or cromolyn before exercise but some may need inhaled steroids	Although many studies were used, there was no explanation given about how they sourced these papers and whether they excluded any other important papers. Therefore there is a risk of bias.



Study	Study Type	Level of Evidence	Purpose	Results	Comments
Bruton and Lewith 2005	Systematic Review	Level 1	Provides the background to the buteyko breathing technique (BBT), reviews the available evidence for its use and examines the physiological hypothesis claimed to underpin it	BBT was found to successfully relieve symptoms but without evidence of change in objective lung function measures or bronchial responsiveness. The evidence is not yet conclusive that this technique works by the original theory that the breathing patterns used for this technique affects Co2 levels.	This review is of reasonably good quality considering 4 out of the 6 trials included were RCT's Papers did not include quality of life scales Further research is needed to establish equivocally whether it works, although the results from the review are positive Limitations: Outcome measures varied considerably between the studies so it is difficult to directly compare results, especially since only 1 study included CO2 levels as a measure.
Burgess et al 2011	Systematic Review and Meta Analysis	Level 1a	To synthesize the literature on complementary and alternative medicine techniques that utilize breathing retraining as their primary component and compares evidence from controlled trials with before-and-after trials	BBT consistently demonstrated a reduction in asthma medication use, and showed an improvement in AQOL and the subjective experience of asthma symptoms, despite no significant improvement in lung function. Respiratory Muscle Training caused improved lung function and quality of life, and a meta-analysis showed a significant reduction in medication use. A meta-analysis showed a favorable effect of yoga on AQOL and a similar, although limited, effect was seen on one measure of lung function	Included a Cochrane review containing only RCTs from 2004 and analysed studies done since then. 12 out of the 41 studies included were RCT's. Due to the systematic nature of the search there is a very low risk of bias. The authors critically appraised each article included.  Limitations: despite the high quality of studies included, too few well-designed studies with adequate power and length of follow-up to allow definite conclusions to be drawn.

Study	Study Type	Level of Evidenc	Purpose	Results	Comments
Holloway and Ram 2004	Cochrane Review	Level 1a	To evaluate the evidence for the efficacy of breathing retraining in the management of asthma	<p>Breathing training causes: improved QOL, increased mean daily PEFr values (l/min), decreased rescue bronchodilator use and decreased acute exacerbations, when compared to control groups.</p> <p>Breathing training also causes increased QOL in the Marks, Dunn and Woolcock scale and also decreased need to use inhaled steroids when compared to groups receiving just asthma education. However, there were no changes in bronchodilator use or lung function tests</p>	<p>Highest level of evidence available. Included randomised or quasi randomised controlled trials of breathing retraining or therapy in patients with a diagnosis of asthma.</p> <p>The authors sought data clarification and further information from all authors in order to improve and increase the amount of data entered into the review, which caused all the studies to be methodologically rated as 'A'.</p> <p>It was not possible to blind patients to their intervention because they must know whether or not they are undertaking breathing training or asthma education to ensure compliance.</p> <p>4 studies were low bias</p> <p>Limitations: The studies were too small to provide a reliable estimate of the efficacy of breathing exercises for asthma</p>

## *Key Points for a Physiotherapist Working With A Sports Team*

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- Become aware of your team
  - Identify those with asthma, who report asthma-like symptoms or those with allergies
- Action plans
  - Recognition of symptoms
  - Self-management
- Equipment
  - Essential – inhalers of those prescribed
  - Possible – Peak Flow device, Sats monitor, stethoscope

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# Chpt 5: Spinal Cord Injury

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## *Introduction*

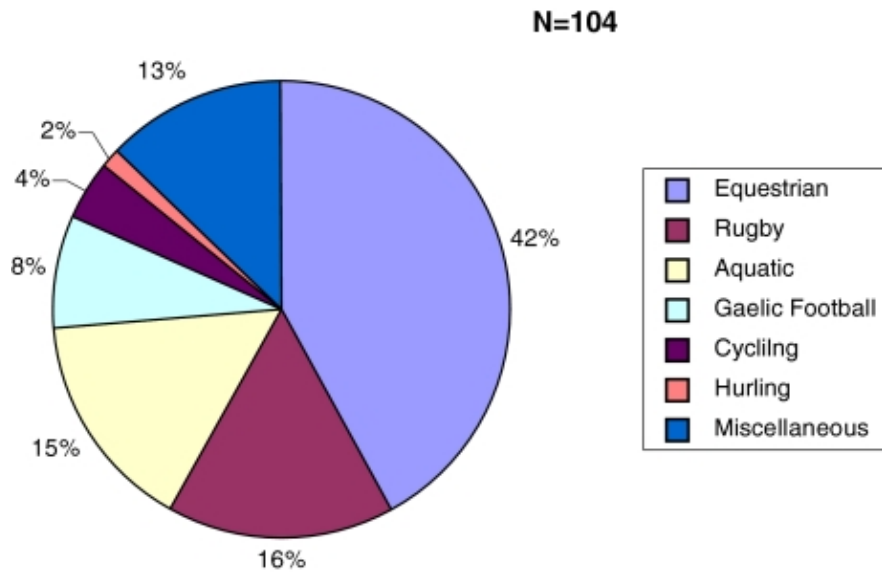
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Though a rare occurrence in sporting events, accidents resulting in spinal cord injury have devastating consequences. Spinal injuries, with or without damage to the spinal cord itself, are said to account for 2-3% of all sporting injuries (Holtz and Levi 2010). More recently, thanks to changes banning ‘spearing’ tackles, the incidence of spinal cord injuries has been on the decline. Between 1965 and 1974 (before the tackling rules were changed) in the US, 40 fatalities were recorded as a result of spinal cord injury in athletes. In the decade following the rule changes the number of fatalities dropped to just 14, and in the following decade, they dropped further, to just 5 fatalities (Bailes *et al* 2007). However, it is still of paramount importance to be able to recognise and manage a potential spinal injury when it occurs.

Sources differ on the incidence of spinal cord injury, but it is generally agreed that sporting injuries are the 3<sup>rd</sup> or 4<sup>th</sup> most common cause of spinal cord injuries overall (depending on which countries’ statistics are viewed) (Castellano 2007; Fuller 2008; Swartz *et al* 2009). However, this rises to the 2<sup>nd</sup> most common cause in people under 30 years of age (Swartz *et al* 2009). Falls, road traffic accidents and gunshot wounds rank above sports injuries as the leading causes of spinal cord injury (SCI). Unsurprisingly, there is greater risk of spinal cord injury associated with contact sports, with varying incidences reported. However, the risk of having sustained a SCI is surprisingly not related to the force of the collision of the head or neck, but rather to whether or not the athlete falls after the assault (Hanson and Carlin 2012). C5 is the most commonly injured vertebra, and this thought to be because this level of the spine has the greatest mobility (Holtz and Levi 2010).

A prospective study published in 2009 investigated the incidence of acute spinal cord injury in Ireland. It found that sport accounted for 11% of all spinal injuries recorded over the study period. The breakdown of the sports associated with spinal injury are outlined in the pie chart shown (Fig 5.1). The study also found that the cervical spine

was most commonly damaged (51%), followed by the lumbar (28%) and thoracic (21%) regions (Lenehan *et al* 2009).



**Fig 5.1 Pie chart showing breakdown of sports most commonly associated with spinal injury.**

**(Lenehan *et al* 2009)**

Outside of Ireland, American football, wrestling, martial arts and ice hockey are among the sports listed in the literature as being most commonly associated with catastrophic injury (Swartz *et al* 2009; Ye *et al* 2009; Zemper 2010).

### *Signs and Symptoms*

<u>Conscious</u>	<u>Unconscious</u>
Alterations in consciousness	Loss of response to pain below lesion site
Altered mental status	Flaccid areflexia
Sudden, severe pain over spine or below injury site*	Diaphragmatic breathing
Paralysis/impaired movement below injury site	Hypotension with bradycardia
Altered sensation	Priapsim**
Weakness	Skin warmth or flushing
Pain radiating into the lower extremities	

**Table 5.1: Signs and symptoms of SCI (Bahr and Maehlum 2003; Castellano 2007; Anderson and Parr 2011)**

\*may radiate to front of body

\*\*a persistent erection caused by changes in normal blood flow following SCI

NB It is important to note that pain from a spinal cord injury will not necessarily be localised to the site of injury.

**\*\*If any of these signs or symptoms are present the patient should be immobilised and immediately referred to a doctor\*\*** (NICE 2007).

The main reasons for overlooking a potential spinal injury are listed below:

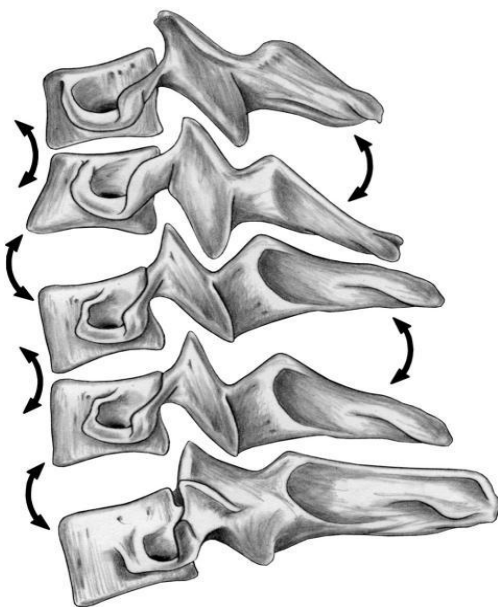
- Failure of the clinician to consider the possibility
- The patient being unconscious
- No obvious spinal deformity noted
- Distraction of the clinician by other injuries
- Poor interpretation of radiographs
- Assuming a normal radiograph excludes the possibility of spinal cord injury

(Driscoll 1998)

### *Causes of spinal injuries*

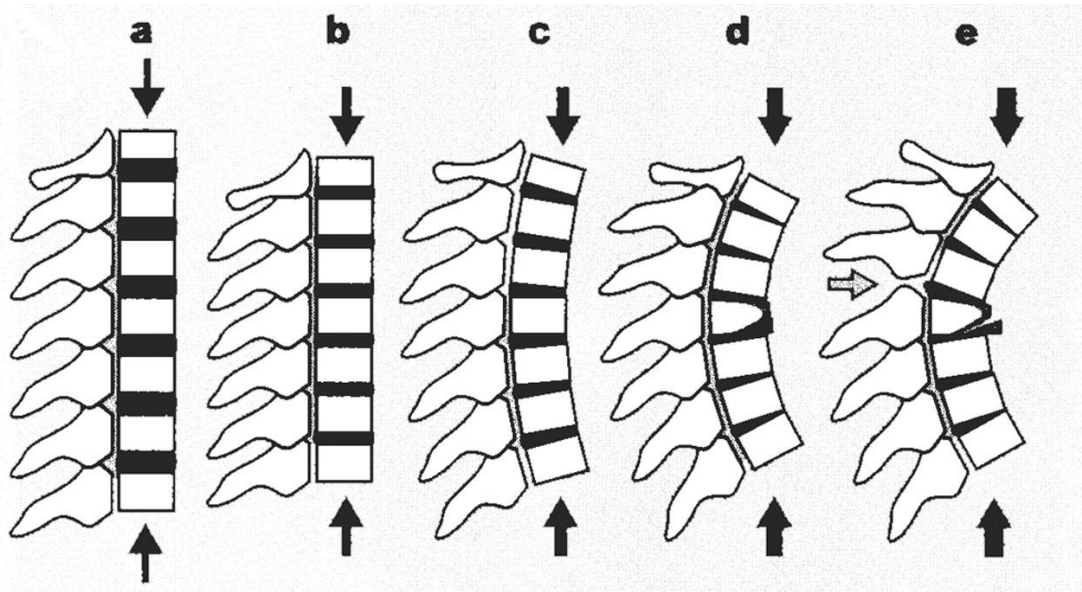
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- Direct blow to the spine-usually results in contusions or fractures
- Compression of the spine-usually results in sprains, contusions or fracture
- Twisting/Torsion of the spine-usually results in sprains, strains or fractures (Flegel 2008)
  - Axial loading (Wilson *et al* 2006, Swartz *et al* 2009)-This type of



mechanism is particularly dangerous when the neck is slightly flexed, as this takes the cervical spine out of its normal lordotic position. In this position the musculature cannot assist in dissipating the force as effectively. The compressive force is such that it causes a ‘buckling’ effect in the C spine. Usually forces are absorbed by the intervertebral discs but if the force applied is excessive, herniation, fracture or dislocation may result (Bell 2007).

***Fig 5.2 Buckling of the cervical spinal column as a result of axial loading (Swartz *et al* 2009).***



*Fig 5.3. Biomechanically, the straightened cervical spine responds to axial loading forces like a segmented column, (a and b) Axial loading of the cervical spine first results in compressive deformation of the intervertebral disks, (c) As the energy input continues and maximum compressive deformation is reached, angular deformation and buckling occur, (d and e) The spine fails in a flexion mode with resulting fracture, subluxation or dislocation. Compressive deformation leading to failure, with a resultant fracture, dislocation or subluxation occurs in as little as 8.4 milliseconds (Chao et al 2010).*

### Categorisation of Spinal Cord Injuries

Spinal cord injuries can be placed in 2 broad categories: complete or incomplete:

#### **Complete**

This involves loss of neuromuscular function below the level of injury, including the most distal sacral segments, that lasts longer than 48hrs.

This type of injury can result from anatomic disruption of the spinal cord, but is most commonly a result of ischemia, haemorrhage or oedema (Bailes et al 2007). These types of injury are not often reversible, but after swelling recedes, improvement of 1 spinal level can result.



## Incomplete

This is when motor OR sensory function is preserved below the site of the injury and in the most distal sacral segments (Driscoll 1998).

Depending on the impact site and its severity, incomplete spinal cord injury can result in a number of different presentations called 'syndromes'. These are described briefly below:

- **Central Cord Syndrome**
  - Cause: Damage to the central part of the spinal cord. This type of injury is thought to result from ischaemic/haemorrhagic insult to the corticospinal tracts. The more medially placed tracts serving the upper extremities are more affected as a result of the central damage. It is most often associated with hyper-extension injury.
  - Motor function: Weakness is more prominent in the upper extremity than the lower.
  - Sensory function: There are sensory deficits below the level of the lesion and can cause bladder and sexual dysfunction (Bailes *et al* 2007).
  
- **Anterior Spinal Cord Syndrome**
  - Cause: Ischemia from the anterior spinal artery to the anterior two-thirds of the spinal cord (Bell 2007). Unlike central cord syndrome, this type of injury does not strongly associate with any one mechanism (Bailes *et al* 2007).
  - Motor function: Complete loss of function below the level of the injury- with neither upper nor lower extremity loss predominating.
  - Sensory function: Loss of sensitivity to pain and temperature which is caused by damage to the spinothalamic pathways. Loss of sphincter and sexual dysfunction.
  
- **Brown-Sequard**
  - Cause: Partial or complete hemi-transection of the spinal cord. This syndrome rarely presents on its own, but more often has a mixed presentation with central cord syndrome (Bailes *et al* 2007). For example

the patient may have unilateral motor loss with contralateral sensory loss, but this may effect the upper extremities more than the lower.

- Motor function: Ipsilateral paralysis (caused by damage to the corticospinal tracts)
  - Sensory function: Contralateral loss of sensitivity to pain and temperature (caused by damage to the spinothalamic tracts which decussate at a spinal level) and loss of tactile discrimination (Bell 2007).
- **Posterior Spinal Cord Syndrome:**
    - Cause: ischaemia of the posterior spinal artery
    - Motor function: This syndrome rarely presents clinically. It results in loss of the dorsal column function; however, corticospinal tracts remain intact (Bailes *et al* 2007). Therefore the patient may have difficulty coordinating movements, but will maintain their strength.
    - Sensory function: Spinothalamic tracts remain intact, therefore sensation remains intact.

## Management of Spinal Cord Injuries

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Regardless of the mechanism or site of injury, the immediate management of any potential spinal injury should be the same.

1. Immobilize the patient
2. Check the ABCDs (airway, breathing, circulation, disability)
3. Assess motor function
4. Assess sensory function
5. Palpate
6. Transfer if necessary
7. Assess range of motion

## 1) Immobilisation

### **\*\*This is the first step to be taken with any patient with suspected spinal cord injury\*\***

Up until 20 years ago it was estimated that up to 25% of spinal cord injuries could be aggravated after the initial accident (Castellano 2007). However, this theory is now being challenged. It is now believed that damage to the cord occurs at the time of the initial insult, and that any subsequent movement is not sufficient as to warrant further spinal cord damage (Kwan *et al* 2009). Furthermore, the vast majority of patients do not have spinal instability, and therefore do not benefit from immobilisation.

For ethical reasons there are no RCTs investigating the effects of spinal immobilisation on mortality, neurological outcome or spinal stability. Pressure sores, breathing difficulties and aspiration problems have all been listed as risks of spinal immobilisation (Kwan *et al* 2009). Its practice is therefore not without its controversy. There is a need for large scale RCTs to investigate the risk: benefit ratio of spinal immobilisation. Though there is a lack of evidence supporting the belief that cervical immobilisation prevents further injury, there is equally no evidence to contradict its use. A Cochrane review in 2009 (Kwan *et al* 2009) concluded that this practice is mainly based on historical, not scientific, precedent. However, it remains that, for a certain number of patients, spinal immobilisation can be necessary to prevent the devastating consequences of spinal cord injury. Immobilisation of the cervical spine is therefore still widely practiced (NICE 2007). However, long periods of immobilisation should be avoided.

### **\*\*The patient exhibiting signs of potential SCI should be immobilized with their spine in neutral alignment\*\***

Contraindications to returning patient to neutral alignment:

- If movement into neutral alignment compromises the airway
- If movement causes severe pain
- If movement causes muscle spasm
- If there is resistance or it is physically difficult to realign the spine
- If the patient expresses apprehension (Swartz *et al* 2009)

Traditional immobilisation ('triple immobilisation') involves use of a semi-rigid collar, block and straps on a supportive device. Studies using cadaveric models drew the usefulness of semi-rigid collars for immobilisation, into question. Too tight a collar could potentially increase intra-cranial pressure. Studies have also shown semi-rigid collars have little effect on preventing intersegmental motion of the spine. However, these studies have been challenged. Challengers say that the cadaveric models lack the oedema and swelling seen in true, in-vivo SCIs, and this accounts for the unrealistic hypermobility seen at the segmental level (Hanson and Carlin 2012).

The 2 main methods of spinal immobilisation are:

- Manual stabilisation
- Use of orthotic devices-backboards, splints, cervical collars.

The literature describes a number of different techniques used to achieve spinal immobilisation including manual inline stabilisation and the use of the trap squeeze. These are briefly explained below.

- **Manual inline stabilisation (aka head squeeze):**

This simply involves the clinician kneeling/lying behind the patient and placing a hand over either side of the patient's head, to protect it from movement (Hanson and Carlin 2012).

- **Trap squeeze:**

Similar to the head squeeze, the clinician lies/kneels behind the patient's head and places their hands at the base of the neck, gripping the upper trapezius muscles, so that the head lies between the forearms (Hanson and Carlin 2012).

## 2) Check the ABCDs

This approach is not SCI specific, nor indeed sports injury specific. It can be applied to all emergency assessment situations. Checking the ABCDs of any patient is vital before any tertiary assessment can be done. **First reassure the patient.** Then check the ABCDs as outlined below.

### Airway

- Ensure the airway is exposed and that the patient is breathing. If not begin CPR.
- If the patient responds to you in a normal voice, it is safe to say the airway is patent (Thim *et al* 2012).
- Signs of a semi-obstructed airway include:
  - noisy breathing
  - increased work of breathing
  - reduced levels of consciousness
  - a changed voice
  - In the unconscious patient, ‘snoring’ can be indicative of a partially blocked airway (Thim *et al* 2012)
- Ensure the airway is clear, remove any blockages (vomit, mouth guard), tilt the head and chin to open the airway.

### Breathing

- Listen and look for breath sounds. Check the respiratory rate and look for signs of cyanosis.
- If conscious, ask the patient if they feel they are having any difficulty swallowing or breathing?
- Hanson and Carlin 2012, suggest that in the event of severe injury oxygen therapy should be administered at a rate of 15l/min. However, physiotherapists can only be involved in the administration of oxygen if they have completed an advanced first aid course

### Circulation

- Check for a pulse and capillary refill time.
- Look for changes in skin colour, sweating or decreased levels of consciousness- these are indicative of reduced blood perfusion (Thim *et al* 2012).
- If there is no pulse begin emergency CPR immediately.
- Problems with circulation indicate immediate onward referral.

### Disability (Neurological status)

- Check the patient's levels of responsiveness using the Glasgow Coma Scale.
- If conscious, ask if they have any numbness, pins and needles or burning in their extremities.
- Ask appropriate questions to assess whether the patient is experiencing either long or short-term memory problems.

**\*\*Note\*\*** In the event that the injured athlete's ABCs, or cervical immobilisation are being compromised by the player's head gear, this may be removed. You should be properly trained and practiced in removing this head gear. Head gear is commonly worn in American football, ice hockey, and is becoming more commonly used in hurling. Power screwdrivers and normal screwdrivers are associated with the least head movement during removal. However, should they fail, cutting devices should be available (Jenkins *et al* 2002; Decoster *et al* 2005).

### 3) Motor

Without moving the patient, ask if they can squeeze your fingers (this tests the cervical spinal nerves) Then ask if they can dorsiflex both ankles (this tests their lumbar spinal nerves) (Anderson and Parr 2011). If any deficits are noted, refer on to emergency services.

### 4) Sensory

Run your hands and finger nails over the patient's upper and lower extremities, back and thorax asking if sensation feels the same on one segment compared to the other (Anderson and Parr 2011). If any deficits are noted refer on.

### 5) Palpation

Palpate along the spine for any deformities or excessive muscle guarding.

**\*\*Note\*\*** This step does not have to be carried out in order, rather it can be carried out at the most convenient time during the assessment e.g. during rolling. Furthermore, it is important the physiotherapist recognises the importance of

prioritisation- if the patient is having difficulty with any of the ABCs, palpation is unnecessary, keeping the patient stable is priority above all else.

## 6) Transfer (if necessary)

Transferring the patient onto a spinal device will be required if the possibility of a spinal cord injury cannot be excluded. This must be done in the way that causes least movement of the spine. Techniques used to carry out safe transfer, and their uses, are discussed below.

- **Log roll**

Log rolling may be necessary to place a patient on a spinal board, if spinal injury cannot be ruled out and they have to be removed from the sporting event. It requires a minimum of 3-4 people to control the head, chest, pelvis and lower limbs (at the knees and feet if possible). It is a manoeuvre to roll the patient onto their side while keeping the spine inline, to allow for their positioning on a spinal device or examination of the spine (Holtz and Levi 2010).

- **The 'lift and slide' technique**

This technique can be used if the patient is supine. It avoids rolling, and simply involves lifting the patient a number of centimetres off the ground so that a spinal device can be moved into position under them. It causes less segmental motion of the spine during transfer than the log roll technique (Swartz *et al* 2009).

- **The 'high arm in endangered spine' technique**

This involves the clinician using their extended arm to support the patient's head and limit lateral flexion of the neck, while the patient is being rolled (Hanson and Carlin 2012).

There is much debate surrounding the optimal spinal handling technique. However each of those outlined above has its uses. Studies suggest that use of the lift and slide technique produce the least movement of the cervical spine. However, its use is only suitable in patients who are already supine. Furthermore, it requires that clinicians grasp the athlete's clothing. In modern sporting arenas, 'performance' attire worn by the majority of athletes, is unsuitable for gripping to enable a lift and slide

manoeuvre. Also although concerns have been raised around the amount of rotation that occurs when using a combination of the log roll and inline stabilisation techniques, use of the log roll is unavoidable in a prone casualty situation.

Another argument that has been put forward against the use of the log roll is that it can potentially dislodge haematomas in the case of major internal injury or a fractured pelvic ring. However, injury to the pelvic ring is rare in sports and it is unlikely that haematomas would have had time to form at a sporting event due to the rapid response of pitch side clinicians.

Theoretically speaking it would be beneficial to only use the handling technique that causes least segmental movement (i.e. lift and slide). However, in reality this is not practical. Therefore while the lift and slide technique should be favoured in the supine casualty, use of the log roll is unavoidable if the patient is prone. Use of the high arm in endangered spine technique is useful in vomiting casualties, to prevent lateral flexion during rolling (Hanson and Carlin 2012).

Further debated issues in transportation include the most appropriate spinal device. There are 3 types in common use; the traditional long spinal board, split devices and vacuum mattresses. Each has their own purpose, and these are outlined below.

- **Long board**

This is the traditional mode of spinal immobilisation, consisting of a flat board with attached triple immobilisation. They come in varying lengths and widths and can be padded. However, due to issues with the development of pressure sores, athletes should not be immobilised on this aid for more than 30 minutes.



- **Split Devices**

These immobilisation boards are popular because they can avoid a log roll in supine casualties. Furthermore, in motor vehicle casualties they can help extricate a victim from a vehicle. However, they are only designed for





transfers and should not be used to transport a patient any distance. Similarly they are unsuitable for heavy athletes (Hanson and Carlin 2012).

- **Vacuum mattress**

Of late these mattresses are gaining in popularity. They are made of a double bagged polystyrene ball system. This enables them to be moulded to the individual athlete's shape. Therefore unlike other devices, they avoid the issue of pressure sores (Swartz *et al* 2009). Once the air is removed from the system it becomes rigid. However, because of the potential for a puncture/valve loss, if a vacuum mattress is being used, there should always be an alternative device available (Hanson and Carlin 2012).



During transfer continue to assess the patient's GCS and to monitor the ABCDs.

### **Outcome measures that can aid assessment**

Outcome measures such as the Canadian C-spine rule or the NEXUS can be used to further evaluate a patient's spinal integrity. These incorporate use of the Glasgow Coma Scale (GCS). A copy of each of these is to be found in the appendices (Appendix E, G and H respectively)

Studies have shown that patients with a GCS of below 8 are at a higher risk of having suffered a cervical injury than those with a score of 8+ (Swartz *et al* 2009).

In a large scale prospective cohort study, the Canadian C-Spine rule was shown to be more sensitive and specific than the NEXUS in assessing alert, stable patients. Its use also results in lower levels of radiography (Stiell *et al* 2003).

Further imaging should be sought for patients with any of the following:

- GCS < 15
- Paralysis, paraesthesia or other neurological deficit
- Severe neck pain (NICE 2007)
- Abnormal vital signs

- Neck pain and any of the high risk factors listed below:
  - Fall from higher than 1 meter or 5 stairs
  - Axial load to the head
  - High speed motor vehicle accident
  - Rollover motor vehicle collision
  - Patient thrown from vehicle
  - Bicycle collision
  - Age 65+
  - Injured more than 2 days ago
  - Established vertebral disease
  - Re-attending hospital for same injury
- Patient with a dangerous mechanism of injury and either a visible injury above the level of the clavicles or reporting severe thoracic pain

In the event that none of the high risk factors are present, but some of the following low risk factors are present, the patient's cervical immobilisation can be removed and their range of motion assessed:

- Walking at any time since injury
- Sitting
- Delayed onset of spinal pain
- Absence of midline spinal tenderness
- Rear ended motor vehicle accident (but not if the vehicle in question was pushed into the back of another vehicle or hit at speed, or hit by a large vehicle)

Patients who are identified as fitting into the low risk category, do not require imaging IF they can actively rotate their neck (to both sides) to 45°. Patients who are unable to rotate both sides to 45°, or report severe pain while attempting, should have further imaging (The College of Emergency Medicine 2013).

## **7) Assess range of motion (ROM)**

Perform a thorough ROM assessment before concluding about the player's safety to return to play.

### *Points to remember*

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- A spinal cord injury should always be considered as a possibility in the unconscious patient.
- If the patient is wearing a helmet- do not remove it. Removing the helmet could cause further damage!! Any treatment/immobilisation should be given with the helmet still in place (Bailes 2007), unless:
  - You are unable to check their ABCDs (airway, breathing, circulation, neurological status and levels of consciousness).
  - The helmet is ill fitting and so immobilisation of the helmet does not immobilise the head (Swartz *et al* 2009).
  - If the helmet prevents neutral alignment of the cervical spine (Swartz *et al* 2009).
- Immobilisation of the cervical spine should be maintained until a full satisfactory clinical assessment has been carried out, and imaging (if deemed appropriate) has been completed (NICE 2007).

## Examination of the Evidence:

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Bailes <i>et al</i> 2007	Literature Review	Level 5	To provide an understanding of the mechanisms, anatomical structures, complications and management recommendations for potentially catastrophic injury	<ul style="list-style-type: none"> <li>• Recommendations given on the variety of clinical syndromes resulting from SCI.</li> <li>• Outline recommendations on appropriate evaluation and transportation of a SCI</li> </ul>	Thorough analysis of the management of cervical spine injury in sport. However, no outline was provided, of how articles were selected for inclusion other than been dated between 1970 and 2005. Furthermore, no evidence of literature appraisal seen.
Hanson and Carlin 2012	Literature Review	Level 5	Discussion of major differences between evidence base for sports prehospital care and general prehospital care. Discussion of current evidence base for management techniques.	<p>Discussion of differences between sports immediate management and emergency department's response to a SCI.</p> <p>Discussion of most appropriate spinal handling techniques.</p> <p>Discussion of most appropriate equipment and its limitations.</p>	As in many of the cases involving injuries as potentially catastrophic as SCI, the systematic review approach was not suitable in this instance. This is because the majority of literature regarding acute management of SCI is contained in books or based on historical approaches, rather than high quality research studies. This is because researchers could not ethically deny treatment to anyone with such a potentially serious injury.

Study	Study Type	Level of Evidence	Purpose	Results	Comment
NICE 2007	NICE guideline	Level 1	To provide a guideline on the early management of head injury, based on the best evidence currently available.	<ul style="list-style-type: none"> <li>• Outlines the triage, assessment and early management of head injury.</li> <li>• Provides a summary of its recommendations.</li> <li>• Provides a recommendation on indications for cervical spine immobilisation.</li> </ul>	Provides a useful synthesis of information and recommendations to be applied in the case of suspected SCI. However, does not expressly detail what is the most appropriate method of spinal handling or transportation etc.
Kwan <i>et al</i> 2009	Cochrane Review	Level 1	To compare the effects of different modes of immobilisation on the following outcomes: mortality, neurological disability, spinal stability and adverse effects.	<ul style="list-style-type: none"> <li>• Found no RCTs of spinal immobilisation.</li> <li>• Concluded that the effects of immobilisation on many adverse outcomes in SCI are uncertain.</li> <li>• Acknowledged that the possibility that spinal immobilisation increases morbidity and mortality by compromising the airway, cannot be excluded.</li> </ul>	Highlights the need for good quality, large scale RCTs in the area of spinal immobilisation. However, despite acknowledging the lack of scientific evidence in support of immobilisation, and the possibility that immobilisation could contribute to increased morbidity and mortality, it provided no recommendation as to the need to continue/ cease the practice of spinal immobilisation.

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Swartz <i>et al</i> 2009	Positional Statement		To provide recommendations on the best way to manage a potentially catastrophic cervical spine injury.	<ul style="list-style-type: none"> <li>• Prevention of, planning for and management of a cervical spine injury.</li> <li>• Equipment management and imaging in cervical spine injury.</li> </ul>	<p>Provided evidence based recommendations for cervical spine management.</p> <p>Provided recommendations for the management of equipment in lacrosse, ice hockey, American football and other equipment-heavy sports.</p> <p>However, provided no outline of how the current literature was searched for appropriate papers for inclusion.</p>
Thim <i>et al</i> 2012	Expert consensus	Level 5	To provide a useful, practical 'how-to' guide on managing the ABCDE approach to critically ill patients.	<ul style="list-style-type: none"> <li>• An outline of how to practically carry out an ABCDE assessment.</li> </ul>	<p>Again despite being a 'low level' of evidence, the expert consensus approach taken by this paper, was the most suitable approach available. There is no higher quality evidence available in this area due to blatant ethical issues involved in carrying out treatment trials on critically ill patients.</p>

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Jenkins <i>et al</i> 2002	Outcomes research	Level 2	To investigate the effects of 4 different types of face mask retraction tools on retraction time, forces and torques applied to a helmet.	<ul style="list-style-type: none"> <li>A standard screwdriver or use of a 'quick release system' were faster and generated the least force and torque during retraction.</li> </ul>	<p>Provided a fair comparison of face mask removal using a variety of tools, in a standardised situation.</p> <p>Despite identifying the tools that caused the least amount of spinal movement, an acceptable amount of spinal movement in spinal injury has not been established. Therefore the authors could not conclude whether helmet removal using these tools would be a safe process.</p> <p>Furthermore, the study was carried out without live subjects, which could effect the outcome.</p>
Decoster <i>et al</i> 2005	Cross sectional study	Level 2	To investigate the % of face masks that could be removed using a power screwdriver	<ul style="list-style-type: none"> <li>82.4% could be successfully removed and concluded that, due to quicker removal and reduced head movement, power screwdrivers make better facemask removal tools than cutting tools.</li> </ul>	<p>A large scale study of over 222 helmets from 3 different highschoools.</p> <p>However, results cannot be generalised across all sports.</p>

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Stiell <i>et al</i> 2003	Prospective cohort study	Level 2	Comparison of the Canadian C-Spine Rule with the NEXUS for superiority in detecting need for further radiography.	Found the Canadian C-Spine Rule to have greater sensitivity (99.4 vs. 90.7%) and specificity (45.1 vs. 36.8%) compared to the NEXUS in alert patients.	Good quality, large scale study with 8283 participants, across 9 Canadian ERs. Neither tool can be used in unconscious patients.
The College of Emergency Medicine 2013	Guideline Recommendations	Level 1a	To outline guideline recommendations on the management of the cervical spine by adding new evidence to the NICE 2007 guidelines.	Updated management guidelines of the cervical spine	Compiles NICE recommendations with more recent research and provides a useful guideline including assessment of the levels of evidence on which each guideline is based.



## Spinal Cord Injury Management at a Glance

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### Signs and Symptoms

<u>Conscious</u>	<u>Unconscious</u>
Alterations in consciousness	Loss of response to pain below lesion site
Altered mental status	Flaccid areflexia
Sudden, severe pain over spine* or below injury site	Diaphragmatic breathing
Paralysis/impaired movement below injury site	Hypotension with bradycardia
Altered sensation	Priapism
Weakness	Hot skin or flushing
Pain radiating into the lower extremities	

Table 5.3 Signs and Symptoms of SCI

\*May radiate to the front of the body

**\*\*If any of these signs or symptoms are present the patient should be immobilised and immediately referred to a doctor\*\*** (NICE 2007).

### Immediate Treatment

#### **Remember:**

1. Immobilize
2. Check ABCDs
3. Assess motor function
4. Assess sensory function
5. Palpation
6. Transfer if necessary or remove immobilisation if indicated
7. Assess ROM

Regardless of type or site of injury, evaluation should be the same.

- Always suspect a head /Spinal cord injury in an unconscious athlete.
- Never move the athlete during the evaluation unless you are unable to check their airway, breathing or circulation or if they are at risk of further injury.
- If an athlete is wearing a helmet leave it on!
- If an athlete walks off and complains of pain anywhere along the spine perform the evaluation as they are, e.g. if they are standing, do it in standing.
- Always ensure the patient is not at risk of further damage-stop play if necessary.

### Outcome Measures that can assist

- Glasgow Coma Scale
- Canadian C-Spine Rule OR NEXUS

## Useful Resources

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- Hanson, J. R. and Carlin, B. (2012) 'Sports prehospital-immediate care and spinal injury: not a car crash in sight', *British Journal of Sports Medicine*, 46(16), 1097-1101. (explains how immediate care in sports differs from that of general medicine)
- Glasgow Coma Scale
- Canadian C-Spine Rule

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# Chpt 6: Internal injuries

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## *Introduction*

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An internal injury (or closed abdominal injury) is an injury to underlying tissues without a break in the skin or mucous membrane. The amount of bleeding depends on the particular damaged and the blood vessels that supply it. The organ involved may be compressed by a force and bleeding can occur inside the organ, or the lining of the organ can be torn and the blood can spill into the abdominal cavity.

Most athletic events present potential for abdominal trauma for their participants. The responsibility of the “most medical” professional at the event is to have the knowledge to recognize and properly manage these injuries. Fortunately, abdominal injuries occur relatively infrequently (Barrett and Smith 2012).

Although physiotherapists cannot directly treat the cause of this injury; assessment and recognition of potentially serious internal injuries will allow the athlete to be referred to a physician for rapid diagnosis and treatment (Rehberg 2007)

An abdominal injury may present with two life-threatening dangers: haemorrhage and infection.

### **Haemorrhage**

This is when there is severe bleeding into the abdominal cavity. It presents with immediate consequences, and may cause shock. ‘Hypovolemic shock’ can be defined as ‘a state resulting from dyshomeostasis in tissue perfusion, which leads to an inability to maintain normal organ functions’. It is due to an inadequacy of circulating blood volume. Extra caution must be taken with athletes taking aspirin, clopidogrol or warfarin due to the increased risk of bleeding.

### **Infection**

This presents as a later stage and may be just as lethal as immediate intra abdominal bleeding, but does not require field intervention beyond prevention of gross contamination.

- The patient who has suffered blunt trauma may initially have no pain and little external evidence of injury.
- Abdominal wall injuries not involving the internal organs are generally localised and don't get worse with time. However visceral injury (injury to the organs) which is more serious, often gets worse with time and usually presents with non-voluntary guarding (Rifat 2003)
- It may take a few hours for abdominal injury symptoms to appear (monitor if possible, or inform them of symptoms to look out for to seek medical help).
- Organs can haemorrhage slowly for days or even weeks before symptoms of systemic dysfunction or organ failure will be displayed. For this reason, all athletes with significant abdominal trauma should have a medical examination even if they show no obvious signs of organ damage.

(Doral 2012)

### *Our role as 'sports physiotherapists'*

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The reason this topic is covered in our short course: 'The International Federation of Sports Physical Therapists' outlines the competencies required to be a recognised 'sports physiotherapist'. Although this short course cannot fully cover all the competencies needed, it should provide a solid foundation that can be built upon with further learning and experience. It identifies knowledge of 'internal injuries' as an important aspect of working with athletes:

- **Section 2A: 3** States that physiotherapists should be able to “accurately describe signs and symptoms of acute injuries or illness and relevant examination strategies”.
- **Section 2D: 1** States that physiotherapists should be able to: “rapidly synthesise information to formulate an initial diagnosis of the type and severity of injury or illness in different sporting contexts, based on..... acute systemic trauma (such as spleen rupture and kidney contusion)”.

(IFSPT 2005)

### *Epidemiology*

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- Serious abdominal injuries are most common in contact sports.

- Main sports:
  - Martial arts
  - Skiing
  - Cycle and motorcycle events
  - Equestrian events
  - Football
  - Mountain biking
- More common in children because their abdominal organs are less protected by bone, muscle and fat.
- A review of children admitted to hospital with abdominal injuries over a 30 year period has shown that sport is an increasingly common cause.
- Serious abdominal injury accounts for 10% of all abdominal injuries.
- Below are abdominal injuries listed on the bases of how common they occur in sports:

Most common	Less common	Must not be overlooked !
Side stitches	Penetrating abdominal injury,	Any intra-abdominal organ injuries
Winding,	Liver injuries,	Acute nontraumatic abdominal pain (multiple causes)
Abdominal wall contusion,	Kidney injury,	
Rectus abdominis muscle tear,	Gastrointestinal tract rupture,	
Other abdominal muscle tears,	Diaphragmatic rupture,	
Splenic injury.		

**Table 6.1: Abdominal injuries in sports categorised by how commonly they occur (Ryan 1999)**

### ***Serious Abdominal injuries and internal bleeding signs and symptoms***

Signs and symptoms depend on where the bleed is located what structures are affected and how much bleeding has occurred:

- Cold, sweaty skin
- Shortness of breath
- Rebound tenderness (Likelihood ratio (LR)= 6.5)
  - To perform the rebound test, press firmly into the abdomen with the pads of your fingers with both hands overlapped and release the pressure quickly (as shown).



**Fig 6.1: (Barrett and Smith 2012) Rebound tenderness hand placement**

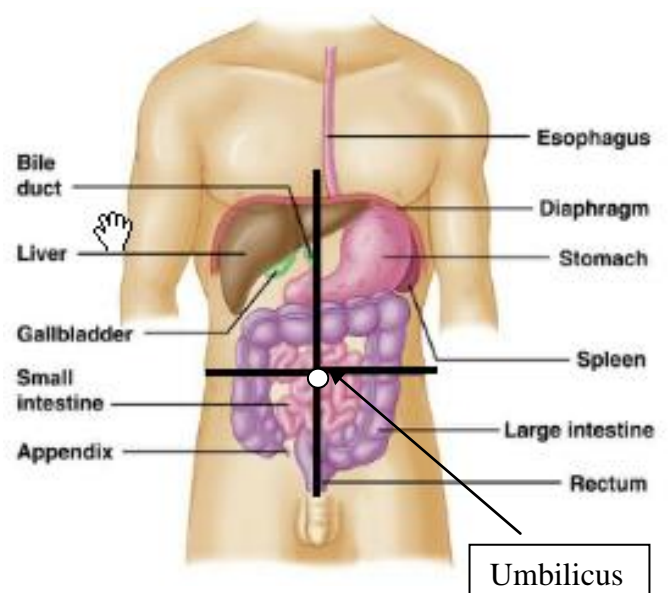
If the athlete complains of significant tenderness after the release of pressure, there is sufficient evidence of organ damage to secure transportation for the athlete for advanced medical treatment.

- Rebound tenderness is associated with stretching the irritated peritoneum, which lines the inner wall of the abdomen and pelvis. The peritoneum is injured when there is internal bleeding or visceral injuries, thus causing rebound tenderness).
- Abdominal pain, initially mild then rapidly increasing in severity
- Coughing up blood
- Abdominal distension (LR=3.8)
- Nausea and vomiting
- Skin bruising
- Guarding (LR=3.7)
- Rapid pulse
- Low blood pressure (LR= 5.2)
- Severe thirst
- Loss of consciousness

(Nishijima *et al* 2012)

## Abdominal Quadrants

- **Upper left:**  
Spleen, pancreas, stomach, left kidney
- **Upper right**  
Liver, gallbladder, duodenum, right kidney
- **Lower left**  
Large+ small intestines, left ovary, bladder
- **Lower right**  
Large+ small intestines, appendix, right ovary, bladder



**Fig 6.2: Abdominal Quadrants (Doral 2012)**

## Most Common Abdominal Injuries

	Cause	Signs and Symptoms	Why Important to Recognise
<b>Kidney injury</b> (often co-exists with other internal injuries)	<ul style="list-style-type: none"> <li>Direct blow to either side of mid-back. (most commonly injured visceral organ in children)</li> </ul>	<p><u>Early Stage</u></p> <ul style="list-style-type: none"> <li>Pain at site of the blow</li> </ul> <p><u>Advanced Stage</u></p> <ul style="list-style-type: none"> <li>Blood in urine</li> <li>Frequent/ painful urination</li> <li>Muscle spasm over impact site</li> <li>Pain lower back, lateral thighs, anterior pelvis</li> </ul>	Even if kidney only mildly bruised, can worsen over time and become life threatening over time if not treated.
<b>Spleen injury</b> (filters and stores blood)	<ul style="list-style-type: none"> <li>Direct blow to left side of the body under lower ribs and stomach (most commonly damaged organ in blunt abdominal trauma in sports (50%) and most common cause of death due to abdominal trauma in adults).</li> <li>Fracture 9<sup>th</sup>/10<sup>th</sup> left rib</li> <li>Caused by rapid deceleration</li> <li>8/17 footballers who suffered ruptured spleens, had glandular fever just before the injury</li> </ul>	<p><u>Early Stage</u></p> <ul style="list-style-type: none"> <li>Pain and tenderness over upper left abdomen</li> </ul> <p><u>Advanced Stage</u></p> <ul style="list-style-type: none"> <li>Left shoulder and proximal third left arm pain (Kehr's sign) and neck pain (blood irritating the diaphragm)</li> <li>Dull left 'flank' pain (lateral pain between pelvis and lower ribs)</li> <li>Chest pain on inspiration</li> </ul>	If athlete continues to play (even if symptoms do not progress to advanced stage), another direct blow can cause perfuse bleeding and hemorrhagic shock.
<b>Liver injury</b>	<ul style="list-style-type: none"> <li>Direct blow to right upper abdomen or right lower ribs</li> <li>25% intra abdominal injuries</li> </ul>	<ul style="list-style-type: none"> <li>Pain upper right abdomen</li> <li>Right shoulder pain</li> <li>Pain just below right scapula</li> </ul>	<ul style="list-style-type: none"> <li>Liver is delicate and has large blood supply.</li> <li>Blood passes through liver before returning to heart.</li> </ul>
<b>Intestinal injury</b>	<ul style="list-style-type: none"> <li>Direct blow to lower abdomen</li> </ul>	<ul style="list-style-type: none"> <li>Tenderness to the area</li> <li>Changes in bowel function</li> <li>Guarding of area</li> <li>Bloating</li> </ul>	If the contents leaks out, it could cause serious infection
<b>Testicular Trauma</b>	<ul style="list-style-type: none"> <li>Direct blow to the groin area</li> </ul>	<p><u>Early stage</u></p> <ul style="list-style-type: none"> <li>Pain</li> <li>Nausea</li> <li>Swelling, discolouration, deformity (on self-examination)</li> <li>Spasm of testicles</li> </ul> <p><u>Advanced Stage</u></p> <ul style="list-style-type: none"> <li>Testicles draw upwards</li> </ul>	<ul style="list-style-type: none"> <li>The testicles can rupture or the testicular cord can get twisted (cutting off blood flow to the testicles which can cause sterility)</li> </ul>
<b>Bladder injury</b> (75% with pelvic fractures)	<ul style="list-style-type: none"> <li>Blunt force to lower abdomen (when distended with urine)</li> </ul>	Pain lower abdomen Shock Bloody urine/ inability to urinate	Infection and bilateral obstructive uropathy (blockage of urine from the kidneys)

Table 6.2: Most common internal injuries in sports (Barrett and Smith 2012 , Hyde and Gengenbach 2007)



- Retroperitoneal organ lesions are mostly due to sudden decelerations with aortic lesions being the most life threatening, along with pancreatic lesions.
- Pancreatic injuries are rare and is usually seen with injury to other organs
- Abdominopelvic visera (inferior parts of urinary tract and internal reproductive organs) are usually well protected during sports (Doral 2012).

### *Signs and symptoms of hypovolemic shock*

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- Pale, cool peripheries
- Clammy skin
- Tachycardia > 100 bpm
- Bradycardia < 60 bpm
- Decreased pulses peripherally
- Confusion
- Chest pain

(Rossaint *et al* 2010- Level 1a)

### *Management of an internal injury at a sporting event*

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#### **Abdominal Injury**

- Question them about exact mechanism of injury and description of pain
  - Where did they get hit?
  - How did it happen?
  - How long ago did the pain start
- Lie them supine with knees flexed (to relax abdominal muscles).
- Do not extend or elevate the legs.
- Assess vital signs
  - RR- rapid, shallow breathing indicates shock
  - HR- rapid, weak pulse indicates shock
  - BP- Hypotension indicates shock
- Control any external bleeding with a sterile dressing.
- If they vomit, roll them onto side.

- Avoid rough handling that could cause further injury
- Keep reassuring the athlete. If they are in a calm state it minimises the effects of shock  
(Anderson 2003)
- If signs and symptoms don't progress to advanced stage but tenderness persists for more than 15 minutes, advice to see GP.
- If they progress, send for emergency services to receive CT scan if signs and symptoms progress to advanced stage.
- Monitor breathing and circulation
- If shock symptoms are observed, elevate the player's legs to assist blood flow to the head and heart, try to keep them warm and provide O2 if available.
- Do not allow them to have any food or water (if digestive organs are injured, food/ fluids can leak out the abdominal cavity and cause infection. If surgery is required, food/water can increase likelihood of vomiting/aspiration during general anaesthesia)
- Do not allow them to leave a game without being monitored by someone.
- If it is only a minor blow, inform the athlete of the signs and symptoms of a serious internal injury.
- If an athlete has to stop participation due to abdominal pain/discomfort, a qualified medical professional (can be a physiotherapist) should assess them before returning to play.
- Note: The American College of Surgeons suggest that if there are multiple injuries, the assessment and management of abdominal injuries must take second place to potentially more life threatening ones. Thus, airway and cervical spine control and ventilation must take priority over circulation and control of haemorrhage, which are usually the most serious consequences of severe abdominal injury
- **General Tip:** Not eating immediately before competition and urinating before a game can significantly reduce the risk of injury to the digestive organs, and bladder.

(Flegel 2008; Barrett and Smith 2012; Ryan 1999; Rehberg 2007)

## Management of Testicular trauma

- Assist the athlete into most comfortable position
- Encourage slow, deep breaths
- Apply ice to the area for 15 mins
- If above signs and symptoms are present for more than 1 hour after the injury or if pain does not stop after 20 mins, athlete requires immediate medical attention.
- If athlete recovers within a few mins, explain how to identify signs and symptoms of a more sinister injury should they encounter them within a few hours

(Koester 2000)

## Sports Hernia

- A sports hernia occurs when there is a weakening of the muscles or tendons of the lower abdominal wall.
- It is a bulge or incipient posterior inguinal wall hernia that creates lower abdominal or groin pain, leading to loss of inguinal canal integrity without the presence of a true hernia.
- It is due to a weakening of the posterior inguinal wall weakening from excessive or high repetition shear forces .
- Sports hernias occur more often in men, usually during athletic activities that involve cutting, pivoting, kicking and sharp turns.
- There is no palpable hernia.
- **Signs and symptoms:**
  - Pain in the lower abdomen
  - Pain in the groin
  - Pain in the testicle (in males)
  - pubic tubercle tenderness,
  - hip adductor origin tenderness
- Symptoms are exacerbated with activities such as running, cutting, and bending forward. Patients may also have increased symptoms when coughing or sneezing. Sports hernias are most common in athletes that have to maintain a bent forward position, such as hockey players. If you suspect one, advise to go to GP.

(Caudill *et al* 2008 (Level 2A))

## *Differential Diagnosis*

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### **Side Stitches**

- Lateral abdominal, cramp like pain when running
- Not related to blunt trauma
- Usually when unconditioned or ate recently
- Thought to be caused by diaphragmatic ischemia or rapid increase in venous flow to the liver
- Stretch arm on affected side and flex trunk
- Usually resolves within a few minutes

(Bahr 2012)

### **Winding**

- Blow to abdomen/fall on back
- Occurs due to temporary paralysis of the diaphragm
- S+S: Difficulty breathing, inability to speak, pain just below sternum
- **Management:**
  - Reassure them and advice them to sit leaning forward over flexed knees
  - Encourage slow, deep, diaphragmatic breaths
  - If the athlete is asthmatic they may need their inhaled medication
  - If normal breathing doesn't resume within a few mins, seek medical attention

(SMA 2006)

### **Abdominal muscle strains and abdominal contusions**

- Strain typically not caused by abrupt abdominal movement (usually stretching or twisting mechanism)
- Contusion caused by compressive force
- Symptoms relieved immediately in absence of movement
- **Management:**
  - Remove athlete from play, apply ice and compression wrap

### **Appendicitis**

- Not related to trauma
- Mild to severe pain in lower right abdomen
- Possible nausea and vomiting (Doral *et al* 2012)

## *Management of an open abdominal wound*

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1. Position the casualty by placing the casualty on his back with the knees up (flexed).
2. Uncover the wound unless clothing is stuck to the wound.
3. **While wearing gloves, remove any obvious dirt or debris from the wound**
  - a) Don't remove any large or more deeply embedded objects. Your principal concern is to stop the bleeding.
4. **Apply pressure directly on the wound until the bleeding stops (Grade 1C evidence).**

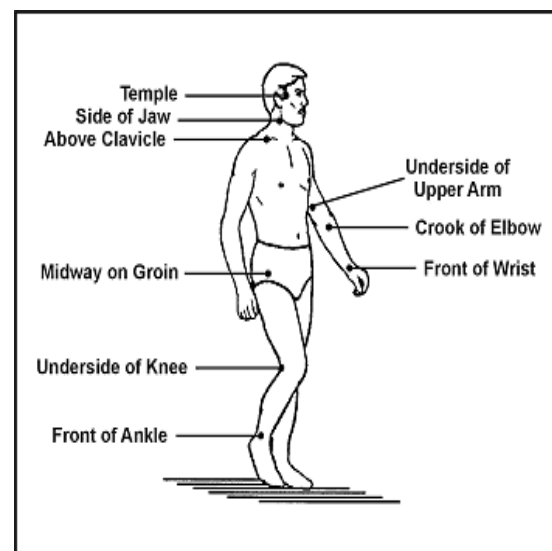
- a) Use a sterile pressure bandage or clean cloth and hold continuous firm pressure for a few minutes. Maintain pressure by binding the wound tightly with a bandage or clean cloth and adhesive tape
- b) Use your hands if nothing else is available. If possible, wear rubber or latex gloves or use a clean plastic bag for protection



**Fig 6.3: Abdominal pressure bandage**

5. **Don't remove the gauze or bandage**
  - a) If the bleeding continues and seeps through the gauze or other material you are holding on the wound, don't remove it. Instead, add more absorbent material on top of it

6. Squeeze a main artery if necessary
  - a) If the bleeding doesn't stop with direct pressure, apply pressure to the artery delivering blood to the area as outlined in Fig 6.4.
  - b) Keep your fingers flat. With your other hand, continue to exert pressure on the wound itself.
  - c) Pressure points of the arm are on the inside of the arm just above the elbow



**Fig 6.4: Places to apply direct pressure to the main arteries to stop bleeding (Rehberg 2007)**

and just below the armpit.

d) Pressure points of the leg are just behind the knee and in the groin.

7. Immobilize the injured body part once the bleeding has stopped

a) Leave the bandages in place and get the injured person to the emergency room as soon as possible.

b) Keep the athlete warm to reduce the risk of hypothermia since hypothermia in trauma patients represents an independent risk factor for bleeding and death.

(Rossaint *et al* 2010- Level 1a)

Medical assistance is needed for an abdominal wound under the following circumstances:

- If a cut is longer than about  $\frac{1}{3}$  inch ( $\frac{3}{4}$  centimeter), is on the face, appears deep, or has edges that separate.
- If bleeding does not stop on its own or within several minutes after pressure is applied.
- If there are symptoms of a nerve or tendon injury, such as loss of sensation, loss of movement, or numbness.
- If a scrape is deep or has dirt and particles that are difficult to remove.
- If there is a puncture wound, particularly if foreign material in the wound is likely

### *Examination of evidence*

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There is differing levels of evidence available for abdominal injuries. While information regarding identification of these injuries were found in books and recent systematic reviews and the management of external bleeding is based on the most recent European guidelines, the management of internal bleeding and visceral injuries was extracted from two review papers, with only a 'level 5' evidence rating.

While this would warrant the results to be interpreted with caution, where there was any ambiguity about the reliability of information obtained, several other sources were checked to confirm its validity, including books and the expert opinion of experienced sports physiotherapists.

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Nishijima <i>et al</i> 2012	Systematic review	Level Ia	This review assess the accuracy of different signs and symptoms along with lab tests and imaging studies to identify intra-abdominal injuries in patients who have received blunt abdominal trauma.	<p>Clinical tests for intra-abdominal injury:</p> <ul style="list-style-type: none"> <li>• Rebound tenderness (LR, 6.5; 95% CI, 1.8-24)</li> <li>• Hypotension (LR, 5.2; 95% CI, 3.5-7.5), abdominal distention (LR, 3.8; 95% CI, 1.9-7.6)</li> <li>• Guarding (LR, 3.7; 95% CI, 2.3-5.9)</li> </ul> <p>The absence of abdominal tenderness to palpation does not rule out an intra-abdominal injury (summary LR, 0.61; 95% CI, 0.46-0.80)</p>	<p>Based on 12 studies that examined the identification of intra-abdominal injuries</p> <p>Each paper was independently critically appraised by 2 authors.</p>
Rossaint <i>et al</i> 2010	Evidence based guidelines	Level I	Updating the multidisciplinary 'Task Force for Advanced Bleeding Care in Trauma' 2007 guidelines.	<p>Outlines recommendations on the best management of external bleeding, which are graded depending on the level of evidence underpinning the recommendation.</p>	<p>The most recent European guidelines formulated using a systematic review approach alongside the views of an expert panel in the area who ensured the recommendations based on the literature were realistic to implement</p> <p>Uses RCT's and well designed retrospective studies</p>

<b>Study</b>	<b>Study Type</b>	<b>Level of Evidenc</b>	<b>Purpose</b>	<b>Results</b>	<b>Comment</b>
Barrett and Smith 2012	Review	Level 5	To review the literature on the recognition and management of abdominal injuries and offer a guide to managing abdominal injuries at a sporting event. To do this, they outline key points to remember about mechanisms of injury, vital sign monitoring and assessment of signs and symptoms.	Outlines recommendations for the recognition and management of abdominal injuries at athletic events	<p>The systematic review approach was not suitable in this instance. This is because the majority of literature regarding acute management of internal injuries is contained in books rather than high quality research studies This is because researchers could not ethically deny treatment to anyone with such a potentially serious injury.</p> <p>Limitation: 5 of the 6 references included are from books</p>
Ryan 1999	Review	Level 5	To review causes of abdominal injury specifically in sports and describes the patterns, causes and signs and symptoms of injury in different sports	<p>Recommends initial Management and investigation of abdominal injuries with different sports. It also aims to outline management of these injuries according to the research and describes how injury prevention can play a significant role.</p>	<p>Limitation: Old study, many of the management strategies outlined may be obsolete due to improved levels of scientific evidence and also the massive changes in clinical practice over the last 13 years due to significant technological advances.</p> <p>Although many papers are referenced, there was no description of the system they used to source information and thus is subject to bias</p>



## Internal Injuries- At a Glance

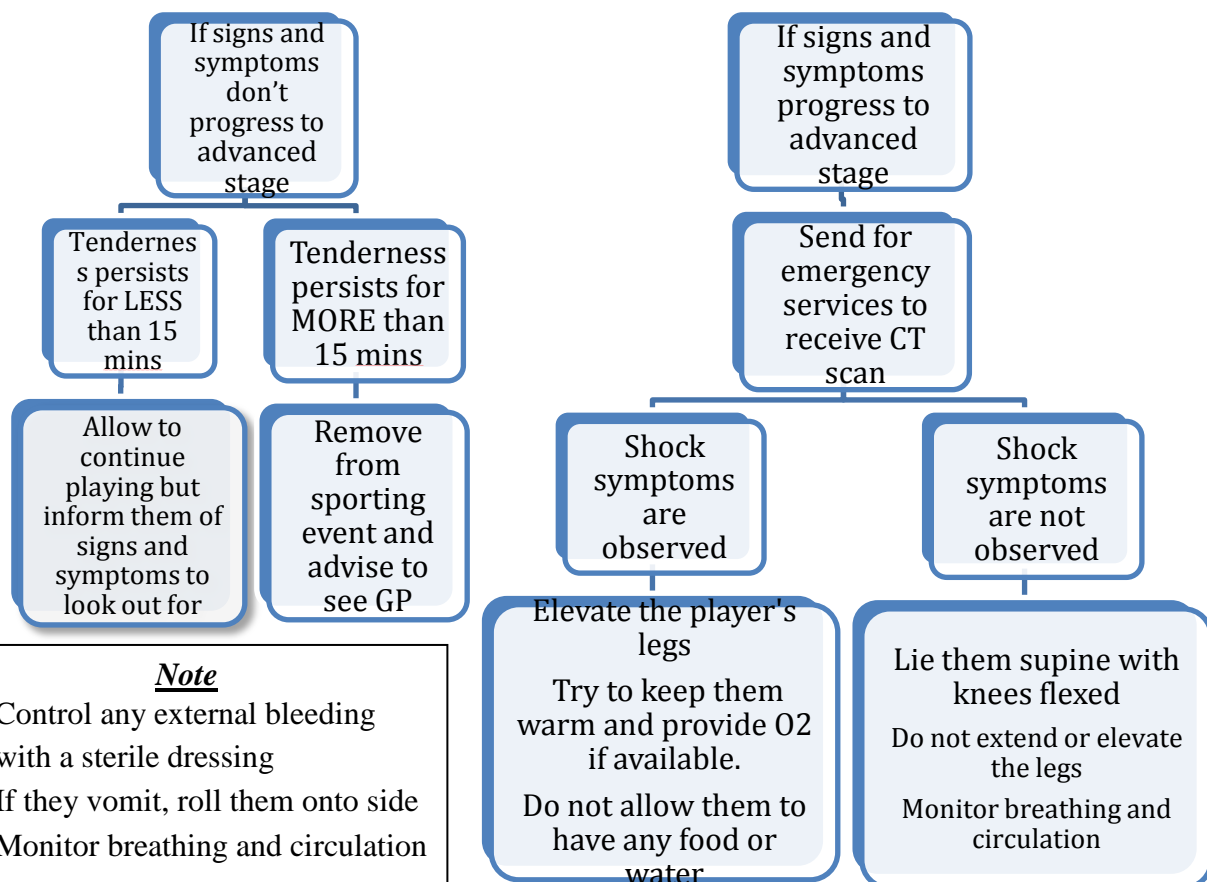
### Signs and symptoms of serious abdominal injury

- Cold, sweaty skin
- Shortness of breath
- Rebound tenderness
- Abdominal pain (initially mild then rapidly increasing in severity)
- Coughing up blood
- Abdominal distension
- Nausea and vomiting
- Skin bruising
- Rapid pulse
- Low blood pressure
- Severe thirst
- Loss of consciousness
- Bloody/cloudy urine

### Signs and symptoms of shock

- Pale, cool peripheries
- Clammy skin
- Tachycardia > 100 bpm
- Bradycardia < 60 bpm
- Decreased pulses peripherally
- Confusion
- Chest pain

### Management of Internal abdominal injury at a sporting event



#### Note

- Control any external bleeding with a sterile dressing
- If they vomit, roll them onto side
- Monitor breathing and circulation (RR, BP, HR)
- Do not allow them to leave a game without being monitored

Fig 6.5 Management of Internal Abdominal Injury

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# Acute Compartment Syndrome

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## *Introduction*

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**Definition:** ‘a condition in which increased pressure within a limited space comprises the circulation and function of the tissues within that space’ (Elliott and Johnstone 2003).

The most common overall areas of occurrence are the leg and forearm. Other possible sites for occurrence are the arm, thigh, foot, buttock, hand and abdomen.

The most commonly affected site is the anterior compartment of the lower leg (Brunker and Kahn 2006).

## **Pathophysiology**

The arteriovenous pressure gradient theory has been recognised as a prominent cause of acute compartment syndrome. It was first described by Matsen and Krugmire. Ischemia begins when blood flow cannot meet the metabolic demands of the tissue. Intra-compartmental pressure increases along with intraluminal venous pressure resulting in a decrease in arteriovenous pressure causing diminished or absent local perfusion. Interstitial tissue pressure increases due to the decrease in venous drainage. Tissue oedema forms as a result. Lymphatic drainage increased to protect against the rise in interstitial fluid pressure. When interstitial fluid pressure peaks there is a further increase intracompartmental pressure causing deformation and ultimately collapse of the lymphatic vessels.

Arterial flow is only compromised in the late stages of compartment syndrome. The continuing flow of blood augments the swelling and oedema throughout the early stages of the syndrome (Elliott and Johnstone 2003).

## *Cause*

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It typically presents after **traumatic injury most likely open fractures and/or severe soft tissue injuries**, but may also occur after burns, prolonged limb compression (e.g. after drug overdose), crush injuries or poor positioning during surgery. It is important to remember that the syndrome can occur after any injury regardless of the aetiology, velocity or degree of comminution of a fracture (Elliott and Johnstone 2003; Wall *et al* 2010).

## Demographic of Population most at risk

- Males aged less than 35
- Diaphysis fracture of the tibia and distal radius and/or ulna is the most common cause (Wall *et al* 2010)

## Diagnosis

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Despite attempts to identify consistent clinical and objective measures of an impending compartment syndrome, no reliable, clear-cut diagnostic guidelines have been established so far. (Elliott and Johnstone 2003).

Acute Compartment Syndrome should be considered in any patient with an extremity injury marked by hematoma or edema (Brunker and Kahn 2006) or following any limb injury (Wall *et al* 2010)

A conscious patient will complain of pain. If the patient is unable to communicate, compartment pressures should be measured (Brunker and Kahn 2006).

Continued monitoring of compartment pressures may allow the diagnosis to be made earlier thus minimising the risk of complications (McQueen *et al* 2000).

## Measuring Compartment Pressures

Monitoring Intra-compartmental Pressure (ICP) should be routine in any patient suspected of having acute compartment syndrome particularly in those unable to communicate any other symptoms (Elliott and Johnstone 2003).

The use of the slit catheter has been acknowledged as the most accurate method for measuring ICP over a 24 hour period (McQueen *et al* 2000).

The latest device for monitoring pressure is the transducer-tipped probe. This has been shown to be easy to use and highly accurate, with an excellent dynamic response to changing pressures.

## Other injuries that may cause acute compartment syndrome

- Soft-tissue injury
- Crush syndrome
- Diaphyseal fracture of the radius and/or ulna
- Femoral fracture

- Tibial plateau fracture
- Hand fractures
- Tibial pilon fractures
- Foot fractures
- Ankle fracture
- Elbow fracture-dislocation
- Pelvic fracture
- Fracture of the humerus

(McQueen *et al* 2000)

## Signs and symptoms

- Palpable tenseness or swelling of the compartment
- Pain out of proportion to the injury
- Paraesthesia of skin supplied by nerves traversing the compartment
- Paresis of muscles supplied by nerves traversing the compartment
- Pallor of skin overlying the compartment
- Pulses present

(Wall *et al* 2010)

## Complications

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If untreated the following may occur:

- Neurological deficit
- Muscle necrosis
- Ischemic contracture
- Infection
- Delayed healing of fracture
- Crush syndrome
- Acute renal failure
- Cardiac arrhythmias
- Amputation due to extensive irreversible muscle damage

The incidence of these complications is strongly related to the timing of fasciotomies and therefore it is essential that compartment syndromes are diagnosed and treated as early as possible (Elliott and Johnstone 2003). The most predominant factor for poor outcome involves a delay in diagnosis (McQueen *et al* 2000).

### *Management Guidelines*

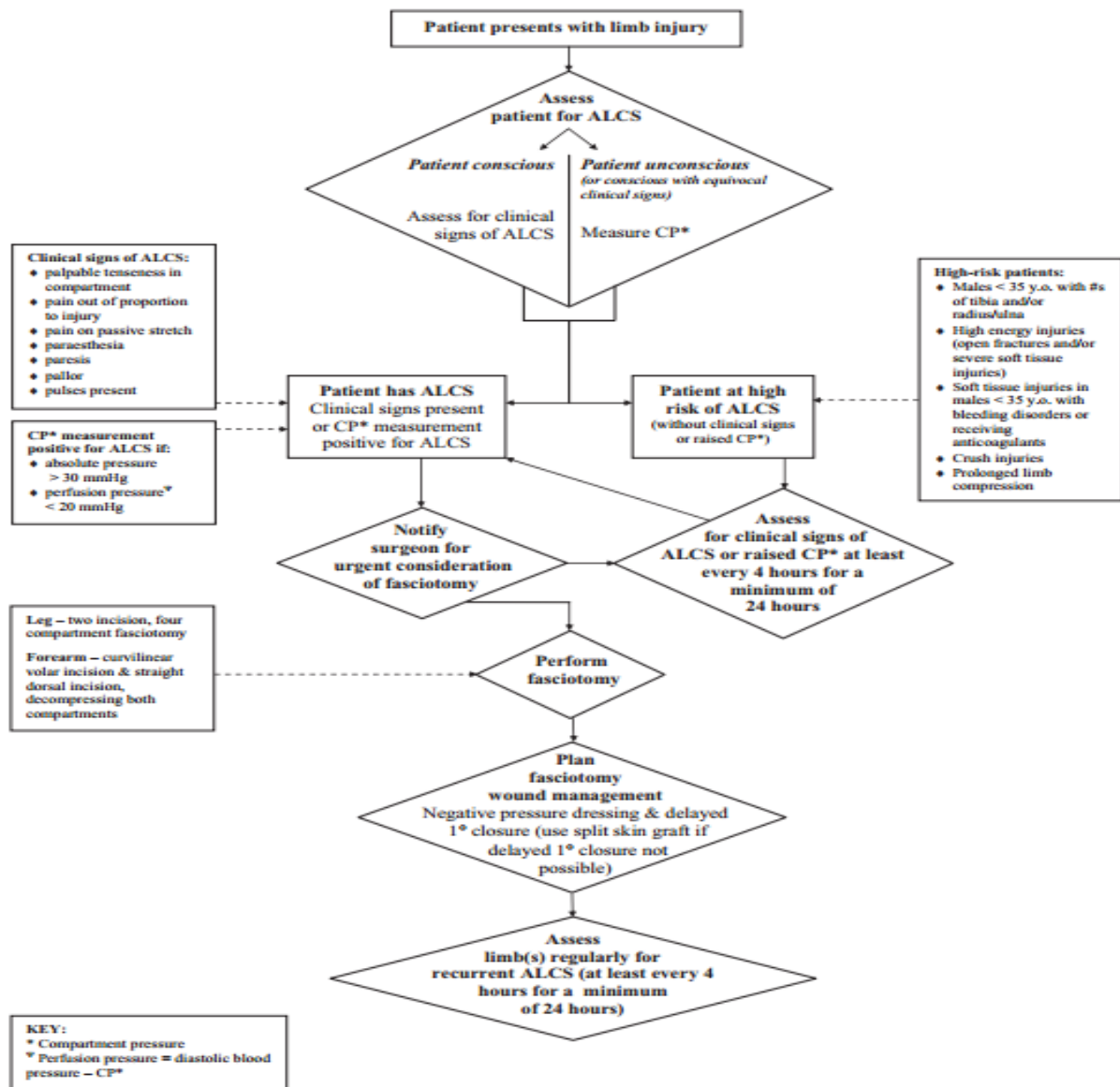
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1. Vigilance must be maintained in all potential cases of acute compartment syndrome. The education of those caring for these patients is essential, therefore sports physiotherapists must familiarise themselves with how to recognise and manage this.
2. Emergency conservative measures should be instituted if the delta pressure approaches or drops below 30 mmHg, or clinical symptoms develop. **Appropriate measures include the removal of all constrictive clothing or strapping, the maintenance of the limb at heart level, and immediate transferral to the hospital for the commencement of supplementary oxygen and restoration of normal blood pressure in the hypotensive patient.**

(Wall *et al* 2010)

3. It is essential to get the athlete to the hospital as quick as possible, because guidelines state that full and extensive fasciotomies should be performed within six hours if the delta pressure remains less than 30mmHg and/or clinical symptoms and signs persist despite conservative measures. In the leg the fasciotomies should be performed using both medial and lateral incisions and should include all four compartments. Although the morbidity of fasciotomies is significant, it is preferable to the outcome of a missed compartment syndrome.

The following diagram illustrates the procedure to follow if Acute Compartment is suspected following traumatic limb injury:



**Fig 6.5 Flow chart for assessment and management of acute compartment syndrome (Wall et al 2010)**

### At a Glance

All patients following limb injury should be suspected of acute compartment syndrome. Fracture to radius, tibia and/or ulna are the most prominent causes.

If suspected you should

- Remove all constrictive clothing or strapping
- Maintain the limb at heart level
- Immediate transfer to a hospital as a fasciotomy is required to reduce risk of complication

The main cause for complications to occur is a delay in diagnosis.

## Examination of Evidence

Study	Study Type	Level of Evidence	Purpose	Results	Comment
McQueen <i>et al</i> 2000	Review	Level 5	To assess the causes of acute compartment syndrome	Outlines various causes for acute compartment syndrome and highlights the most prevalent	Provides a good understanding of the range of causes of acute compartment syndrome
Elliott and Johnstone 2003	Review	Level 5	To provide a background on acute compartment syndrome. To provide the best available evidence for management of acute compartment syndrome	Describes compartment syndrome. Outlines recommendations for the assessment, treatment and management of acute compartment syndrome. Draws up clinical guidelines from the findings.	The article provides a good analysis of compartment syndrome as well as good recommended guidelines.
Wall et al 2010	Clinical Practice Guidelines	Level 1b	To provide an up to date account of the best available evidence for the management of acute lower limb compartment syndrome	Describes clinical guidelines for the management of acute lower limb compartment syndrome	A good up to date analysis of the best available literature for the management of acute lower limb compartment syndrome



## References

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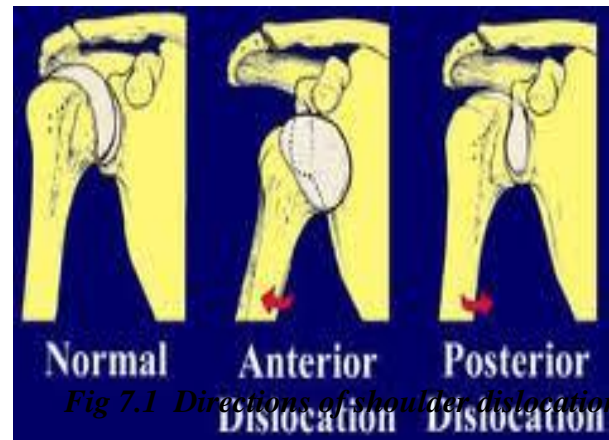
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# Chpt 7: Dislocations & Fractures

## *Introduction to Dislocations*

Dislocations are a common injury of certain joints in the athlete population. Dislocation of the glenohumeral joint accounts for 50% of all dislocations. In the general population it is the most dislocated joint in the body. 90% are anterior dislocations (Bottoni *et al* 2002) with 4 % posterior dislocations (Logerstedt 2004). Associated injuries carry significant morbidity and must be recognized. The evidence is now siding towards a role for acute surgical arthroscopic stabilization in certain patient groups (Bottoni *et al* 2002).

- A dislocation occurs when the bones that form the joint have slipped out of their normal position in the joint.
- Can occur at any joint – big or small.
- X-rays are usually taken to confirm a dislocation diagnosis and to rule out any subsequent fractures.
- Time required to heal is dependent on the joint affected, and any consequential injuries sustained.
- Subluxation – bones of a joint shift, but do not fully dislocate. This can be a chronic problem.
- Most common sites of joint dislocation are: shoulders, fingers, knees, wrists, and elbows (Brukner and Khan 2006).
- General complications of dislocations are:
  - Tearing of muscles, tendons and ligaments near the affected joint.
  - Nerve or blood vessel damage
  - Susceptibility to re-injury if a severe or multiple dislocations have occurred



- Development of arthritis in affected joint as time passes.

(Brukner & Khan 2006)

- Physiotherapy can act as a long-term/preventative treatment – to strengthen muscles imperative to joint stability.

## *Causes*

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Dislocation can be caused by a fall, blow, or any other excessive tension on the joint. Each joint also has specific spatial conditions that make it more susceptible to dislocation and these are:

- Shoulder - arm abducted, externally rotated.
- Finger – most often the middle knuckle of the finger, when ‘jammed’ or forcefully over-extended.
- Elbow – caused by a fall when the arm is fully extended, or by a forceful yanking on the arm, as seen in cases of ‘nursemaid’s elbow’.
- Knee-fairly rare, usually occurs in motor vehicle collisions.

Dislocations can also be caused by diseases or defective ligaments (i.e. Rheumatoid arthritis). Some joints are more susceptible to dislocation due to their high level of mobility. Can cause damage to the joint depending on the severity of the dislocation.

## *Recognising a Dislocation*

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- The first notable symptom is an individual’s inability or refusal to use said joint.
- Dislocations can be informally assessed pitch side given the following symptoms – pain, numbness or tingling, and physical deformity. The advice of a health professional as well as radiographic imaging should always be performed to supplement on-field diagnosis to rule out more severe injuries.

## *Knee Dislocation*

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Acute knee dislocation occurs when the tibia and femur are out of place in relation to each other. It is an uncommon diagnosis in an acute sporting setting. 50% spontaneously reduce prior to attendance by the medical practitioner. However it is important to be able to recognise because it has a high rate of associated injuries and potentially limb threatening complications. Up to 40% of knee dislocations have associated vascular injury and injury to the perineal nerve occurs in up to 25-35% of knee dislocations. It may be the most serious acute knee injury and presents one of the few true orthopaedic emergencies. **RAPID** reduction and neurovascular assessment are essential to minimise risk of serious injury.

### **Incidence**

The reported incidence in <.02% of musculoskeletal trauma, however, due to the aforementioned self reduction, the real incidence is unknown. There can be long term pain and instability post knee dislocation. Although advancements have progressed in the last 20 years, optimal treatment of these injuries remains controversial. Few high level evidence studies are available to help guide management. The low incidence and diverse co-morbidities of the injury makes RCT's difficult to facilitate.

A basic knowledge of the injury along with particular attention to the physical examination & initial management (outlined on page 89) will allow the treating physiotherapist to manage a patient with knee dislocation appropriately, with a potentially reduced risk of complications. Increased incidence is due to the increase in popularity of extreme sports and because athletes are maintaining interest in sports into an older age than before (De Los *et al* 2000).



***Fig 7.2 Knee Dislocation***



*Fig 7.3 AP dislocation of tibia*



*Fig 7.4 PA dislocation of tibia*

### Mechanism of Injury

- Motor vehicle collisions
- More recent times have seen an increase in numbers of knee dislocations in athletic competition because athletes are now stronger faster and larger.

### Classification

Figure 2. Schenck classification system.

Anatomic Classification of Knee Dislocations		
Schenck 1992		
I	single cruciate + collateral	ACL + collateral PCL + collateral
II	ACL / PCL	collaterals intact
III M	ACL / PCL / MCL	LCL+PLC intact
III L	ACL / PCL / LCL+PLC	MCL intact
IV	ACL / PCL / MCL / LCL+PLC	
V	fracture dislocation	

The diagram shows two anatomical views of a knee joint. The top view is a medial view showing the femur, tibia, and patella. The bottom view is a lateral view showing the femur, tibia, and patella. The ligaments are represented by lines and circles, with plus signs indicating their status. The top view shows the ACL, PCL, MCL, and LCL. The bottom view shows the ACL, PCL, MCL, and LCL. The diagram is divided into two sections, each with a different ligament status.

*Table 7.1 Anatomical classification of knee dislocation (Bond and Colbert 2011)*

## Clinical Presentation

- Pain out of proportion to the injury, or absent or decreased pulses are suggestive of knee dislocation.
- Pain and swelling.
- Haemarthrosis (bleeding in a joint space) due to a coexisting fracture or ligament tear.
- Ecchymosis (hematoma).
- Knee dislocation may be misdiagnosed as compartment syndrome or missed altogether
- A finding of varus or valgus instability in full extension indicates unstable dislocation that has spontaneously reduce

**\*\*Note\*\*** Dislocation of the knee typically injures both cruciate ligaments and one or both collateral ligaments

(Bond & Cobert 2011)

## Red flags

- If the mechanism of injury is posterolateral rotatory dislocation (indicated by an anteromedial skin furrow as shown in *Fig 7.5*), it is irreducible by closed reduction and requires immediate open reduction.
- Decreased or absent pulses requires immediate consultation by a vascular surgeon.
- **\*\*Note\*\*** Presence of normal pulses does not rule out vessel injury (Fanelli *et al* 2005).

Figure 6. Irreducible knee dislocation with dimple sign.



***Fig 7.5 Skin furrow indicating posterolateral rotary dislocation of the knee***

## Outcomes

For the most part, the majority of patients treated for a knee dislocation can expect a return to their activities of daily living, with varying degrees of functional loss based on the severity of the injury, success of the reconstruction and the presence of associated vascular, neurological or open injury (Fanelli *et al* 2005).

Following treatment and prompt reduction, 60-70% of athletes will recover with a painless, stable knee. Approximately 15% of patients will return to reasonable function, and the remaining 15% have a chronically unstable knee. A review in 2010 demonstrated a 79% return to sport, with only 33% of athletes returning to the same pre-injury competitive level (Hirschmann *et al* 2010).

### **Possible Complications**

- Injury to the popliteal artery
- Delay in treatment of vascular damage (may lead to above the knee amputation)
- A popliteal artery thrombosis (could take up to a few weeks to form)
- Peroneal nerve injury
- Compartment syndrome
- DVT
- Fracture (Tibial plateau, tibial shaft, proximal fibula)
- Ligamentous injury
- Pseudoaneurysm
- Chronic instability
- Arthrosis
- Stiffness
- Chronic pain

# Fractures

## *Introduction to Fractures*

Fractures are caused by a strong force, impact, pressure, or stress that is stronger than the bone itself. On average, a person will experience 2 in their lifetime. There are 4 types of fractures:

- Complete – a bone breaks in to two or more pieces.
- Incomplete – a bone is cracked but does not fully break in to pieces.
- Open (compound) – the bone breaks through the skin and is exposed.
- Simple – a bone does not break the skin, subdivided into: hairline, greenstick, oblique.
- Stress fracture.



***Fig 7.6 Complete tibial #***



***Fig 7.7 Incomplete radial #***



***Fig 7.8 Open # of tibia and fibula***



***Fig 7.9 Greenstick # of radius***



- Fractures are more likely in children and the elderly.
- #s can be caused by certain medical conditions that weaken the bone – such as osteoporosis, bone cancer, osteogenesis imperfecta (pathologic fractures).

### *Recognising Fractures*

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- If unrecognized, fractures can lead to serious complications such as hypovolaemic shock, infection, or compartment syndrome (Lee and Porter 2005).
  - Pain or tenderness
  - Guarding
  - Patient pointing to specific injury site
  - Examine site: looks for deformity or angulation (compare to uninjured side)
  - Patient may complain of grating sensation or sound (crepitus) or pins and needles
  - Bruising or exposed bone
  - Patient may complain of inability to move joint or extremity
- See next chapter on ‘clinical fracture rules’ for more in depth information on recognizing fractures.

### *Management of Fractures and Dislocations*

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The management of fractures and dislocations both involve immobilization and thus the following information will be applicable to both injuries

**\*\*“Primum non nocere” ~ “First do no harm”\*\***

**NB\*\*\*Do not relocate a dislocation at an athletic event. It is NOT within our scope of practice\*\*\*NB**

The most common fractures associated with sporting occurrence are tibial and ankle fractures and the most common dislocation is the shoulder. Following a simple, logical assessment such as that outlined in Fig 7.10 provides the best management:

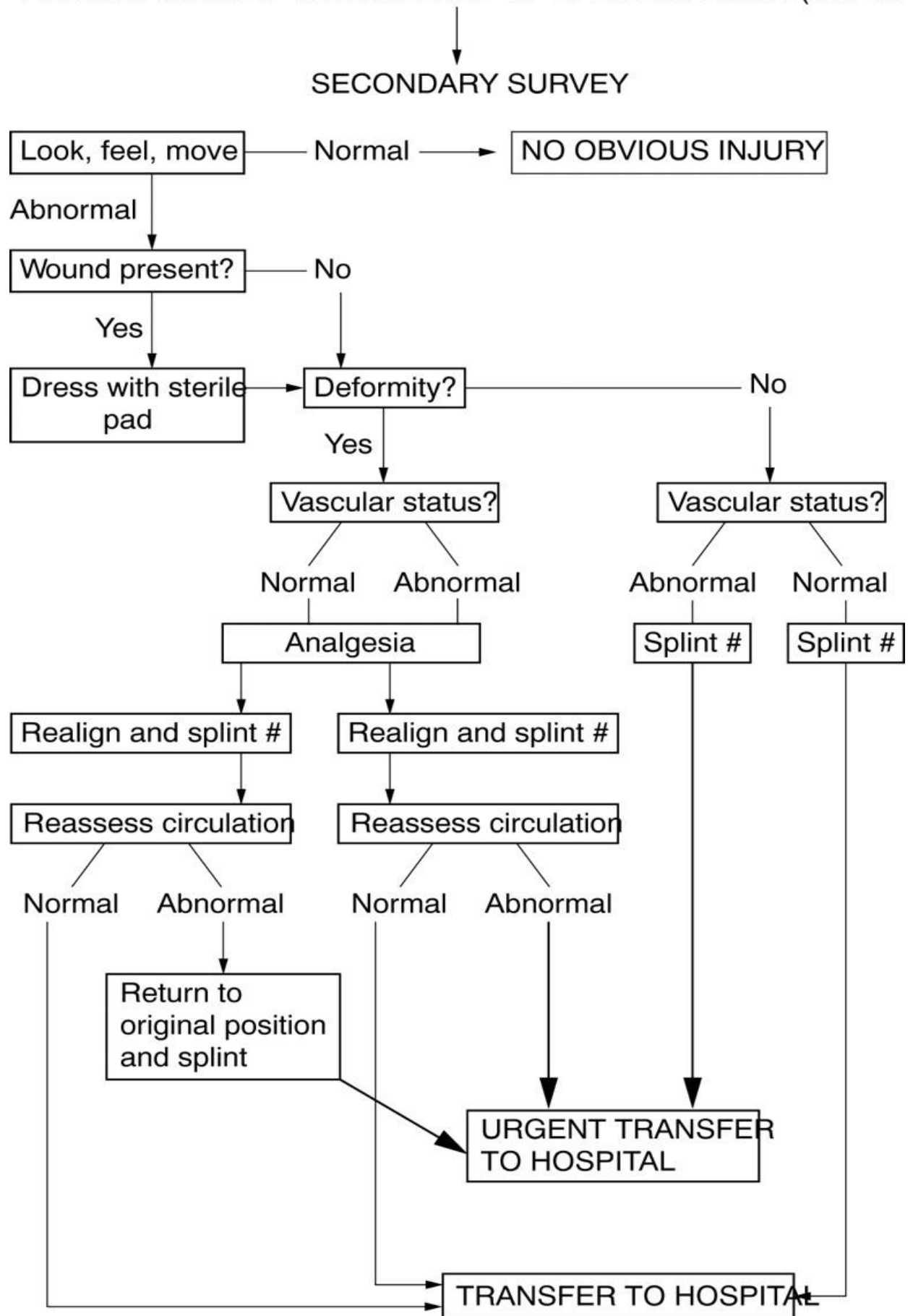
- 1) Check the scene safety
- 2) Follow the ABCD principles.
- 3) Apply oxygen if available if the fracture is significant

- 4) Gather a Hx of the injury from player/observer
- 5) Ask the patient (if talking) about all any allergies, medications, PMHx, when they last ate, their tetanus status and their mechanism of injury
- 6) **Look** for; swelling, deformity, bruising, symmetry, & overlaying wounds
- 7) Then **feel** for swelling/joint effusion, tenderness, crepitus (always check for sensation & pulses)
- 8) If inspection indicates that a fracture or dislocation may be present, follow the flow diagram in Fig 7.10
- 9) Finally **move** assessing active and passive ROM & stability (It is vital that the patient's neurovascular status is assessed before and after movement. Refer to Appendix I for pulses.
- 10) Prepare athlete for the ambulance crew and hand over
- 11) Endeavour to have someone go from management with the injured player to hospital

(Carlin 2013)

- Management of the ABCD of the patient should always take priority over fractures or dislocations **\*\* HOWEVER, if the patient is bleeding profusely and at risk of dying from blood loss, stemming the blood flow must take priority over managing the ABCDs \*\***
- In the case of open fractures attempts should be made to remove any gross contamination.
- The sooner the wound is cleaned the less likely of an infection. (For open injuries – saline is a good sterilizer that should always be part of your kit).

PRIMARY SURVEY WITH ARREST OF HAEMORRHAGE (see tab



*Fig 7.10 Flow chart depicting the pre hospital management of #s (Lee and Porter 2005)*

## *General Points About Fracture and Dislocation Management*

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- If possible a photograph of the injury should be taken—this provides more information to the medical team upon arrival at the hospital.
- Immobilize the extremity along with the joint above and below the injury.
- Splint in the position found.
- If circulation is absent—reposition to neutral position to establish a pulse (This is the only exception to the ‘do not relocate’ rule because the ABC is more important than protecting a dislocation).
- Maintain stabilization until splint is secured.

## *Splinting*

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Splintage is vital in the management of fractures and dislocations. Benefits include:

- Pain reduction
- Decreased blood loss
- Decreasing risk of pressure sores
- Decreasing risk of fat emboli
- Reducing risk of further damage

(Lee and Porter  
2005)

- Common types of splint include vacuum splints and box splints.
- Do not apply splint too tightly, cutting off circulation, damaging nerves and soft tissue.
- Do not apply splint too loosely, reducing its ability to immobilize, causing further soft-tissue damage and an open fracture.

### **Box Splint**

Consists of 3 padded boards and a foot piece. The 3 boards wrap around the limb and are secured using Velcro. The foot piece is designed to keep the ankle in neutral. It is used to stabilize knee injuries, ankle and tibial fractures.



**Fig 7.11 Box splint**

## Vacuum Splints

Vacuum splints, like the vacuum mattress used in SCI, can adjust to supply solid support to a deformed limb. Removal of the air from the splint makes the splint solid. As with vacuum mattresses the risk that a puncture may occur is always present. Therefore back-up splints must always be available.



*Fig 7.12 Vacuum splint*

## Contraindications to splinting

There are no complete contraindications to the application of a temporary splint. However, swelling must be considered before splinting is applied. Place extra padding beneath the splint if extensive swelling is expected-this allows for the expansion of the limb secondary to oedema (Fitch *et al* 2008).

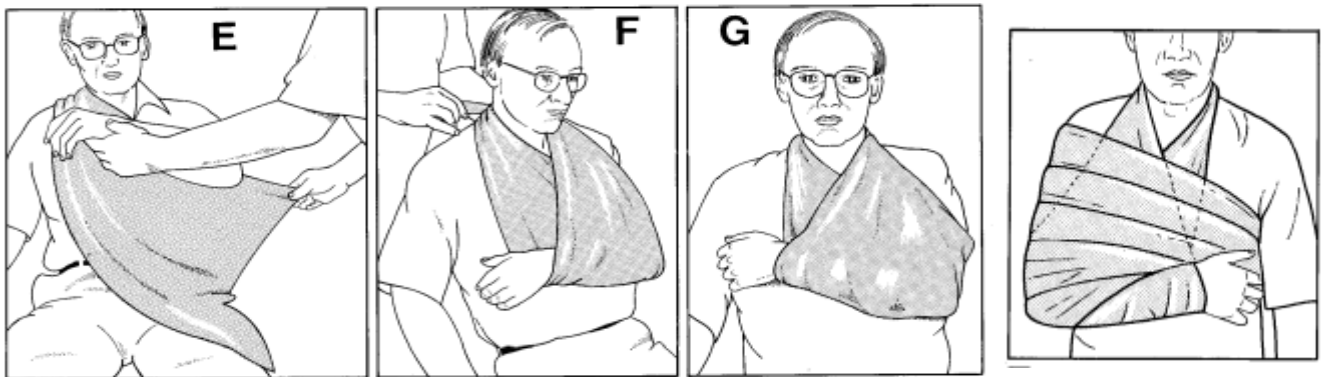
## Management of Upper Limb Fractures and Dislocations

Below are the steps to immobilize different fractures and dislocations in the upper limb

### Scapula and clavicular fractures or shoulder dislocations

- 1) Stabilize the injured extremity
- 2) Check pulse, motor function, sensation
- 3) Use a sling and swathe
- 4) Position sling and secure with forearm slightly elevated across chest
- 5) Position knot so it is not resting on spine pad the knot
- 6) Stabilize the arm with a cravat across the chest maintaining elevation

7) Recheck distal pulse, motor function, sensation.



**Fig 7.13 Stabilisation for shoulder/clavicular #s or shoulder dislocation**

### Humerus

- Proximal fracture: use a sling and swathe as with scapula/clavicle.
- Distal fracture: use a narrow sling (supporting the wrist), leaving elbow exposed; stabilize with a swathe.
- Mid-shaft: secure a padded board splint to arm and leave fingertips exposed; support with a sling, stabilize with a swathe.

### Elbow

- Elbow in straight position
  - Secured a measured padded board splint to forearm leaving fingertips exposed
  - Place padding between patient and splinted arm
  - Secure arm to torso
- Elbow in bent position
  - Place padded board splint over angle of the arm
  - Secure with triangle bandage
  - Apply a wrist sling, keeping forearm elevated against chest

### Radius, Ulna, Wrist or Hand

- 1) Measure and apply splint from elbow to fingertips
- 2) Secure splint with roller gauze, wrapping distal to proximal,
- 3) Leave the fingertips exposed
- 4) Apply sling, keeping forearm elevated against chest, and secure with a cravat

## **Fingers**

- 1) Splint injured finger to an uninjured finger with tape, or
- 2) Splint injured finger with tongue depressors

(MIEMSS 2012)

## ***Management of Lower Limb Fractures and Dislocations***

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Untreated lower limb fractures or dislocations can lead to significant blood loss-and this may go unseen. Estimated blood loss for a closed fracture of the femur is 1000-1500ml and this can as much as double in the case of an open fracture (Lee and Porter 2005).

## **Femur**

- 1) Immobilize using a long spinal board
- 2) Place padding between the legs
- 3) Long leg box splint
- 4) Bind the legs together at ankle level

## **Knee (including knee dislocations)**

- Bent Knee
  - 1) Stabilize above and below the knee.
  - 2) Place 2 splints, either side of the injured leg.
  - 3) Tie the boards together, securing at the ankle and thigh.
- Straight Knee
  - 1) Use a box splint that extends from the gluts to the ankle.
  - 2) Pad the voids.
  - 3) Place padding between the legs.
  - 4) Bind thigh, calves and ankles together.

## **Tibia/Fibula**

- 1) Immobilize using splint that extends above knee and below ankle.
- 2) Pad the voids.

## **Ankle**

- 1) Remove shoes if it is possible without moving the ankle-this allows assessment of neurological status of the foot.
- 2) Secure above and below the joint and at the arch of the foot.

(Lee and Porter 2005)

## *Points to Remember*

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Is it safe to approach?

- AcBCDE assessment
- Limb assessment
- NVA assessment
- Analgesia/realign
- Repeat NVA assessment
- Splint
- Repeat NVA assessment
- Transfer

(Carlin 2013)



## Examination of Evidence

Study	Study Type	Level of Evidence	Purpose	Findings	Comments
Fanelli <i>et al</i> 2005	Review	Level 5	To provide an understanding of the, anatomy, pathophysiology, mechanism of injury, diagnosis, treatment of the multi-ligament damaged knee	This paper describes the anatomy of the knee in detail. It discusses the systematic approach needed for evaluation and treatment. It lists and discusses the surgical procedures and the outcomes of these.	As in many of the cases involving injuries of the acute sporting arena injury, the systematic review approach to study design was not suitable in this instance. This is because the majority of literature regarding management of the acute dislocated knee is contained in books or based on historical approaches of First Aiders, rather than high quality randomized controlled trials. RCTs are not a suitable/feasible/ethically viable approach to such a potentially serious joint injury.
De Loes <i>et al</i> (2000)	Retrospective study	Level 2b	To review the risks and costs of knee injuries to male and female population of 12 sports	There was 3005 knee injuries in 2820 males, and 859 knee injuries in 7591 women. Women are more susceptible to knee injury than men in 9 of the 12 sports. The cost per male in US \$ was 1097 for male and 1131 for female	A comprehensive coverage of injury in the male and female population with a broad spectrum of sports.
Bond & Cobert (2011) -	Review	Level 5	To review the anatomy of the knee the pathology and management.	Findings: A review paper that covered all types of dislocations and outcomes. Traumatic dislocations of the knee, while uncommon (with an incidence of 0.02%), can result in significant morbidity and mortality. The incidence of knee dislocations is probably significantly underreported because many dislocations reduce spontaneously.	Comments: The authors present a comprehensive and detailed review of the diagnosis and management of knee and patellar dislocations. Common pitfalls and diagnostic advances are reviewed and discussed to maximize patient outcome and decrease long-term functional morbidity

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# Clinical Decision Rules for Fractures

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## *Introduction*

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Clinical Decision Rules are a set of rules designed to make life easier for health professionals. They give a strict set of criteria that allow them to make complex decisions more straightforward. As a physio at a sporting event, an athlete may come to you after receiving direct trauma to their knee or wrist. They may have twisted awkwardly on their ankle. The athlete may ask you if you feel they need an X-ray. There is a significant cost to the health care system of unnecessary x-rays. It is further cost and burden to the patient to have to attend an emergency department and wait to receive an X-ray if unnecessary. However, rather than make a decision based on your clinical finding alone, there are clinical decision rules that can make this process much easier. This section will discuss the various rules to determine if further imaging is indicated, how to perform them, and how accurate they are at predicting fractures.

**Sensitivity:** The percentage of fractures is correctly reported as positive by the test.

- Highly sensitive test:  
Positive for most fractures, missing very few

**Specificity:** The percentage of the positive results that are actually fractures.

- Highly specific test:  
If positive, you are fairly sure that there is a fracture, very few false positives.

A specific and sensitive test will not miss any fractures, but will not get any false positives. Thus, you would be confident you would not miss any fractures and would be able to reduce the amount of unnecessary tests. It also allows more consistent and quality of patient care while reducing patient exposure to radiation (Northrup *et al* 2005a).

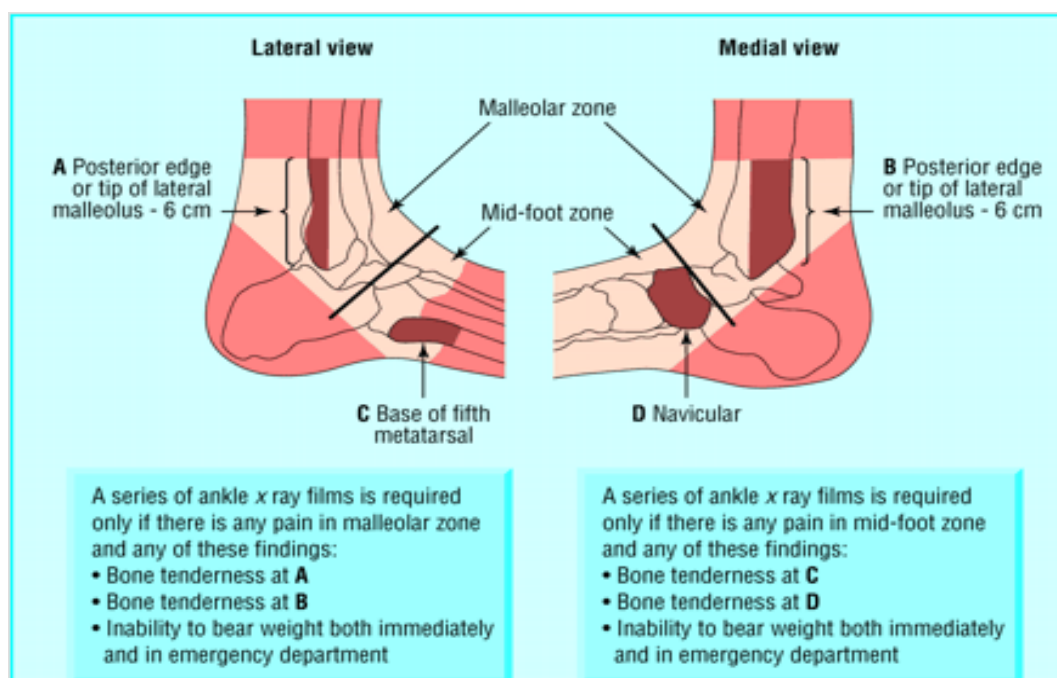
Below are the most commonly fractured sites in the body and some commonly used tests for that you can perform at a sporting event to guide your decision making process. These are:

1. Ankle: Ottawa ankle and midfoot rules (OAR)
2. Knee: Ottawa knee rules + Pittsburgh knee rules
3. Neck: Canadian C-spine rules
4. Wrist: Amsterdam wrist rules
5. Pelvis
6. Clavicle

### 1. Ankle

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- Ankle and foot injuries have been reported to account for 15-42% of injuries in sport
- Fractures are rare compared to soft tissue injury, only occur in less than 15% of sprain injuries (Bachmann 2003)
- The Ottawa Ankle rules (OAR) are a tool to determine if a radiograph is required for a suspected ankle or midfoot fracture
- The diagram below outlines the Rules:



*Fig 7.14 Ottawa Ankle Rule*

*(Bachmann 2003)*

A mnemonic to remember: 44-55-66-PM

(Gravel *et al* 2010)

- 4 – Unable to take 4 steps immediately
- 4 – Unable to take 4 steps in Emergency department

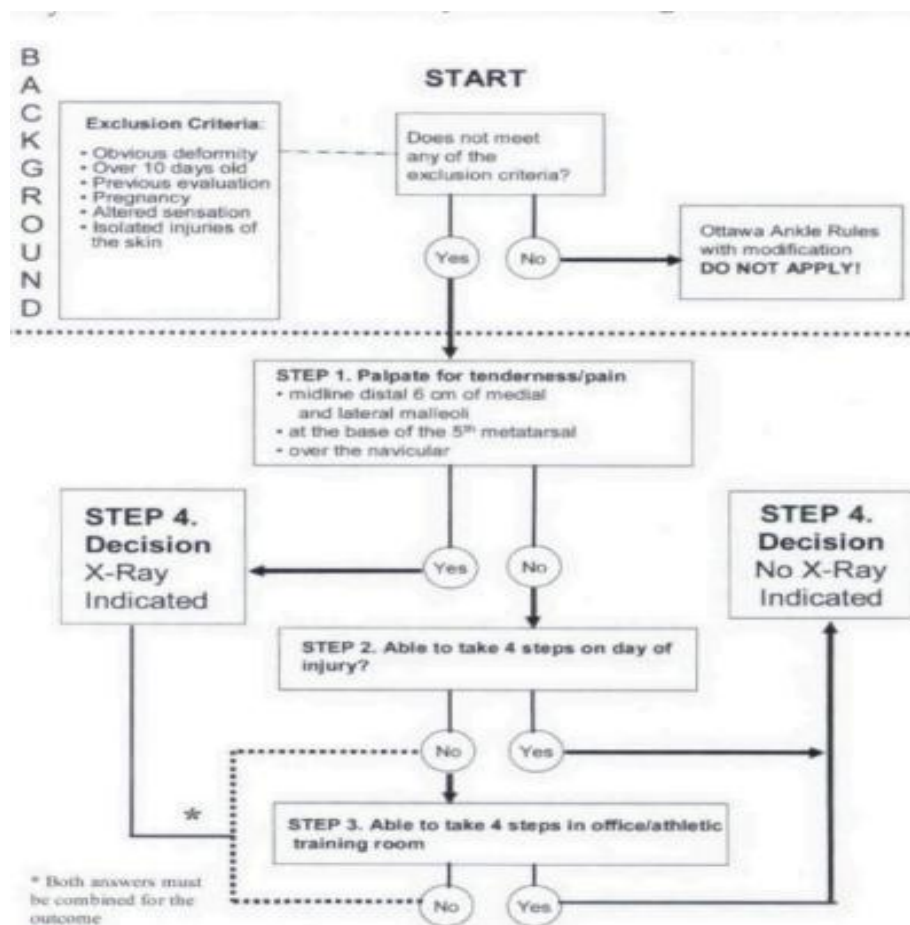
OR

- 5 – pain at the base of the 5<sup>th</sup> metatarsal or
- 5 – pain at any point on the navicular

OR

- 6PM – tenderness on the posterior edge of the distal 6cm of the lateral malleolus
- 6PM – tenderness on the posterior edge of the distal 6cm of the medial malleolus

There are exclusion criteria for those to whom the rules do not apply. The algorithm below illustrates how to apply the rules from start to finish.



**Figure 2** Outline of the Ottawa ankle rules procedures for making a decision on referral for radiograph.

**Fig 7.15** Flow chart of Ottawa ankle rules for making a decision on need for referral for radiograph

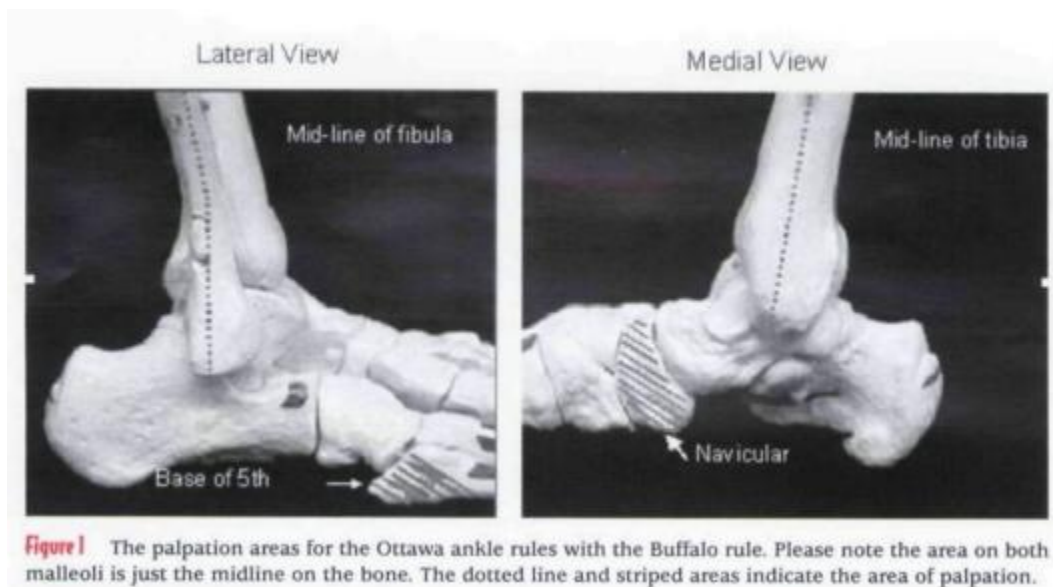
- **Key Points:**
  - Limping is acceptable as long as walking is independent and unsupported
  - Prompting and encouragement is acceptable
  - Palpation of correct areas and full structures is important
  - Exclusion criteria is important

(Northrup *et al* 2005 b)

### Buffalo Rule

A modification added to the OAR to attempt to improve its specificity without affecting its sensitivity. Using the buffalo rule, the midline of the lateral and medial malleoli are palpated as opposed to the posterior aspect. There are ligamentous attachments to the posterior malleoli which are often painful after sprains with no fracture. This adaption is justified as most fractures are through the midline of the bone. Only one study has compared the buffalo rule to the original OARs. This found a sensitivity of 100% with both. However the specificity of 66% with the Buffalo rule dropped to 35% with the original rule set and more sprains were being referred for X-rays. The diagram below illustrates the midfoot and ankle palpation with the Buffalo rule.

(Northrup *et al* 2005a)



(Northrup *et al* 2005b)

**Fig 7.16 Palpation areas for OAR with the Buffalo rule**

## The Evidence

Study	Study Details	Participants	Results (95% CI)	Comments
Bachmann 2003	Systemic R/V	32 studies 15,581 participants	Within 48 hours Sens: 99.6 (98-100) Spec: 48 (42-77.1) Global Ax Sens:96 (93-98) Spec: 26 (19-34)	Systemic review
Leisey 2004	Prospective Study Saudi Arabian military	45 participants	Sens: 100 (46-100) Spec: 40 (25-56)	Small sample size Small no. of significant #s Experienced physicians
Yazdani et al 2006	Prospective Cohort Iran	200 participants	Sens: 100 (85.3-100) Spec: 40.5 (32.8-48.1) Radiographs – decreased by 33%	Found good inter-rater reliability Narrow range of # types
Fan and Woolfey 2008	Prospective RCT Single Blind Canada	123 participants	LOS* OAR: 73 mins LOS Control: 79.7 mins Not statistically or deemed clinically significant	Relatively short waiting time anyway Delays in placing participants into groups Accuracy of reported times
Can et al 2008	Prospective Cohort Swiss	251 participants 33 #s	Sens: 100 (89-100) Spec: 21 (16-27)	Failed to register 42 results due to admin recording errors Low number of #s
Dowling et al 2009	Systemic Review of OAR on children >5years	12 studies 3130 participants 671#s	Sens: 99 (97-99) Spec:7.9-50 Reduction in Xrays: 24.6% (5-44) 10 #s missed: 2 insignificant, 2 salter-harris, rest unclassified	Specificity not pooled due t heterogeneity

\*LOS – length of stay

## 2. Knee

TABLE 1  
**Characteristics of Patients Who Should Undergo Radiography After Knee Trauma**

<b>Ottawa knee rules</b>
Age 55 years or older
Tenderness at head of fibula
Isolated tenderness of patella
Inability to flex knee to 90 degrees
Inability to walk four weight-bearing steps immediately after the injury and in the emergency department
<b>Pittsburgh decision rules</b>
Blunt trauma or a fall as mechanism of injury plus either of the following:
Age younger than 12 years or older than 50 years
Inability to walk four weight-bearing steps in the emergency department

**Table 7.1 Table describing differences between OAR and Pittsburgh**

(Seaberg *et al* 1998)

- An editorial by Bryony in 2012 notes that there are only two studies that compare these two methods and these studies are critically appraised below:

	Study Details	No. Participants	Ottawa	Pittsburgh	Comment
Richman et al 1997	Prospective Cohort	351	Sens: 84.6 (65-95) Spec: 49.8 (44-55)  # missed: 4	Sens: 84.6 (65-95) Spec: 48.9 (43-54)  #missed: 4	X-rays only at discretion of physician, not designed to compare, 40 pts lost to follow-up, no power calc.
Seaberg et al 1998	Prospective Cohort	934	Sens: 97(90-99) Spec: 27 (23-30)  # missed: 3/87	Sens: 99 (94-100) Spec: 60 (56-64)  # missed: 1/91	Children in one group, not other, Convenience sample, stricken definition of walking in Pittsburgh, Verification bias (only 750/934 had X-rays)

- Direct comparison would suggest that the Pittsburgh rules are much more specific without losing sensitivity.



- However, there is only one study to suggest this, and it has some methodological flaws (Seaberg *et al* 1998).
- Studies evaluating the Pittsburgh Rules outside of these two are difficult to find in the literature and further research should be performed to confirm if these findings are accurate.
- In comparison, several other studies have looked at the Ottawa Knee Rules (OKR):

	<b>Study Details</b>	<b>Participants</b>	<b>Results</b>	<b>Comment</b>
Bachmann et al 2004	Systemic Review	6 studies 4,249 participants	Sens: 98.5 (93-100) Spec: 49 (43-51)	They felt lower CI on sens was too low to be cost effective according to economic analysis
Nichol et al 1999 USA and Canada	Economic Analysis		Using OKR reduced cost per patient by: USA: \$34 (24-47) Canada: \$31 (22-44)	
Vijayasankar et al 2009	Systemic Review – OKR for children	4 studies 1,130 participants	Sens: 99 (94.4-99.8) Spec: 46 (43-49.1) Decreased X-rays by: 30-40%	

These results from systemic reviews show that the OKRs consistently have a very high sensitivity. It also reports a consistently higher specificity than that achieved in Seaberg’s study (Seaberg *et al* 1998).

Finally we can see that, use of the OKR reduces the amount of unnecessary X-rays and is economically superior then not using a clinical decision tool. We cannot yet decisively determine from the literature which tool is more effective, however, as the OKRs are more extensively researched, and are proven to be of a sufficient standard, they would appear to be the most justified the use presently. What is clear is that either tool is likely to be more efficient and cost-effective than no tool.

### 3. Neck

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More details on the Canadian C Spine rule are outlined in the chapter 5 on spinal cord injury.

## 4. Wrist

Bentohami *et al* (2011) conducted a study which aimed to develop rules which would help decide if an X-ray is required for a suspected distal radius fracture in a similar fashion to the Ottawa Rules. This became known as the ‘Amsterdam Wrist Rules’.

- Part One: Determine the relevant rules
- Part Two: Validate these rules in a prospective study

Results of this study will hopefully be published in 2-3 years. No other clinical decision rules or other predictors of fracture are currently available.

### Predicting Scaphoid Fractures

**Duckworth *et al* 2012** – “Predictors of fracture following suspected injury to the scaphoid”

- 260 patients reported to the emergency department with suspected scaphoid fractures – 55 confirmed
- 223 returned for 2 week re-evaluation and became part of the study group

PREDICTORS OF FRACTURE FOLLOWING SUSPECTED INJURY TO THE SCAPHOID

967

**Table IV.** Diagnostic performance characteristics for the seven clinical signs used to detect the presence of the scaphoid fracture. Values represented include those determined with latent class analysis and conventional analysis, with positive predictive value (PPV) and negative predictive value (NPV) determined using Bayes’ theorem

Clinical sign	Latent class analysis		Conventional calculations			
	Sensitivity (%) (95% PI*)	Specificity (%) (95% PI)	Sensitivity (%) (95% CI†)	Specificity (%) (95% CI)	PPV (%)	NPV (%)
<b>Time point 1 (&lt; 72 hours)</b>						
ASB tenderness	99 (96 to 100)	10 (6 to 28)	100 (95 to 100)	4 (2 to 4)	25	100
Pain on thumb-index finger pinch	82 (72 to 90)	52 (43 to 61)	77 (65 to 87)	44 (41 to 47)	30	86
Scaphoid tubercle tenderness	84 (73 to 93)	45 (38 to 54)	86 (75 to 93)	39 (35 to 40)	31	90
Pain on axial compression of thumb	88 (80 to 95)	45 (39 to 56)	73 (60 to 83)	33 (30 to 36)	25	80
Decreased range of thumb movement	78 (66 to 87)	46 (37 to 57)	66 (53 to 77)	38 (34 to 41)	25	78
ASB pain in ulnar deviation/pronation	90 (81 to 98)	50 (42 to 58)	100 (93 to 100)	45 (34 to 45)	36	100
ASB pain in radial deviation/pronation	88 (78 to 95)	49 (41 to 57)	89 (77 to 95)	42 (39 to 43)	32	92
<b>Time point 2 (approx. day 14)</b>						
ASB tenderness	98 (92 to 99)	66 (54 to 77)	82 (70 to 90)	48 (45 to 50)	33	90
Pain on thumb-index finger pinch	70 (60 to 82)	89 (80 to 93)	48 (35 to 60)	73 (70 to 77)	36	82
Scaphoid tubercle tenderness	79 (69 to 89)	75 (66 to 83)	82 (70 to 90)	65 (62 to 68)	42	92
Pain on axial compression of thumb	73 (62 to 82)	86 (80 to 92)	39 (27 to 51)	68 (65 to 71)	28	78
Decreased range of thumb movement	67 (50 to 78)	87 (80 to 92)	46 (33 to 58)	72 (69 to 76)	34	81
ASB pain in ulnar deviation/pronation	95 (87 to 99)	79 (76 to 86)	80 (67 to 89)	61 (58 to 63)	39	91
ASB pain in radial deviation/pronation	87 (77 to 95)	76 (67 to 82)	71 (58 to 81)	59 (56 to 62)	35	87
Fracture incidence	36.9%		28%			

\* PI, probability interval  
† CI, confidence interval  
‡ ASB, anatomical snuff box

**Table 7.2 Diagnostic performance for the 7 clinical signs of scaphoid #**

(Duckworth *et al* 2012)

- Fig 7.17 is an algorithm proposed by the authors which can be used to determine the probability of a fracture based on certain variable. This algorithm begins with an X-ray, however, it can be used by answering the first question with “no”.

A. D. DUCKWORTH, G. A. BUIJZE, M. MORAN, A. GRAY, C. M. COURT-BROWN, D. RING, M. M. MCQUEEN

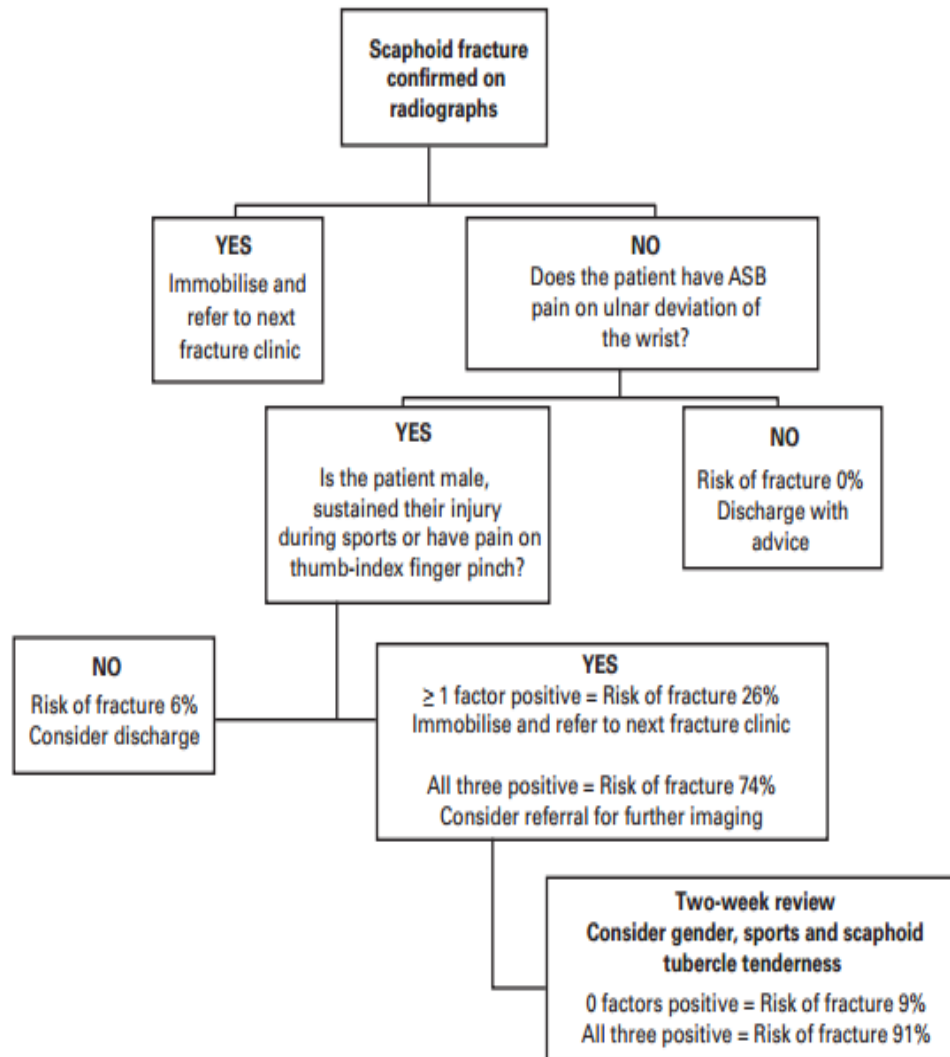


Fig. 2

A potential management algorithm based on clinical prediction rule 2 (ASB, anatomical snuff box).

(Duckworth et al 2012)

**Fig 7.17 Potential management algorithm based on clinical prediction Rule 2**

- The probability of fracture within 72 hours:
  - factors = 6%
  - one factor = 26%
  - two factors = 45%
  - three factors = 74%

- This gave a sensitivity of 77% and a specificity of 60% for a prognosis of fracture with two or more factors.
- At the two week review the probability of fracture in this model is:
  - zero factors = 9%
  - one factor = 12%
  - two factors = 39%
  - three factors positive = 91%
  - This gave a sensitivity of 82% and a specificity of 70% for a prognosis of fracture with two or more factors.

(Duckworth *et al* 2012)

**Rhemrev et al 2010** – “Clinical prediction rule for suspected scaphoid fractures: A Prospective Cohort Study”.

- Cohort of 78 with 13 definite fractures
- They found previous fracture, supination strength and extension strength to be the best predictors of fracture
- The table below details the predicted probability of fracture based on the findings on these 3 predictors:

Table 3. Prediction algorithm: probability of definite scaphoid fracture based on three multivariate predictors.<sup>a</sup>.

Previous fracture	Supination strength ≤10% contralateral side	Extension <50% contralateral side	Predicted probability	95% confidence interval
Y	Y	Y	97	77–100
Y	Y	N	80	40–96
Y	N	Y	75	15–95
N	Y	Y	50	27–70
Y	N	N	25	5–60
N	Y	N	10	1–40
N	N	Y	7	1–30
N	N	N	1	0–5

<sup>a</sup> Probabilities are derived from logistic regression using a generalised estimating equations (GEE) approach and are independent of age, sex, grip strength, and mechanism of injury.

**Table 7.3 Probability of scaphoid # based on 3 predictors**

(Rhemrev *et al* 2010)

Limitations of this study:

- Requires specific tools to measure supination and extension strength
- Low number of patients and fractures
- Lack of blinding
- Did not evaluate scaphoid tenderness

## 5. Pelvis

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### *Ham et al 1996*

- Study in the Netherlands with 39 participants, usually in RTA or fell from horse/paragliding/walking/off ladder. Could happen in high impact collision in sport. The table below outlines the tests studied and their sensitivity and specificity values:

Test:	Positive Sign	Sensitivity	Specificity
Active SLR	Unable to SLR	.90	.95
Compression of ilia	Pain	.6	.63
Distraction of ilia	Pain	.5	.74
Pubic bone thrust	Pain	.55	.84

***Table 7.4 Tests for predicting pelvic # and their corresponding sensitivity and specificity***

- However, this is a small study with only 39 participants and 20 fractures

### **Sauerland et al 2004**

“The reliability of clinical examination in detecting pelvic fractures in blunt trauma patients: a meta-analysis”

- 12 studies – 5,454 participants
- Clinical Exam compared to X-ray
- Sensitivity – 90% (95% CI 0.85-0.93)
- Specificity – 90% (95% CI 0.84-0.94)
- Of the 49 false negative results, the majority had altered consciousness (on GCS) or minor fractures only
- Only 3 clinically relevant fractures were missed

- Components used in various clinical exams: History, swelling, compression, instability, neuropathy, hip ROM, rectal exam, inspection, Flexion test, deformity, urethral bleeding
- However, this study was unable to make recommendations with regard to specific tests

**Den Boer et al 2011**

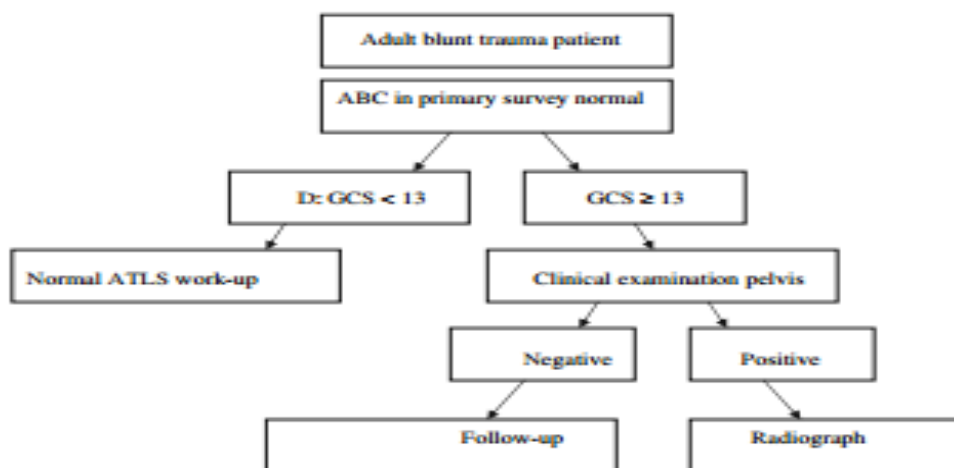
“The value of clinical examination in diagnosing pelvic fractures in blunt trauma patients: a brief review”

- 2 studies – 3,555 participants. Clinical exam versus X-ray compared to CT scan as GOLD standard

	Duane et al 2008	Gonzalez et al 2002
<b>Negative Predictive Value</b>		
X-ray	0.98 (0.93-0.99)	0.99 (0.99-1.0)
Clinical Exam	0.99 (0.98-1.0)	1.0 (0.99-1.0)
<b>Positive Predictive Value</b>		
X-ray	0.97 (0.96-0.98)	0.97 (0.90-0.99)
Clinical Exam	0.18 (0.16-0.23)	0.35 (0.30-0.42)

**Table 7.5 Predictive values of x-ray vs clinical exam to detect pelvic #s**

- This means a negative clinical exam is very accurate at ruling out fracture, and patients should simply be followed-up. However, a positive exam does not guarantee a fracture and should be followed up with an X-ray.
- This study gave no description of what was entailed in the clinical exam.
- It suggests the following as a decision tree for deciding if an X-ray is necessary.



**Fig 7.18 Decision tree for work-up of pelvis in alert trauma patients**

## 6. Clavicle

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We were unable to find clinical decision rules or predictive factors for the clavicle in the literature.

Some signs and symptoms of a fracture:

- History of trauma e.g. fall or blow
- Focal pain, snapping sensation
- Rapid swelling and crepitus
- Usually deformity present
- Pain, crepitus and sometimes motion on gentle palpation
- Often grinding sensation at fracture site on attempting to lift the affected arm
- Watch out for signs of
  - Pneumothorax (3% of cases)
  - AC separation,
  - Sternoclavicular dislocation
  - Rotator cuff injury
  - Labral Pathology
  - Shoulder contusion

(Pujatte and Housner 2008)

### *At A Glance*

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- The Ottawa ankle rules are a quick and highly sensitive tool for determining if an ankle X-ray is required.
- The Pittsburgh and Ottawa knee rules are both highly sensitive predictors of Knee fracture. Ottawa is much more widely researched but the little available literature on Pittsburgh is promising.
- The Canadian C-Spine rules are useful for determining the presence of a cervical fracture.
- Predictive factors are available for scaphoid and pelvic fracture but no complete set of rules exists.
- A clinical decision tool is currently being made for distal radius fracture.

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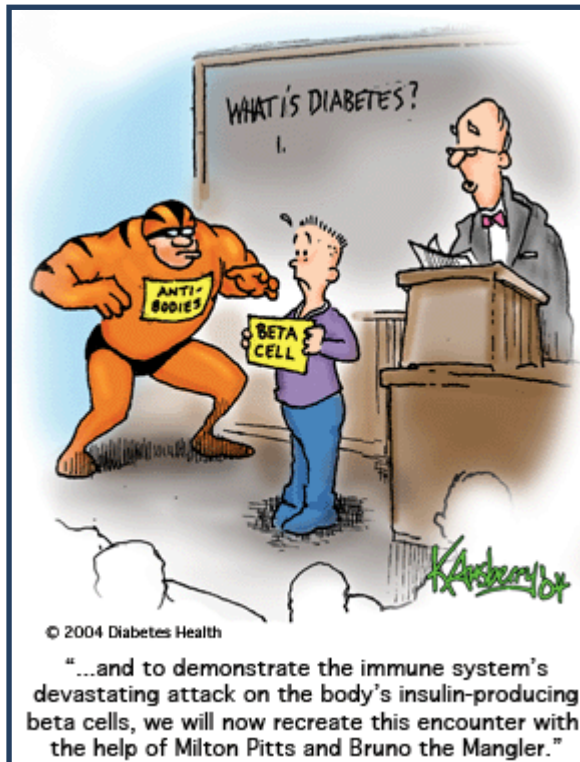
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# Chpt 8: Diabetes – Management in Competitive Athletes

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## *Introduction*

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A wide variety of people with diabetes mellitus are able to participate in sport, ranging from youth competitions to Olympic athletes. Exercise is recommended as a core therapeutic tool for patients with diabetes and those at risk (Hornsby and Chetlin 2005). However, although athletic participation is deemed safe, they nonetheless present a significant challenge to health professionals working with such athletes (MacKnight et al 2009). This is a

direct result of the unpredictable energy demands placed on athletes. As diabetes has been covered before in our course, this chapter will focus minimally on pathology and everyday management of the disease. Instead, it will focus on the prevention of hypo and hyperglycaemia, and upon the management of a patient, should a blood sugar disturbance occur.

## *Normal Glucoregulation during Exercise*

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### **Moderate Intensity Exercise**

- Almost exclusively aerobic metabolism – mixture of carbohydrate (CHO) from glycogen stores and circulating free fatty acids
- At beginning of exercise, there is an increase in sympathetic nervous activity which:
  - Increases endogenous glucose production in liver

- Stimulates the release of free fatty acids
- Alpha-adrenergic stimulation of pancreatic islet inhibits insulin secretion, which in turn signals the release of glucagon
- This mechanism matches glucose usage by the exercising muscle, maintaining blood sugar within a very narrow range.
- Exercise enhances the ability of muscle to absorb glucose by two mechanisms
  - Independently increases glucose transport via a pathway independent of insulin-stimulated glucose uptake allowing glucose absorption even in the absence of insulin
  - Increased recruitment of capillaries creating a larger surface area for glucose exchange
- The decrease in insulin at the initiation of exercise is critical to counterbalance this increase in glucose absorption in the muscle, thus preventing hypoglycaemia and allowing effective exercise
- Sustained muscular activity has the additional benefit of increasing insulin sensitivity for several hours post-exercise

### High Intensity Exercise

- Exercise up to  $Vo_{2max}$  is sustained primarily by aerobic metabolism including oxidative phosphorylation and to a limited extent, beta oxidation.
- Exercise beyond  $Vo_{2max}$  (3-30 seconds max intensity) utilises the anaerobic energy system: glycolysis and the ATP-PCr system
- All of these systems are highly dependent on glucose as a fuel produced by hepatic or muscle glycogenolysis
- High intensity exercise is also marked by accumulation of lactate and a significant rise in catecholamine of 14- to 18-folds above baseline (as opposed to 2- to 4-folds at moderate exercise)
- At high intensity exercise, hepatic glucose production exceeds the amount that can be absorbed by muscle leading to slight hyperglycaemia as a result of the fact that norepinephrine and epinephrine are powerful stimulants of muscle and liver glycogenesis

## Post-Exercise

- Insulin levels rise rapidly:
  - In response to the high blood glucose levels
  - Following the removal of circulating catecholamines
- This leads to a 20-60 minute window where hyperglycaemia and hyperinsulinemia are both present, an environment favourable for glycogen replenishment to prepare for future exercise.

## *Exercise Considerations for Type 1 Diabetes*

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- Type 1 diabetes mellitus (DM) accounts for only 10% of people living in the US
- Type 2 DM is strongly correlated with older adults (>40years) and sedentary lifestyles
- Athletes with Type 2 diabetes experience the same health and quality of life benefits as healthy peers
- However, without careful education and precautions, exercise can lead to hypoglycaemia
- In general circumstances, Type-1 diabetics are encouraged to maintain “tight” control on their glucose and keep it within narrow ranges with insulin – this strongly correlates a reduction in long-term complications of diabetes
- However, the diabetes complications and control trial reported a 3-fold increase in the incidence of hypoglycaemia in individuals who use insulin to strictly control their glucose levels
- Pre-competition excitement can lead to elevated glucose levels which are difficult to predict based on findings in practice sessions
- Exercise in heat and high humidity can increase counter-regulatory responses to high-intensity exercise and affect the rate of absorption of insulin
- Athletes must carefully alter and monitor their balance of exercise regimes, nutrition and insulin dosing to avoid both hypo and hyperglycaemia

## *Exercise Considerations for Type 2 Diabetes*

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- As aforementioned, it is rare to encounter young competitive athletes with type 2 DM
- However, as the focus on exercise and lifestyle modification in type 2 DM continues to grow, it is likely that a higher proportion of Type 2 DM athletes will participate as “masters” athletes (over 35 years)
- Defects of insulin signalling/secretion in cannot be fully reversed but exercise has a significant benefit on insulin-stimulated glucose uptake and insulin resistance
- In approximately 3 years, lifestyle interventions reduced incidence of diabetes by 58% compared to 31%
- The American Diabetes Association recommend at least 150min/week exercise of moderate to vigorous intensity
- Other important considerations for Type 2 DM include comorbidities (eg hypertension) and the effects that medication may have on exercise such as:
  - **Diuretics**: potential for negative electrolyte homeostasis
  - **Beta-blockers**: reduction of exercise capacity and athletic performance in high intensity exercise
  - **Aspirin or ACE inhibitors**: increased susceptibility to hypoglycaemia

## *MDT Management of Diabetic Athletes*

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- It is vital that physicians, physiotherapists, coaches and dieticians work in co-ordination with athletes because medication, nutrition and exercise are intricately related. A change to one factor will usually have an effect on both other factors
- **Dietician**: Timing of food intake, type of nutrition and fluid balance are 3 vital components of the management of diabetic athletes. Further details of optimal food consumption before, during and after exercise, the timing of ingestion and fluid balance are outlined elsewhere (Macknight et al 2009)
- **Physician**: will be responsible for providing and educating athletes with regard to insulin prescription and dosage, insulin pumps, insulin sensitizers etc (MacKnight et al 2009)

## *Management of Hypoglycaemia*

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### **Common Causes**

- Too high daily dose of insulin or oral hypoglycaemics
- Errors in dosage
- Increased activity duration or intensity
- Insufficient or delayed food intake
- Alcohol intake immediately of after exercise
- As glycogen stores in muscle and liver become depleted, risk of hypoglycaemia increases
- Athletes with prior episodes generally demonstrate blunted counter-regulatory responses during future exercise. These individuals maintain a higher susceptibility to future episodes

### **Prevention**

- Adjustments in insulin dosages prior to exercise as determined by physician:
  - Hypoglycaemia incidence can be reduced by decreasing insulin dose 30-50%
  - If exercise is beyond 60 mins, dose should be reduced by 80%
  - However, this can be difficult due to unplanned exercise, especially in children
- Adequate CHO intake prior to, during and after exercise – if insulin is not altered prior to exercise then a small CHO snack should be ingested
  - No major dietary adjustments for type 2 DM but oral hypoglycaemics may need to be reduced

### **Management of Acute Hypoglycaemia (<70 mg/dL)**

- Symptoms include: dizziness, weakness, sweating, headache, hunger, pallor, blurred vision, slurred speech, confusion, irritability and poor coordination
- If hypoglycaemia occurs, exercise should be stopped and blood sugar monitored every 15 mins until it returns above 80mg/dL
- Should be treated immediately with 15g CHO (½ cup fruit juice, 4 glucose tablets, 6oz sweetend carbonated beverage, 8oz low fat milk)

- Patient using alpha-glucosidase inhibitors will require treatment with glucose tablets

### **Management of Late Onset Hypoglycaemia**

- This can occur in Type 1 diabetes from 6-24 hours post exercise, often nocturnal, as a result of several mechanisms:
  - Increased insulin sensitivity post exercise
  - Increased glucose uptake by peripheral tissues
  - Glycogen stores are filled by circulating plasma glucose
- This leads to a blunting of the gluco-regulatory response to insulin-induced hypoglycaemia
- Research has shown that glucose concentrations fell 22 hours post exercise regardless of post-exercise supplementation
- **Prevention:** Consumption of slowly absorbed pre-bedtime snacks such as chips, chocolate and fruit nuts, sports drinks or whole milk

### ***Management of Hyperglycaemia (>250mg/dL)***

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- More common in type 1 DM due to low circulating insulin levels
- Other causes: inadequate insulin administration, excessive food intake, inactivity, failure to take oral hypoglycaemics, illness, stress or injury
- Pre-exercise glucose >250 mg/dL then athlete should check for urinary ketones
  - If kentonuria is moderate to high: exercise should be avoided until glucose and ketones resolve
  - Aggressive lowering of blood sugars can prevent ketoacidosis developing
  - If glucose is 250-300mg/dL and no ketones are present, it is suggested that they are able to exercise as long as they monitor their glucose levels every 15 minutes and find it to be falling
- Patients with Type 2 DM should avoid exercise if glucose is above 400mg/dL

- Key difference between Type 1 and type 2 is the risk of ketosis and acidosis with inadequate insulin and increasing glucose levels
- Hyperglycaemia in type 2 diabetes usually occurs due to overeating, insufficient activity or poor glucose utilisation from insulin resistance

(MacKnight *et al* 2009)

### *Special Considerations*

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Motivation of athletes to control their blood sugar levels must be aimed specifically at the athlete. Some athletes will accept health consequences to improve performance. Thus, motivation should promote performance and health benefits of adequate glycaemic control, rather than simply setting a target range.

Athletes may reduce or avoid taking insulin as it can help them lower their body weight. This is common in female athletes such as gymnasts, ballet etc. and in sports such as boxing and wrestling where weight restrictions may apply. Other techniques such as dehydration, diet pills, laxatives, diuretics, vomiting and extreme diets can be extremely dangerous in any athlete but especially in diabetics. Health professionals involved in sport must be aware of the effects and potential consequences of these risky behaviours and should make every attempt to prevent them. This can be done through patient education and referral to sports psychologist if appropriate.

### *Pre-Game Travel Kit*

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- This should be a coordinated effort between athlete, physician, athletic trainer and physio
- The kit should be kept with the athlete at all times, eg not checked into baggage if flying
- Labelled kit should include:
  - Unused syringes, insulin, insulin pump (if needed), glucagon emergency kit and ketone testing supplies
  - Additionally, extra prescriptions for all medication and pre-packed meals or snacks should be brought
  - Twice as much medication as is anticipated to be needed should be brought



- A letter from the athlete's physician stating his condition, a sharps container, athlete's health insurance card and emergency contact numbers should also be included
- The athlete should carry an ID card or medical bracelet stating the medical condition

### *At A Glance*

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- Be prepared: Identify those on your team with diabetes, prepare an emergency plan, continually monitor and adapt insulin, eating and exercise levels in practice to attempt to have an effective regime for competition. Have a travel or match day kit prepared if involved with a diabetic athlete
- Be aware: Know the effects nerves, anxiety and stress in competition and personal life can have on blood glucose levels. Know how the effects of comorbidities and other medications have.
- Work in conjunction with the athlete and the MDT
- Hypoglycaemia is the most common adverse effect, lookout for dizziness, weakness, sweating, headache, hunger, pallor, blurred vision, slurred speech, confusion, irritability and poor coordination. Monitor blood glucose levels in those suspected. Remove from play if glucose is below 80mg/dL and administer 15g CHO
- Beware of late onset-hypoglycaemia

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# Concussion

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## *Introduction*

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Concussion is a common type of head injury that can occur in most contact sports. It is defined as traumatically induced physiological disruption of brain function with a short period of altered or loss of consciousness. The incidence of concussion in contact or collision sports is higher than in non-contact sports. Although the consequences of a concussion are controversial, there is concern about cumulative effects and the risk of developing long-term behavioural or cognitive problems from multiple concussions. In addition, some studies suggest that athletes who have had a prior concussion have a higher risk of repeated concussions. Such considerations can have a significant impact on the continuance of an athletic career, causing temporary suspension of play and even early retirement (Koh *et al* 2003).

The rate of concussion has been increasing steadily over the past two decades. This trend is likely caused by improvements in the detection of concussion, but may also reflect an increase in the true number of concussive impacts occurring (Daneshvar *et al* 2011).

## *Incidence*

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3.8 Million concussions per year (Saunders *et al* 2013).

A review of concussion in contact sports carried out in 2006 by Tommasone and McLeod showed that high school males ice hockey demonstrated the highest incidence of concussion (3.6 per 1000 athlete exposures) with soccer athletes the lowest incidence of concussion (0.18 per 1000 athlete exposures). In professional sport, similar concussion rates were found for both ice hockey (6.5 per 1000 player games) and rugby (9.05 per 1000). In individual male sports karate, tae kwon do and boxing had the highest incidence in professional 0.8 per 10 rounds and amateur 7.9 per 1000 man minutes (Tommasone and McLeod 2006).

## Male Vs Female Gender Difference?

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A review of the literature carried out by Dick (2009) which looked at soccer, basketball and ice hockey compared incidence of concussion over a 10 year period. 10 studies were chosen as suitable and 9 of these studies showed higher absolute injury rates for female concussions vs. males with 4 of these studies reaching statistical significance.

In conclusion females may be at greater risk for concussion than their male counterparts.

**\*Note\*** Concussion is a clinical diagnosis often dependant on self reporting. Females have been shown to be more honest in their reporting of symptoms than males. The greater incidence of concussion in females could be explained by reporting bias. The centre of disease control and prevention in the USA estimates that up to 50% of concussions go unreported (Saunders *et al* 2013).

## Frequently Asked Questions

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### What causes a concussion?

"A Concussion may be caused by either a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head" (McCrorry *et al* 2009).

### What are the signs and symptoms of a concussion?

Headache	Sensitivity to light	Fatigue or low energy
“Pressure in head”	Sensitivity to noise	Confusion
Neck pain	Feeling slowed down	Drowsiness
Nausea or vomiting	Feeling like “in a fog”	Trouble falling asleep
Dizziness	“Don’t feel right”	Irritability
Blurred vision	Difficulty concentrating	Sadness
Balance problems	Difficulty remembering	Nervousness or anxiety

**Table 9.1: Adapted from SCAT2 ( McCrorry *et al* 2009)**

### **How many symptoms must be present for a concussion to be suspected?**

When one or more of these components is present, a concussion should be suspected (McCrory *et al* 2009).

### **How long will symptoms last for?**

80-90% of concussions resolve in a short period (7-10 days). The recovery time has been seen to be longer in children than adults (McCrory *et al* 2009).

### **How can a player be evaluated for acute concussion?**

When a player shows any signs of concussion he/she should be treated using standard emergency management principles with particular attention to excluding a cervical spine injury. Once first aid issues have been addressed, then an assessment of the concussive injuries should be made using the standardised concussion assessment tool (SCAT2) or Maddocks Questionnaire. (See Appendix B and C)

The player shouldn't be left alone following the injury and serial monitoring for deterioration is essential over the initial few hours following injury (McCrory *et al* 2009).

### **How should a concussion be managed and how long before a player can return to play?**

The cornerstone of concussion management is physical and cognitive rest until symptoms resolve and then a graded programme of exertion prior to medical clearance to return to play.

The majority of injuries will recover spontaneously over several days. In these situations, it is expected an athlete will proceed progressively through a stepwise return to play strategy (McCrory *et al* 2009).

### **Graduated return to play protocol**

Return to play protocol following a concussion follows a stepwise process:

Rehabilitation stage	Functional exercise at each stage of rehabilitation	Objective of each stage
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity <70% maximum predicted heart rate	Increase heart rate
	No resistance training	
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer. No head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills, eg passing drills in football and ice hockey	Exercise, coordination, and cognitive load
	May start progressive resistance training)	
5. Full contact practice	Following medical clearance participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6. Return to play	Normal game play	

**Table 9.2: Graduated return to play protocol**

### Is same Day return to play (RTP) possible?

With adult athletes only where you have a team physician experienced in concussion management and resources such as neuropsychologists, consultants, neuroimaging as well as neurocognitive assessment. then return to play may be more rapid (McCrory *et al* 2009).

Any athlete 18 or younger who is believed to have sustained a concussion should never be allowed to return to the playing field the same day (McCrory *et al* 2009). There is data however, demonstrating that at the collegiate and high school level, athletes allowed to RTP on the same day may demonstrate symptoms post-

injury that may not be evident on the sidelines and are more likely to have delayed onset of symptoms (McCrory *et al* 2009).

With this in mind, can same day return to play really ever be truly be advised?

### **What are the risks of returning to play too early?**

There are potential long term affects to concussions especially in children with developing brains. "**Post concussive Syndrome**", defined as 3 months duration of concussive symptoms has been linked to athletes who have sustained a number of concussions over time especially 3 or more (McCrory *et al* 2009).

### **What if mild symptoms return a couple of weeks after RTP?**

"All involved in the process of concussion management (including those mentioned above) must be vigilant for the return of symptoms (including depression and other mental health issues) after a concussive incident even if the graded return to play has been successfully completed. If symptoms re-occur the player must consult a medical practitioner and those involved in the process of concussion management and/or aware of the return of symptoms should do all they can to ensure that the player consults a medical practitioner as soon as possible?"

(McCrory *et al* 2009)

### **How much time is required for assessment?**

The assessment of the player may happen on the field or at the sideline. A rule change was required in rugby to provide the medical personnel the time to take the player to the sidelines for assessment and not interrupt the flow of the game. The injured players team aren't penalised as they get to put on a temporary substitute for the duration of the assessment and the decision is then made on whether the player can return or not.

- The rule prior to 2012 was: "Players displaying symptoms of concussion are assessed on the field and either allowed to continue or taken off for the rest of the match and not replaced."

- **The new rule as of 2012: "Players displaying symptoms will be taken off the field to be assessed for five minutes. Another player will substitute during that time."**

"The recommendation to remove the player can be made by the referee, the independent match day doctor or the team doctor from the player's team. Once that command is made, the referee will indicate that the player is leaving the field of play with a hand signal. Once the player has been removed from the field of play and temporarily replaced, the team and independent match doctors will proceed through an IRB pitch-side concussion assessment procedure incorporating standardized questions and observations. If the player fails any aspect of the assessment and has relevant symptoms he will not be able to return to the field of play and the substitution becomes permanent" (APN Holdings New Zealand Ltd 2012).

"Sideline evaluation of cognitive function is an essential component in the assessment of this injury. Brief neuropsychological test batteries that assess attention and memory function have been shown to be practical and effective." (McCrory *et al* 2009).

The importance of the calculation of incidence and severity has been seen in soccer. A clear mechanism of an upper limb trauma to the head has been established, specifically the elbow which accounted for 50% of concussions. Leading with the elbow has been classed as dangerous play which can result in a player being sent from the field in soccer games (McCrory *et al* 2009).

### **What Tests are the most appropriate?**

- Maddocks Questions: Quick questions which can be administered on the field of play. (See Appendix C)
- Standard Assessment of Concussion (See Appendix D)
- SCAT2 (See Appendix B)
  - **Latest SCAT2 research**

A study by Jinguji *et al* (2012) has shown that non concussed high school athletes scored a near total score with the exception of concentration and balance testing. Tandem and single leg stance showed the most variability. Therefore, baseline testing is important. Concentration testing has been



shown to be unreliable because of baseline error and is likely to produce a high rate of false negatives and false positives. Therefore return to play decisions should not rely on concentration testing without a baseline test for comparison. (Jinguji *et al* 2012).

- Standard Orientation Questions
  - Questions such as time, place and person have been shown to be unreliable when compared with memory assessment (McCrary *et al* 2009)
  - "It is recognized, however, that abbreviated testing paradigms are designed for rapid concussion screening on the sidelines and are not meant to replace comprehensive neuropsychological testing which is sensitive to detect subtle deficits that may exist beyond the acute episode; nor should they be used as a stand-alone tool for the ongoing management of sports concussions"(McCrary *et al* 2009)

***\*It should also be recognised that the appearance of symptoms might be delayed several hours following a concussive episode\**** (McCrary *et al* 2009)

### **Does it matter if somebody has a history of concussion?**

Conducting a concussion history on any player/athlete is of value. This will help to pre identify athletes that fit into high risk categories and this gives the healthcare provider the ability to educate the athlete in advance with regard to concussive injury (Concussion Consensus Statement 2009).

***\*Taking a concussion history from teammates or coaches has been shown to be unreliable\**** (McCrary *et al* 2009).

### **Are there any modifying factors that could influence intensity and management?**

There are modifying factors that may predict the potential for prolonged or persistent symptoms. These modifiers would also be important to consider in a detailed concussion history and these are listed in table 2 below:

<b>Factors</b>	<b>Modifier</b>
Symptoms	Number Duration (>10 days) Severity
Signs	Prolonged loss of consciousness (>1 min), amnesia
Sequelae	Concussive convulsions
Temporal	Frequency—repeated concussions over time Timing—injuries close together in time “Recency”—recent concussion or traumatic brain injury
Threshold	Repeated concussions occurring with progressively less impact force or slower recovery after each successive concussion
Age	Child and adolescent (<18 years old)
Co- and pre-morbidities	Migraine, depression or other mental health disorders, attention deficit hyperactivity disorder, learning disabilities, sleep disorders
Medication	Psychoactive drugs, anticoagulants
Behaviour	Dangerous style of play
Sport	High risk activity, contact and collision sport, high sporting level

**Table 9.3: Factors that may predict the potential for persisting symptoms**

### **What if a player loses consciousness?**

The duration of loss of consciousness (LOC) is a predictor of outcome. LOC has been linked with early cognitive deficits but hasn't been linked with injury severity (McCrory *et al* 2009). Prolonged LOC = 1 minute in duration.

### **What if the player has a fit/convulsion?**

Motor phenomena associated with concussion such as tonic posturing or convulsive movements may accompany a concussion but they are generally benign and require specific management beyond the standard treatment. (McCrory *et al* 2009).

## When does a possible concussion require a visit to hospital/Scan?

The Canadian CT Head rule (See Appendix E) can be used to decide whether a head injury or concussion will warrant a scan. High risk factors were seen to be 100% sensitive when predicting the need for neurological intervention. Medium risk factors were 98.4% sensitive for predicting clinically important brain injury (Stiel *et al* 2001). It's difficult to predict whether a scan is required or not but certain symptoms have been shown to be predictors of underlying head injury. A cross-sectional study which compared the use of Canadian CT head rule which compared its use to the gold standard in the detection of head injury the Computed Tomography (CT) Scan and agreed that it is an excellent decision making tool. (Anish *et al* 2012).

### Rules to indicate the need of a CT scan

- Vomiting alone has a 5% predictive value (Anish *et al* 2012).
- Clinicians rely on the GCS to predict Head injury. If a player has any 1 of the following high risk factors a scan is indicated (Anish *et al* 2012):
  - Failure to reach GCS score of 15 within 2 Hours
  - Any sign of basal skull fracture
  - Vomiting for more than 2 episodes
  - Amnesia before impact
  - Dangerous Mechanism of injury
- NHS Guidelines on head injury (2012) that will require a trip to the emergency room:
  - Unconsciousness, either very briefly or for a longer period of time
  - Difficulty staying awake or still being sleepy several hours after the injury
  - Seizure
  - Difficulty speaking
  - Vision problems
  - Reading or writing problems
  - Balance problems or difficulty walking
  - Loss of power in part of the body, such as weakness in an arm or leg

- Clear fluid leaking from the nose or ears (this could be cerebrospinal fluid, which normally surrounds the brain)
- A black eye (with no other damage around the eye)
- Bleeding from one or both ears
- Loss of hearing in one or both ears
- Bruising behind one or both ears
- A lasting headache since the injury
- Irritability or unusual behavior
- Visible trauma (damage) to the head, such as an open, bleeding wound
- Patient has previously had brain surgery
- Clotting Condition or are on Anti-coagulant drugs

(NHS 2012)

If **any of these symptoms** are present, particularly loss of consciousness, even for a short time, immediately go to the accident and emergency (A&E) department of your local hospital or call 999 and ask for an ambulance (NHS 2012).

### **Is there a link between repeated concussions and depression?**

Depression has been seen as a long term consequence of sports concussion in American footballers in a study completed by Guskiewicz *et al* (2007). This study showed that retired players with 3 or more previous concussions were 3 times more likely to be diagnosed with depression and players with 1-2 concussions were 1.5 time more likely to be diagnosed with depression. These findings emphasize the importance of the potential neurological consequences to recurrent concussions and the potential benefits from educating players on the risk factors. A study by Kontos *et al* (2012) showed that athletes experience increased levels of depression up to 14 days after concussion which coincided with neurocognitive decrements in reaction time and visual memory.

### **Do the symptoms of concussion differ in younger athletes?**

Yes, the symptoms differ in that they may be more prolonged and the clinical evaluation may require the child's parents and/or teacher to input. It is accepted that

children should not return to play until clinically completely symptom free which may require a longer time frame than for adults.

The importance of "cognitive rest" has been highlighted as a clinical requirement (e.g. stressors such as text messaging and video games). The child may have to be removed from school if displaying any signs of concussion. There are specific risks (e.g. diffuse cerebral swelling related to head impact during childhood) which promote a more conservative approach to return to play. Concussion modifiers apply even in this particular population.

***\*It is Never appropriate for a child to return to play on the same day as the injury regardless of the level of athletic performance\****

***\*The length of time for graded return to play protocol should be extended in adolescents and children.\****

Although the developing brain has been shown to be more adaptive due to neuroplasticity it is suggested that the developing brain is actually more vulnerable to the widespread damage which is associated with a traumatic brain injury (Duff 2009). When high school students were compared to college students, the high school students showed a longer time to recovery (Field *et al* 2003). Studies are ongoing to obtain incidence data and to conduct empirical studies examining recovery rates and long term outcomes in school going populations (Duff, 2009).

### **Are there any other chronic long term affects to repeated concussions?**

There are links between repeated sports concussions and later life cognitive impairment. Clinicians need to be mindful of the potential for long term problems in the management of all athletes (McCrorry *et al* 2009).

### **What kind of protective equipment is available and does it work?**

Yes and No. Mouthguards have been shown to be effective in preventing dental and orofacial injury and biomechanical studies have shown a reduction in impact forces to the brain with the use of headgear and helmets but these findings haven't show a reduction in concussion incidence. There are some studies to support the use of helmets for skiing and snowboarding and can be recommended for participants in

alpine sports. In sports such as cycling, motor and equestrian sports, protective helmets may prevent other forms of injury such as skull fracture (McCrory *et al* 2009).

The concept of risk compensation must also be taken into account where the wearing of protective equipment results in the adoption of more dangerous behaviour which can result in increase in injury rates (McCrory *et al* 2009).

### *Sports Specific Guidelines for return to play*

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#### **Rugby**

"Returning to play before complete resolution of the concussion exposes the player to recurrent concussions that might take place with ever decreasing forces. We have concerns that repeat concussion could shorten a player's career and may have some potential to result in permanent neurological impairment. Players must be honest with themselves and medical staff for their own protection" (IRB Concussion Guidelines, 2011)

#### **Scenario A** (Managed by Healthcare professional)

If the return to play protocol is being managed by a healthcare professional it is possible for the player to return to play after a minimum of 6 days after concussion or suspected concussion following completion of each stage of the graduated return to play (GRTP) protocol (Appendix T).

**\*A player will only begin the graded return to play protocol when symptom free.\***

"Healthcare Professional" means an appropriately-qualified and practising physiotherapist, nurse, osteopath, chiropractor, paramedic, athletic trainer (North America) who has been trained in the identification of concussion symptoms and the management of a concussed player (IRB Concussion Guidelines 2011).

Where the player completes each stage successfully without any symptoms the player would take approximately one week to proceed through the full rehabilitation protocol from Level 1. If any symptoms occur while going through the GRTP protocol, the player must return to the previous stage at which he/she did not experience any symptoms and attempt to progress again after a minimum 24-hour period of rest has passed without the reappearance of any symptoms. After level 4 the player resumes full contact practice and the medical practitioner must confirm that the player can take part. Full contact practice equates to return to play for the purposes of concussion. However return to play itself shall not occur until Level 6.

Adolescents and children must have clearance from a medical practitioner before they can return to play (IRB Concussion Guidelines 2011).

**Scenario B** (Not managed by healthcare professional)

In these situations where there isn't access to a medical practitioner to diagnose the concussion and to manage the GRTP, the player must not return to play until at least the 21st day after the incident and should follow the GRTP process (See Table 9.2 above). Other players, coaches administrators and coaches associated with the player should insist on the guidelines being followed (IRB Concussion Guidelines 2011).

**What if the concussion is diagnosed by a medical practitioner but does not have access to a medical practitioner to manage the GRTP?**

In this case the GRTP process can only begin after 14 day stand down period from play/training and only if there are no symptoms of concussion. The player therefore will not return to play until the 21st day after the incident. The process should be managed by somebody familiar with the player who may be able to recognise any abnormal signs. Pocket SCAT 2 will assist the person in managing the process (IRB Concussion Guidelines 2011).

## GAA

The GAA's approach to concussion is based on the concussion consensus statement published in 2005. They aren't as current as the IRB guidelines which are based on the 2009 guidelines written by McCrory *et al.* The GAA's approach to concussion is quite

similar to that of the IRB, they recommend the use of the SCAT2 assessment tool and also the use of a stepwise approach:

- "If a concussion is suspected, the player should not return to play in the current game or training without medical assessment" (GAA 2007).
- "The player should not drive after a concussion injury" (GAA 2007).
- "Return to play follows a medically supervised stepwise approach"(GAA 2007).
- "A player should never return to play while symptomatic, **When in doubt, Sit them out!**" (GAA, 2007).

The GAA promote the concussion management with the phrase **"Better to miss one game than miss the whole season"** (GAA 2007).

## Boxing

The International Boxing Association has some competition rules when dealing with concussions and knockouts when in the ring and these are listed below.

- "If a Boxer has been knocked out or received a severe head blow which results in a bout being terminated, the ringside doctor will classify the seriousness of the concussion and prescribe the medical restriction period as follows:
  - In the event of no Lost of Consciousness (LOC), a minimum restriction of 30 days
  - In the event of LOC for less than one minute, a minimum restriction of 90 days
  - In the event of LOC more than one minute, a minimum restriction of 180 days
- Any boxer who suffers a second LOC within 3 months of resuming boxing after a first LOC, will have the previous medical restriction doubled
- Any boxer who suffers 3 LOCs within 12 months will be suspended for a minimum of 360 days from the date of the third LOC
- Any Boxer who has a medical restriction must not train or spar during the restricted period." (IBA 2012)



## Concussion At a Glance

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### Signs and Symptoms

Headache	Sensitivity to light	Fatigue or low energy
“Pressure in head”	Sensitivity to noise	Confusion
Neck pain	Feeling slowed down	Drowsiness
Nausea or vomiting	Feeling like “in a fog”	Trouble falling asleep
Dizziness	“Don’t feel right”	Irritability
Blurred vision	Difficulty concentrating	Sadness
Balance problems	Difficulty remembering	Nervousness or anxiety

### How to recognise concussion

Concussion should be assessed using the SCAT2 Assessment. A pocket SCAT2 is available and can be used to assess players on the sports field.

**Link**                                  **to**                                  **Pocket**                                  **SCAT2:**  
[http://www.irbplayerwelfare.com/pdfs/Pocket\\_SCAT2\\_EN.pdf](http://www.irbplayerwelfare.com/pdfs/Pocket_SCAT2_EN.pdf)

### Points to remember

- **Know your sport!** Each sport has specific guidelines around player welfare, concussion management and return to play.
- If a player is suspected of suffering a concussion then he must leave the field of play. (Only under very specific guidelines can a player return to play and this is only documented in American football).
- An adolescent or child should never return to play in the same game after a suspected concussion.
- The Standard Stepwise return to play model can be applied to all level of athletes as long as the athletes are symptom free when beginning the protocol.
- 80-90% of concussions resolve in a short period (7-10 days).
- There are links between repeated sports concussions and later life cognitive impairment. Be mindful of the potential for long term problems.
- Athletes who have suffered a concussion are more at risk of getting further concussions

## Examination of the Evidence

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Mc Crory <i>et al</i> 2009	Evidence Based Guidelines	Level 1b	This document is developed for use by health care professionals, coaches and other people involved in the care of injured athletes, whether at the recreational, elite or professional level. Experts from around the world have met to produce guidelines on the Prevention, detection and management of sports concussion	Outlines recommendations on the best management of Sports concussion. Return to play protocol developed as well as guidelines for pitch side management.	Experts from across the world come together to decide on this consensus statement that is revised every 3 years. A systematic review
Rossaint <i>et al</i> 2010	Evidence based guidelines	Level 1b	Updating the multidisciplinary 'Task Force for Advanced Bleeding Care in Trauma' 2007 guidelines.	Outlines recommendations on the on the best management of external bleeding, which are graded depending on the level of evidence underpinning the recommendation.	The most recent European guidelines formulated using a systematic review approach alongside the views of an expert panel in the area who ensured the recommendations based on the literature were realistic to implement  Uses RCT's and well designed retrospective studies

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Stiel <i>et al</i> 2001	Prospective Multicentre study	Level 4	This study was used to develop the Canadian CT Head Rule, a highly sensitive decision rule for use of CT.	The CT head rule was derived which consists of 5 high risk factors, 1. Failure to reach GCS of 15 within 2 hours, 2. Suspected Open skull fracture, 3. 2 episodes of vomiting, 4. Amnesia before impact, 5. Dangerous mechanism of injury.	This rule has the potential to significantly standardise and improve the emergency management of patients with minor head injury.
Anish <i>et al</i> 2012	Cross Sectional Study	Level 4	This study evaluates the efficacy of CCHR to predict the occurrence of head injury, as evidenced radiologically by a CT head.	This study shows that Clinical manifestations as measured by a GCS score < 13 failed to significantly predict a head injury in the CT scans	Secondly when the CCHR was added to the GCS score then the results were statistically significant. (P Value < 0.001). Sensitivity 0.67
Guskiewicz <i>et al</i> 2007	Prospective Study	Level 4	This study investigates the association between prior head injury and the likelihood of being diagnosed with clinical depression among retired professional football players.		Findings suggest a possible link between recurrent sport-related concussion and increased risk of clinical depression. These results emphasise the importance of understanding potential neurological consequences of recurrent concussion

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# Chpt 10: Legal Issues in Sports Physiotherapy

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## *Introduction*

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The area of law, especially medico-legal issues, is complex and multi-faceted. In most cases the answer to a particular legal question is not cut and dry, unless there has been an established precedent for the particular situation. However, a basic understanding of the law and how it affects physiotherapy practice is necessary for the practitioner. Over the following pages the areas of tort law, negligence and liability are discussed in relation to physiotherapy. Examples of case studies or legal cases are provided where possible.

Consequences of legal cases are varying depending upon the seriousness of the offence. Complaints brought against physiotherapists that have resulted in hearings in England and Wales are listed below, followed by their eventual outcomes:

Inaccurate patient records:	Caution
Record keeping and other issues:	Caution
Inappropriate comments to colleagues:	Suspension
Relationship with a patient:	Conditions of practice
Theft from employer:	Struck off
Health:	Suspension.
Lack of competency and misconduct:	Struck off

(In the final case, the physiotherapist had cancelled a patient's appointment to go home early, and led colleagues to believe *the patient* cancelled the appointment. On review of several of his patients it became clear that the physiotherapist's record keeping was very poor and that he had missed red flags on a number of occasions that should have warranted immediate onward referral).

(Dimond 2009)

## *Glossary of Legal Terms*

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Because of the complexity of the law and legal terms used, explanations of the common terms you will come across in this booklet are provided below:

**Bolam Test:** This refers to a standard of reasonable professionalism expected from an expert. The Bolam test was established during a medico-legal case in Britain in which the judge ruled that the test for whether a person is negligent or not “is the standard of the ordinary skilled man exercising and professing to have that special skill. If a professional failed to measure up to that in any respect (clinical judgement or otherwise), he had been negligent and should be so adjudged”. This standard can apply to any professional and the standard of care expected of a physiotherapist would be judged in this way.

**Criminal law:** This covers actions that can be followed by criminal proceedings—a charge of a criminal offence, e.g. murder or assault. Fines or imprisonment can result from rulings brought through criminal law. In a criminal case the prosecution attempts to prove beyond reasonable doubt that the accused is guilty of the offense that they are charged with.

**Civil law:** This covers law which rules on disputes between citizens, or between citizens and the State, e.g. Tort law, marital disputes and disputes over property are all covered by civil law. Damages, compensation and injunction can be awarded if the ruling is in favour of the plaintiff. In a civil case the complainant has to establish on balance of probability that whatever civil wrong is alleged has occurred. There is no jury.

**Claimant:** Complainant

**Defendant:** The accused.

**Fitness to practice:** This involves more than just competence in profession. It includes health and character as well as knowledge and skills to do job safely. Impairment of fitness may involve misconduct, lack of competence, conviction/caution for a criminal offence, physical/mental health of registrant.

**Personal liability:** Occurs when the individual themselves is responsible for their own misconduct.

If a private practitioner was sued they would have to accept personal and professional liability for their actions. They would also be liable for the actions of their employees. However, the employee would not be held vicariously liable for the acts of their employees unless they are at fault for selecting/mis-instructing them.

**Tort law:** These are civil actions brought to the civil courts by an individual/organisation. Tort law refers to a wrongful act that leads to legal liability (Oxford University Press 2012). There are 3 forms of tort:

1. Intentional: For example assault, battery
2. Negligence: An act committed without intent but which is not in line with reasonably held standards
3. Strict liability: Refers to acts committed without any intent (Dimond 2009)

The idea underpinning tort law is that the victims of unreasonable professional conduct should be compensated (Kennedy 2009). In this manner, legal proceedings aim to ensure compensation of the victim for a loss, provide a means by which professionals are held responsible for their actions and to provide a deterrent against poor practice (Herring 2012). Tort law leads to liability only if the person is found to have acted outside of a reasonably held standard. However, difficulty arises in trying to determine exactly what a reasonably held standard is. There are several steps that a practicing physiotherapist can take to protect themselves against any accusations of negligence. These are outlined later.

**Vicarious liability:** Refers to a form of liability whereby one person is held responsible for the misconduct of another. It most commonly occurs in employer-employee relationships.



In a case of negligence involving a hospital-employed physiotherapist, it is unlikely that the physiotherapist would be personally sued, as their employer would be vicariously liable for their actions.

## *Negligence*

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The majority of cases following malpractice are brought under the tort of negligence. If a person is to succeed in their case they will have to prove 4 things: Duty, Breach, Causation and Harm. That is:

1. That the physiotherapist being sued owed the claimant a duty of care.
2. That the physiotherapist breached their duty of care
3. That the breach of duty of care caused reasonably foreseeable harm.
4. That the breach of care caused the claimant a loss (Herring 2012).

### **1. What is meant by duty of care?**

The law recognises the existence of a duty of care where one person can reasonably foresee that their actions/omissions could cause harm to another person. A duty of care always exists between a physiotherapist and their patient.

However, what about in the case of an injured person at an event/crash?

In this case the usual legal principle is that there is no duty to *volunteer* services. However, it becomes complicated as there may be a *professional* duty to volunteer services in some cases.

### **2. Breach of duty of care:**

In order to prove a breach of the duty of care, an established professional standard is first required. It can be difficult to define what consists of a reasonable standard to which professionals are accountable. The courts tend to use what is called the 'Bolam test' (explained above) to establish this. The Bolam test is a principle used to determine the standard of care which should be followed. It states that:

“The standard of care expected is the standard of the ordinary skilled man exercising and professing to have that special skill”.

Applying the Bolam test to physiotherapy implies that anyone calling themselves a physiotherapist should have the level of skills required to suitably treat their patients. Expert witnesses are often used in court to give evidence on the standard of care that would be expected of the defendant. The witness would be asked to place themselves in the situation being disputed, and to give their opinion on the standards of care that *they* would have expected to have been followed in that situation (Dimond 2009). Expert witnesses would be respected physiotherapists or the head of a department or training college. Lawyers would look to the ISCP/Corú for recommended expert witnesses.

### **3. Causation:**

If a breach of duty of care is established, the claimant must now show that this breach caused actual and reasonably foreseeable harm to them. This requires:

- Factual causation to be shown (a link between the breach of duty of care and harm caused).
- Evidence that the type of harm that occurred was reasonably foreseeable.
- Nothing that breaks the chain of causation (Dimond 2009).

An incident breaks the chain of causation if it interrupts the physiotherapist's breach of duty of care and the harm suffered by the patient. For example:

A physiotherapist fails to check that a hoist issued for home use was fully functional before issuing it. The patient falls when being hoisted, suffers a stroke and subsequently dies. Although the physiotherapist's negligence can be reasonably said to have caused the fall, they cannot be blamed for the stroke the patient suffered. They are responsible for the fall but not for the patient's subsequent death. Misconduct and disciplinary proceedings may however be taken against the physiotherapist due to their failure to test the hoist's functionality before issuing it for home use.

### **4. Harm:**

Finally, to successfully win a negligence case, the claimant must prove that they suffered harm which the court recognises as being suitable for compensation. Injury, death, posttraumatic stress syndrome and loss of/damage to property are the main areas of recognised harm (Dimond 2010).

## *Defence against a claim of negligence*

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There are several different approaches to defend against an accusation of negligence.

The most common are listed below:

1. Dispute the allegation
2. Deny that all the elements of negligence (discussed above) are present
3. Contributory negligence
4. Limitation of time
5. Voluntary assumption of risk

(Dimond 2009)

### **1. Dispute the allegation:**

This emphasizes the need for adequate record keeping. Most cases are resolved on what facts can be shown to exist either by witnesses or documentation.

### **2. Dispute that all the elements of negligence exist:**

To win the case the claimant must prove that all of duty, breach, causation and harm are present. If it is proven that one or more of these elements are absent, the defendant will win the case.

### **3. Contributory negligence:**

This occurs when the claimant is partly to blame for the harm which has occurred. While the defendant may still be partly liable, the compensation payable may be reduced in proportion to the claimant's fault.

For example: A physiotherapist made a negligent assessment of a patient, however the patient also withheld information relevant to their needs-they denied having pain on being assessed. The client was subsequently injured, however in a case taken against the physiotherapist; the client's contribution to their own harm would be taken into account.

#### **4. Limitation of time:**

If a patient wants to bring a case against a physiotherapist in relation to personal injury or death, the case should begin within 3 years of the date of the event in dispute. Alternatively, the case should begin within 3 years of the date on which the person had the knowledge of the harm *and* the fact that it arose as a result of the physiotherapist's actions/omissions.

There are however 3 major exceptions to this rule:

1. Children under 18: In this case the time does not start until the child reaches 18 years.
2. Mental disability: In this case time does not start to run out until the disability ceases.
3. Judge's discretion: A judge has the power to extend the time within which a claimant can bring a case, if it is just to do so.

#### **5. Voluntary assumption of risk:**

The voluntary assumption of risk could be used in defence that a person willingly undertook the risk of being harmed.

For example:

Voluntary assumption of risk could be used as a defence in a case involving a rugby player, who willingly accepted the risk of playing on a field which complied with regulations relating to sports fields and activities.

(Dimond 2009)

## *Protection against claims of negligence*

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To help protect yourself against any legal issues, you should follow the rules set out by the country's professional body, always keep accurate records and partake in continued professional development.

Outlined below are relevant points from some of the ISCP's documents in relation to consent, ethics, professionalism and continuing professional development. These should be used to guide your decisions and actions. Complete versions of the documents are available to ISCP members on the ISCP website. It is important to familiarize oneself with these documents and standards because, in the event of a court case, these are the standards to which the physiotherapist will be held. Also, as a responsible clinician, one should understand the levels of professionalism and competency expected and demanded of them by these documents. Furthermore, the 'Rules of Professional Conduct Incorporating Code of Ethics and Guidelines for Professional Behaviour May 2012' (ISCP 2012) state that:

“Physiotherapists are fully accountable for all professional interactions and are informed by the Irish Society of Chartered Physiotherapists' Core Standards of Physiotherapy Practice and Rules of Professional Conduct.”

The following information is a synthesis from the following key documents outlining the roles and responsibilities of the physiotherapist: European Core Standards of Physiotherapy Practice, Rules for Professional Conduct, ISCP Continuing Professional Development Position Statement.

These can be found online on the ISCP's website at: [www.iscp.ie/inventory-of-iscp-documents.html](http://www.iscp.ie/inventory-of-iscp-documents.html)

### **European Core Standards of Physiotherapy Practice 2008**

The Code of Behaviour outlines the minimum expectations of behaviour by a member, which will enable them to maintain the standards set out in the Rules of

Professional Conduct and Code of Ethics. These standards are enforced by an ethics committee which is responsible for:

- Keeping all aspects of professional conduct and ethics under review
- Upholding the code of professional conduct
- Dealing with all matters of professional conduct/ethics
- Recommending to the Board when deemed necessary suspension/termination of membership or other sanctions as deemed appropriate in any particular case in accordance with the provision of Article 12.3
- Recommending to the Board to withhold/withdraw recognition of any Clinical Interest Group in accordance with the terms of Article 8.4.

Members of the Irish Society of Chartered Physiotherapists shall:

- Accept responsibility for the exercise of sound judgment
- Provide an honest, competent and accountable professional service without discrimination, fear or favor
- Recognize the limitations of their professional expertise and undertake only those activities which are within their professional competence
- Maintain and promote high standards of practice, education and research

It also rules that:

- Chartered Physiotherapists shall keep up to date with developments in the practice of physiotherapy. To this end the Society establishes criteria and standards from time to time for Continuous Professional Development (CPD) in the ongoing training and education of practising physiotherapists. Failure to observe such criteria shall be a prima facie (a fact presumed to be true unless it is disproved) breach of the Rules of Professional Conduct.
- Chartered Physiotherapists must keep themselves informed of developments within the profession to ensure the best standards of patient care.

**\*\*Infringement of the rules of professional conduct or the code of ethics renders members liable to disciplinary action with subsequent loss of privileges and benefits of the society\*\***

## Rules for Professional Conduct 2012

### *Behaviour towards Everyone*

Act with respect, courtesy, honesty, accountability, humility, fairness and impartiality  
Be positive, supporting, reassuring and encouraging, open and fair in your dealings with others.

### *Behaviour towards Patients*

- Your paramount professional responsibility is to act in the best interests of the patients whom you are treating. In a situation where you have a concern in relation to conduct, competence or unsafe or potentially unsafe system/s, you must act to prevent any immediate risk to patient safety by taking appropriate steps to notify the relevant authority about your concern as soon as possible. If you are not sure to whom you should report your concerns, ask a senior colleague for advice.
- Strive to provide the highest standard of practice. Maintain your competence throughout your professional career by participating in continuous learning and professional development and meeting the CPD requirements to maintain membership of the professional body.
- Acknowledge your limitations and be willing to seek advice.

**\*\*Chartered Physiotherapists, by accepting membership of the Society, agree to abide by all the terms and conditions of membership and agree to accept sanction in the event of a breach of the Rules of Professional Conduct or Code of Ethics\*\***

## ISCP Continuing Professional Development Position Statement

In relation to CPD, in negligence cases it is always important to establish the competence of the physiotherapist to practice. A formal written way to prove one's competence and committal to ongoing study is to keep accurate records of CPD. The World Confederation for Physiotherapy (WCPT) issued a document entitled: Declarations of Principle and Position Statements (1995), stating that:

"Lifelong learning and professional development is the hallmark of a competent physiotherapist"

Subsequently the ISCP issued a positional statement outlining the levels of CPD expected from its' members. It also provides an online document, which allows the physiotherapist to keep track of their CPD hours\_and learning needs. This again, is available on the ISCP website. Extracts of the statement have been outlined below. A full version is available to ISCP members on the ISCP website.

The minimum recommended requirement is for 100 credit points over a 3 year period, where 1 point is awarded for each hour spent in learning activity.

- A balance between formal and informal CPD should be sought, with no less than 30 points being accrued in either category.
- A maximum of 10 points should be allowed for non-certifiable personal learning over the 3 year cycle.
- CPD records are audited on a random basis over a 3 year cycle.

In relation to CPD this document also outlines that the physiotherapist has the following responsibilities:

- 'To ensure the best standards of care, the Chartered Physiotherapist must keep himself/herself informed of developments in the profession'.
- 'Chartered Physiotherapists shall co-operate with one another to maintain and enhance the standards of the profession'.
- 'Whenever possible, Chartered Physiotherapists shall support and participate in research to improve standards of care'.

The World Confederation for Physical Therapy (WCPT) has also published guidelines named 'WCPT European Core Standards of Practice (2000)', which were adopted by the ISCP in 2002, and are in agreement with the ISCP's recommendations for CPD.



The ISCP recognises the critical role that CPD has in ensuring protection of the public. Therefore, ISCP expects its members to maintain standards of excellence in all aspects of physiotherapy practice and to engage in professional development activities.

The ISCP recognises the following CPD activities such as those outlined below. This list is not exhaustive.

**Formal Activities:** such as relevant courses, conferences, workshops, Clinical Interest Group (CIG) events, scientific meetings, formal post-graduate courses and mandatory training e.g. manual handling, CPR, fire safety etc.

**Informal Activities:** such as in-service training, journal clubs, multidisciplinary education at workplace, teaching, development of policy documents, preparing lectures, in-service training, student education, supervision, research, mentoring, performance appraisal, service development, presentations, posters, professional body committee work, organisation of professional events, reviewing books, journals, grants applications, preparing medico-legal reports, acting as expert witness, reflection, internet searching, personal research for example books, journals, video, DVD, CD-Rom etc.

As an ISCP member you will have access to a large variety of free CPD courses. These you can study in your own time and you will receive CPD certification on their completion.

## ***Consent***

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In relation to consent, as physiotherapists/physiotherapy students we are all well aware that it is mandatory that consent be given before we treat a patient. It is also compulsory that this consent is recorded. This a particularly pertinent issue when legal proceedings are commenced. Below, relevant points from the ISCP's Policy on Consent are outlined. These aim to clarify previously ambiguous scenarios, and/or

draw your attention to consent issues relevant not only to sports physiotherapy, but also to general practice.

- The ISCP's Policy on Consent states that Chartered Physiotherapists shall seek appropriate valid consent from the patient/guardian before physiotherapy is initiated in accordance with the Society's policy
- It is the responsibility of all chartered physiotherapists to ensure that consent is obtained for all interventions, in line with the Society's policy.

It is generally acknowledged that there are two exceptions to the common law rule:

1. Therapeutic Privilege
2. Emergency

### ***1. Therapeutic Privilege***

The therapeutic privilege means that a clinician can withhold information if s/he feels that it would be psychologically damaging to the patient/client to disclose. If a clinician was conscious that an anxious person might refuse important treatment even if told of every single possible adverse outcome, the clinician might, according to their therapeutic privilege, be justified in withholding certain facts. However, the therapeutic privilege does not extend to giving clinicians the right to lie to their patients; clinicians have an ethical duty to share information with their patients. It is rare that a clinician should rely on this particular privilege in justifying the reasons for not telling a patient certain facts in relation to the proposed treatment. This privilege should very rarely, if ever, be exercised.

### ***2. In Case of Emergency***

In an emergency, life-threatening situation where the patient is unable to consent or to appreciate what is required, the clinician may administer the necessary medical treatment in the absence of the expressed consent of the patient. This is known as the Doctrine of Necessity. It applies to an emergency situation where the clinician treats a patient, in the absence of consent, in the best interests of the patient, where the treatment is necessary to save the life or preserve the health of the patient. The

clinician must demonstrate that they attempted to ascertain whether or not an advance directive existed which may be indicative of the patient's wishes/consent.

Consent may be:

1. Expressed
2. Implied

### **1. Expressed**

Expressed consent can be given verbally or in writing. It must be noted that simply giving a person a consent form and asking him/her to sign it is not acceptable practice. Verbal consent is usually requested for less invasive or more routine procedures.

### **2. Implied**

Implied consent is by the conduct or silence of the person whose consent is required. Healthcare professionals should be cautious about implied consent e.g. Consent may be implied, for example, by the patient positioning him/herself for treatment however this does not necessarily imply that the person knows what exactly is going to happen/take place.

Consent is only valid when it is:

- Given voluntarily
- Given by a person with capacity to consent
- Informed
- Given by someone entitled to give consent

People entitled to give consent include:

### **Adults**

People over the age of 18 are usually regarded as competent to decide and consent to their own treatment.

### **Persons aged between 16 and 18 years**

Minors between their 16th and 18th birthday may give their own consent to medical, dental and surgical procedures. The Non Fatal Offences Against the Person Act 1997 states:

“The consent of a minor who has attained the age of 16 years to any surgical, medical or dental treatment which, in the absence of consent, would constitute a trespass to his or her person, shall be as effective as it would be if he or she were of full age; and where a minor has by virtue of this section given an effective consent to any treatment, it shall not be necessary to obtain any consent for it from his or her parents or guardian”.

However, there may be circumstances where it is in the best interest of the minor, or where there is any doubt about the minor’s capacity, to also obtain the consent of the parent or guardian; ultimately this is a decision for the physiotherapist.

### **Children under the age of 16 years**

For children under 16 years, a parent or guardian can/must consent to treatment for the child. Gillick Competence and Fraser Guidelines (UK) states that:

“The parental right to determine whether or not their minor child below the age of 16 will have medical treatment terminates if and when the child achieves a sufficient understanding and intelligence to enable him or her to understand fully what is proposed”.

However, no guidance has yet been forthcoming from the Irish courts regarding the capacity of a child less than 16 years to consent.

Consent for a child can be given by the following person(s):

- The mother.
- The child’s father if married to the mother. In the event of subsequent separation or divorce, both parents remain the child’s legal guardian, even if the child is not living with them and they have not been awarded custody of the child.
- The child’s father who, if not married to the mother, has acquired guardianship via a court order (guardianship rights in relation to his child).

- The child's father when a guardianship agreement has been established between the mother and father.
- The child's legally appointed guardian, appointed by a court or by a parent with parental responsibility in the event of their own death.
- A person in whose favor a court has made a residence order concerning the child.

Where two legal guardians exist, it is expected that the physiotherapist seeks the consent of both guardians. Consent of only one guardian is acceptable only if one guardian is not contactable or indicates that they do not wish to be consulted or that they wish the custodial guardian to make any necessary decisions on their behalf.

There are a few more interesting points regarding issues of consent, particularly around the area of consent for under 16s who are not living with their parent/whose parents are separated or in cases where the parent is in fact legally a child themselves, but these are outside the scope of this short course. More information can be found from the ISCP's consent policy.

(ISCP 2012)

### **European Region of the World Confederation for Physical Therapy**

The European Region of the World Confederation for Physical Therapy states that in relation to consent, a physiotherapist must:

- Accept responsibility for the exercise of sound judgment
- Provide an honest, competent and accountable professional service

These are the standards to which a qualified physiotherapist can be held accountable. We thus again emphasize the importance of familiarizing oneself with the completed versions of these documents, and stress that these are points deemed relevant to this short course only.

(ISCP 2012)

The ISCP provides a document entitled 'Information pack for chartered physiotherapists on medico-legal issues and expert witness issues'. This succinctly

outlines medico-legal issues relating to the physiotherapist, information on medico-legal report writing and on the role of the expert witness and on appearing in court. It also provides further advice on risk management and actions to take to prevent negligence claims occurring.

With regards to achieving adequate risk management, it advises the use of a 4 stage process. This includes:

- Risk/hazard identification
- Risk Analysis: Weighing up the probability of the risk occurring vs. the potential severity of the injury/loss.
- Risk Control: This can be by a variety of methods including providing training, setting up policies and procedures and ensuring staff competency.
- Evaluation: Ensuring the effectiveness of risk management strategies put in place.

They also advise the inclusion of 4 areas in any risk management policy, these are to reduce the likelihood of a risk occurring:

- Good Communication: This includes communication not only with the patient, but also with other staff members.
- Consent: Fully informed consent should be given and recorded.
- Case notes: Appropriate patient notes are key to any defense against claims of negligence.
- Competence: The physiotherapist should be fully competent in treating a patient, and should undergo training in areas they feel require up-skilling. They should also partake in continued professional development.

## *Conclusion*

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In conclusion, the area of law in physiotherapy is very complex. The previous pages aimed to provide a basic understanding of the law, and how it can affect practice. Issues highlighted affect not only the sports physiotherapists' practice, but also the practice of physiotherapists in all other areas. However, it is important to stress the individuality of every case in law. The above information is a guideline only. Useful resources are outlined at the end of this section.

## *Legal Case Studies*

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Below are some examples of sports physiotherapy case studies based on examples outlined by Dimon (2009).

### **Case: Misdiagnosis on field of play**

During a football match the physiotherapist is called onto the pitch to attend one of the players. He reports a lot of pain in the groin region. The physiotherapist uses analgesic spray to relieve the pain, when asked if he should play on the physiotherapist advises the player that he can return to play. The player is later diagnosed with a tension stress fracture which was aggravated by his return to play. He aims to claim compensation for the extra time off work as a result of the physiotherapist's advice.

**Potential result:** In this scenario the footballer would succeed in his claim if the physiotherapist's advice was found to fail the Bolam test, i.e. that the advice given would be given by no reasonable physiotherapist. He would also have to prove that had he been advised otherwise, he would have come off the field.

### **Case: Patient ignores advice given by physiotherapist and gets further injured**

A rugby player playing for an amateur team gets injured during a game. The physiotherapist is called on field. The physiotherapist examines the player and advises him against continuing to play. He is very ambitious and keen to turn professional; hence he ignores her advice and returns to play. Subsequently, his injury worsens and he is forced to give up work. He blames the physiotherapist for not being clear enough about the potential consequences of his decision to continue play.

**Potential result:** If in this case the physiotherapist can prove evidence of her clear advice to him and has witnesses to the advice they gave, it is unlikely that the rugby player will succeed in winning the case brought against the physiotherapist. If the player had understood the advice and still went against it, the player is fully responsible for any injury by way of voluntary assumption of risk. In a situation where the player does not have the mental capacity to understand the information given, the physiotherapist should contact the appropriate carer.

**We are not law students. The outcomes provided are not a definite assurance of outcome. The following 3 case studies are simply our interpretation based on the knowledge we have developed from our background reading of the area.**

**Case A:**

- You are physio to a Gaelic football team.
- At a league match, one of your players sustains an injury. You did not see the incident clearly. You run on and have approximately 45 seconds to assess if they are fit to resume play or if they will need to be replaced.
- When he initially stood up, he was shaky on his feet, but recovered momentarily. On asking modified Maddock's questions, the player answered the score incorrectly. However, he was correct on all other questions.
- You deem the patient is fit to continue.
- However, the player goes on to sustain a head injury, this time from a reckless high tackle. He suffers a miniature brain haemorrhage.
- He brings a claim against you for negligence. His allegation is that you breached your duty of care by providing an insufficient test of what video evidence showed up to be a head injury. This in turn led to him returning to play and being at increased risk of both collision and serious brain injury due to his initial missed concussion.

**Case B:**

- You have treated a patient and advised them to use a heat pack at home.
- You tested sensation and gave them advice on timing and use of a towel.
- In your notes you documented "Advised on use of heat for pain relief" only.
- The patient sustained a burn from the heat pack and brings a case against you for negligence. Her allegation is that you breached your duty of care by prescribing heat without sufficient education, directly causing her burn.

**Case C:**

You are working in a PCCC physio gym. Your patient is an elderly female smoker with a falls history. Your assessment highlights some significant deficits in strength and static balance exercises such as tandem and one-legged stance. You administer a



HEP consisting of strengthening and balance exercise to reduce these deficits and reduce her falls risk. You recommend and document that she should perform the exercises at a countertop for support. However, the patient falls while performing the one-leg stance and incurs a hip fracture. She makes a claim against you alleging that you breached your duty of care in provided an unsupervised balance challenging exercise to a patient with noted osteoporosis and falls risk factors.

### *Examination of Evidence*

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The evidence used in compiling this section has come mainly from a book entitled 'Legal aspects of physiotherapy', by Bridgit Dimond. The author is a reliable source, with extensive knowledge of law in relation to healthcare. She has written several other books advising different health care professions on how the law interacts with their work.

We have been unable to access any real legal cases despite exhausting attempts, due to issues with confidentiality and the release of individual rulings. We have however been able to access the rulings from fitness to practice hearings. Instead we looked into these proceedings and those surrounding a general negligence case-what has to be proved, how you can defend against one and most importantly, how you can prevent one occurring. The ISCP, its documents and website were the greatest sources of information on what exactly is expected of the physiotherapist, their roles and responsibilities. In joining the ISCP one agrees to uphold its' professional standards and abide by its' codes. In this way these documents represent the standards to which each a physiotherapist will be held accountable.

Furthermore, giving more general guidance, the HSE's list of physiotherapy competencies, outline what each physiotherapist should be capable of during each level of their career (Health Service Executive 2013).

In this way, these documents all provide solid evidence of the roles and responsibilities for which the physiotherapist will be held accountable, upon graduating.

# Chpt 11: Ethical Issues in Sports Physiotherapy

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## *Introduction*

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Ethics in physiotherapy has evolved across the decades. Initially it was based upon medical ethics. However, more recently physiotherapy has evolved and built its' own body of work in the area of ethics and ethical decision-making (Delany *et al* 2010). As the profession expands to include more areas, the complexity of ethical dilemmas increases. Hence, so too has the demand for ethical frameworks, from which guidance in ethical decision-making can be taken. This section aims to explore the area of ethics in physiotherapy, and to look at frameworks which are available to offer guidance to the physiotherapist throughout their career, be it in the area of sports physiotherapy, or elsewhere. An understanding of ethics is important in any area of physiotherapy practice.

Like law, the area of ethics is complex. However, in ethics, unlike in law, the area is open to personal interpretation in a large number of cases. The ISCP's documents on 'professional standards', 'rules on professional conduct', 'code of ethics' and other such documents, provide guidance in the area of ethics. If a person is found to be acting contrary to their professions code of practice, they may be deemed as acting unprofessionally. A large number of medical ethics books are also available; these give guidance and illustrate ethical dilemmas by means of case studies. However, there are no clear cut guidelines/approaches/codes of ethics which can be applied to every situation. The reason for this is that 'no set rules can encompass all the subtle complexities of even the most ordinary relationship between two persons'.

(Partridge 2010)

## *Principlism*

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In ethics, the term ‘prima facie’ refers to a duty that *must* be carried out. The only exception to fulfilling this duty would be in an instance where the prima facie duty conflicts with an equal or stronger duty (Greenfield and Jensen 2010). Many papers on ethics in physiotherapy, and in medicine, quote 4 fundamental rules, known as the ‘4 principles’ that should be followed in making ethical decisions. Many classical ethical theories are also based upon these principles. The 4 principles are listed below:

- **Beneficence**: Always striving to do what is in the best-interest of the patient
- **Non-maleficence**: Do no harm.
- **Autonomy**: Recognise that the patient has the ultimate say in their treatment and their decision must be respected.
- **Justice**: All patients should be treated with fairness and equality.

Each of the 4 principles is equally weighted. That is, each is of equal importance (Greenfield and Jensen 2010). However, critics of principlism (the following of these rules for ethical guidance), argue that this approach does not provide a guiding framework to choose one principle over another in a case where upholding all of the principles is not possible. For example, in a case where a patient is refusing treatment (exercising the principle of autonomy), this naturally conflicts with the principle of beneficence, which urges the health professional to provide care in the best-interest of the patient. In their book, Beauchamp and Childress (2008) spend considerable time outlining steps that justify choosing one principle over another in different scenarios. However, due to the individuality of each ethical dilemma, critics argue that principlism does not provide the guidance necessary to apply this ethical model to individual scenarios and come to an ethical decision.

## *Ethical Codes*

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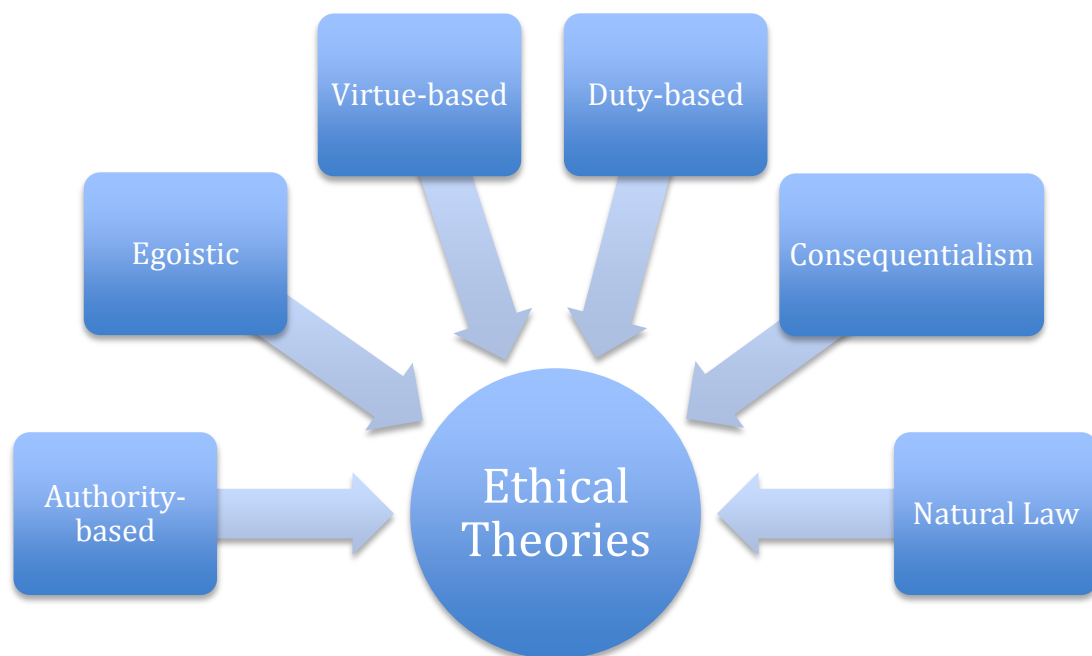
Similar criticisms have been made of codes of ethics. Ethical codes are drawn up by professional bodies to provide their members with a common moral language. Again, the lack of a hierarchy of principles that can be applied to any scenario is a common criticism of these codes. Guidance offered by these codes are often criticised as being too abstract and general to apply to individual scenarios. However, it must be remembered that the code is drawn up to offer guidance to professionals, and could

never possibly cover all of the infinite number of ethical dilemmas that can be encountered in practice. They provide reassurance to the public that physiotherapists, and other medical professionals, are interested in maximising their standards of practice and are concerned with patient care. Therefore codes of ethics do have their purpose. Furthermore, it must be remembered that these codes will be upheld by judges, to determine if professional or ethical behaviour was carried out (Greenfield and Jensen 2010). Often, despite the availability of a code of ethics, due to the complexities of an ethical dilemma, physiotherapists must rely upon their own moral judgement and provide a justification for their ethical decision.

### *Approaches to ethics and ethical decision-making*

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In order to give greater guidance during ethical decision-making, many papers have put forward suggestions for various approaches to ethical decision-making. In their systematic review in 2008, Carpenter and Richardson detailed a brief outline of some of the major approaches to ethics in physiotherapy. Morrison (2008) also gave an outline of common ethical theories (Fig 1). These are outlined below.



**Fig 11.1. Diagram of major approaches to ethical theory, as outlined by Morrison (2008)**

**Authority based approach:** This form of approach is often based upon religion. Using this approach the person decides on the ‘right course of action’ according to what an authority has said.

**Egoistic ethics:** This approach involves doing what is right for the individual personally. It does not have a large role in ethics in health-care because health-care takes the approach that decisions must always be made with the patient’s best-interests put first.

**Virtue based ethics:** After, authority based ethics, is the most longstanding approach to ethics. Its origins can be followed back to Plato and Aristotle (Morris 2008). This approach removes the emphasis from following guideline and rules, to the physiotherapist following their own moral judgement which should lead them to always choose ‘good’ if ever confronted with a choice. This does however take ‘moral courage’, which involves acting to uphold something of moral value even in the face of a difficult situation (Carpenter and Richardson 2008).

**Duty-based ethics:** This urges that an ethical decision be made based upon the physiotherapists’ duties.

**Consequentialism:** This approach urges the physiotherapist to make a decision based upon the consequences of their action.

**Natural law theories:** This approach to ethics involves recognising what is the right thing to do in accordance with the providentially ordered nature of the world. Debates surrounding euthanasia and abortion draw upon concepts rooted in natural law theory.

(Morris 2008)

**Professionalism:** A sports specific source of guidance that could be used to give direction in the case of an ethical dilemma was proposed by Stovitz and Satin (2006). They proposed the use of ‘professionalism’ to guide ethical decision-making. Professionalism, they wrote, demands that one’s actions are in line with the principles of honesty, integrity, respect for others, reliability, responsibility and putting the patient’s needs above all else. They suggest that in adhering to these principles, the

right ethical decision will be reached. This approach could also be applied in non-sporting decisions.

In order to act ethically, each person must act in accordance with their own conscience. Teaching an individual to reach the 'right' ethical decision cannot be done. However, it is important that physiotherapists familiarise themselves with the concept of ethics, and with some of the approaches that give guidance towards making a sound ethical judgement. Despite the recognition of a variety of different approaches to ethical decision-making, recent years have seen an increase in the interest in developing an ethics-based model for use in practice. It has been argued that ethical decision-making is a part of a physiotherapist's clinical expertise, not a separate entity. As such, with the expansion of physiotherapy and subsequent increase in volume of ethical dilemmas encountered by physiotherapists, it is important that our knowledge and understanding of ethics keeps pace with our clinical knowledge. Confrontation with an ethical dilemma can result in anxiety and distress for a physiotherapist, as they struggle with trying to reach an ethically sound judgement. These models of ethical decision making have been proposed to help offer guidance in these scenarios. A wide variety of the ethical decision-making models are available. 3 are outlined below. They have been selected as they are a representation of the different types of ethical models available.

### *Active Engagement Model*

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In 2010, Delany and colleagues proposed an 'active engagement model' for reaching an ethical decision. This model comprised of 3 steps:

- 1) Active listening- involves listening to the patient's perspective in order to gain a greater understanding of their beliefs, values and goals.
- 2) Reflexive thinking- involves an awareness of the physiotherapists' own perspective on the situation. It involves recognising how one's own values and practices might influence the patient's reaction.
- 3) Critical reasoning- involves critical examination of the meaning of beneficence, non-maleficence, justice and autonomy within the situation.

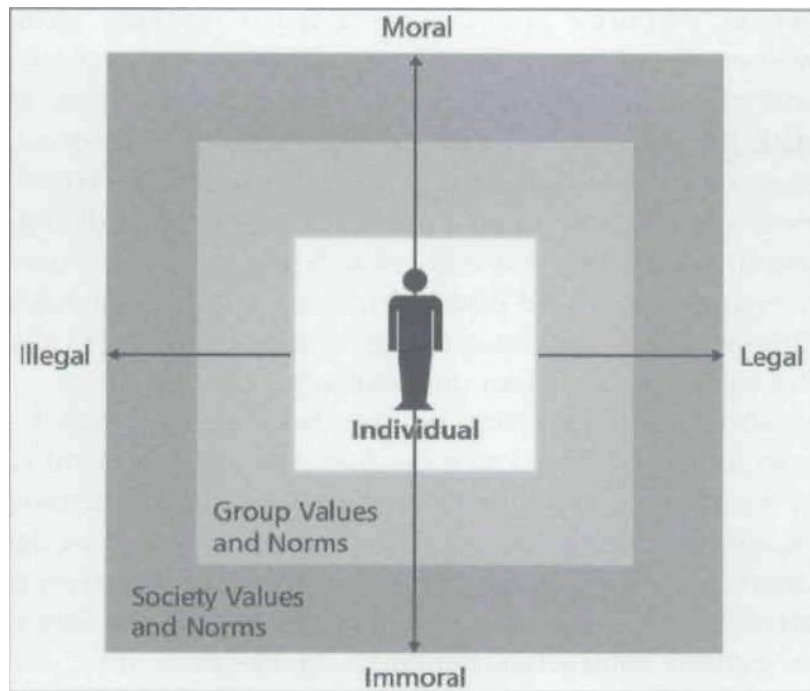
Steps	Facilitating Questions
Step 1: active listening	<ul style="list-style-type: none"> <li>● How has the patient and health care team member cast their story?</li> <li>● Within the story, how do they portray themselves?</li> <li>● Why are they telling the story in this way?</li> <li>● Whose voice in the story is dominant?</li> <li>● Whose voice in the story is not being heard?</li> <li>● How else might this story have been told?</li> <li>● What is ethically at stake in this story?</li> <li>● What are the ethically important moments in the story?</li> </ul>
Step 2: reflexive thinking	<ul style="list-style-type: none"> <li>● What goals and values do I, as the physical therapist, personally bring to a given treatment?</li> <li>● What goals and values are inherent within the physical therapy treatment that I offer?</li> <li>● What influence do my language and my treatment methods have on the patient and others?</li> <li>● How do others (patients, colleagues, managers) know what they know?</li> <li>● What shapes and has shaped their world view?</li> <li>● How do they perceive me and why?</li> <li>● How do I perceive them?</li> <li>● How do they make sense of what I give them?</li> <li>● What perspectives do they bring to the findings I offer?</li> </ul>
Step 3: critical reasoning	<p>Realm of patient and therapist relationship:</p> <ul style="list-style-type: none"> <li>● What values and goals do I bring to the therapeutic relationship?</li> <li>● How do my professional and personal values and goals differ from the patient's?</li> </ul> <p>Organizational realm:</p> <ul style="list-style-type: none"> <li>● What is my relationship with the health care organization?</li> <li>● How does this relationship influence the clinical encounter?</li> <li>● How do institutional systems and structures affect the patient's ability to receive treatment?</li> </ul> <p>Societal realm:</p> <ul style="list-style-type: none"> <li>● What are the health care structures, resources, and economic policies that influence the goals and provision of physical therapy?</li> </ul>

**Fig 11.2. Delany *et al* (2010) Active engagement model and questions**

Delany proposed that this model of ethical decision-making highlights both the obvious and the hidden ethical perspectives in each scenario, and in this way helps the user to reach a well-considered ethical decision (Delany *et al* 2010).

### *Moral and Legal Template for Health Care Practice*

Geddes *et al* (2005) proposed a moral and legal template for the student or health care practitioner with limited experience in ethical decision-making. The model demonstrates the interrelationship between ethics, law and morality. It also takes into account the role of the individual, of the individual as a member of a larger professional body and of society.



**Fig 11.3. Geddes *et al* (2005) Moral and Legal Template for Health Care Practice**

The model (seen in Fig 3.) is composed of horizontal and vertical lines that split the grid into quarters. Within these lines 3 concentric squares represent the roles of the individual, group and society. The innermost square takes into account the individual's values or beliefs, the middle-group norms and the outer-most-societal norms. The vertical line in the figure represents morality at the top, and immorality at the bottom. This line extends through all of the concentric squares as morality is influenced by each the individual, the groups beliefs and those of the wider society. The second line runs horizontally. It represents the law, with legal on the right and illegal on the left. Unlike the vertical line, it does not transect the individual square, as laws are imposed externally on the individual.

In this way, the model is divided into quadrants. The bottom left quadrant represent choices that are both illegal and immoral and as such, should pose no difficulty to the practitioner. For example, not taking informed consent from a patient would be in this quadrant.

The top left quadrant represents actions that are illegal, but may be considered by some to be morally correct. For example, telling a patient's doctor that they have returned to driving despite not getting the patient's informed consent to share this



information. Despite being illegal, given the potential risk to others, some may view this action as being morally right.

Scenarios that fall into the top right quadrant are both moral and legal, and again, as such, should pose no difficulty to the individual. This includes many of the physiotherapists' day-to-day actions, such as onward referral of patients to other services.

Lastly, the bottom right quadrant represents actions that could be seen to be morally wrong but are still legal. For example, the acceptance of long waiting lists.

Ethical difficulties arise when the scenario in question falls into either, the top left or bottom right quadrants. When this occurs the authors urge the consideration of the consequences of the physiotherapists' actions, what might be compromised by making the various decisions and whether or not they are the primary decision maker. The authors also advise seeking advice from colleagues.

Fig 3. Depicts the Moral and Legal Framework being divided into equal quadrants. However, the authors intended the model to be dynamic, with its configuration changing according to each situation. For example in certain situations the individual's square may play a smaller role in the decision making, than the societal square. The model's configuration would change in that scenario.

This model aims to help the user to identify, organise and consider all available choices before coming to a decision.

(Geddes *et al* 2005)

### *The Realm-Individual Process- Situation (RIPS) Model of Ethical Decision-Making*

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The RIPS model of ethical decision-making was proposed by Swisher and colleagues in 2005. It aimed to provide a step-by-step analysis to ethical decision-making. The 4 simple steps proposed in this model are outlined below, each should be considered (as in the Geddes *et al* 2005 model) within the context of the individual, organisation and society.

- 1) Recognize and define the ethical issues
- 2) Reflect
- 3) Decide the right thing to do

4) Implement, evaluate, re-assess

The authors also included a list of questions that should be considered when using the model.

(Swisher *et al* 2005)

## *Conclusion*

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Despite a large number and variety of proposed models for ethical decision-making, many of the proposed models share common components. They all involve:

- Gathering all information relevant to the situation
- Identification of the ethical issues involved
- Exploration of all decisions available and the potential outcomes
- Selection of a course of action

(Geddes *et al* 2005)

Which model you choose to best guide ethical decision-making is down to personal preference. There is no 'hard and fast rule' for ethical decision-making, nor for the selection of the most appropriate model. Seeking out guidance from peers/models/codes of ethics, examination of all relevant information, careful consideration and experience, are all required to aid ethical decision-making. Even then there is often no clear right or wrong answer, for if the answer was clear-cut there would be no ethical dilemma.

## *Ethics case studies*

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Below are some scenarios that have many ethical considerations. These could be useful for applying ethical principles into practice.

### **Case 1**

You are covering the sidelines for your team when a member of the crowd falls and twists their knee when walking through the stands. There is a call for help. Are you ethically required to help or to stay on the field? Could you be legally liable for a bad outcome if you helped the fan? (Stovitz and Satin 2006).

Would you be held accountable if you did not attempt to assist this person as the only health professional on scene?

If you do intervene, can you be held liable for your actions as care of the person is outside of your duties?

**Possible outcome:** At larger events there are usually medical professionals and/or paramedics on site to help in the event of a situation such as this arising. However, at smaller games this may not be the case. This scenario could be likened to one in which a life threatening event occurs, and a call for help is made to anyone in the vicinity with medical knowledge to give aid. It is technically outside the responsibility of the physiotherapist on the sidelines. Therefore you would not be liable if you refrained from assisting. However, it could be ethically unsound not to aid the fallen fan. In this case the physiotherapist would not have a duty to help; however, they may be the most appropriate person to give help in this scenario. There is not a legal precedent for this situation. However, on seeking legal advice, it has been suggested that any assistance given *might* fall under the protections given to the ‘Good Samaritan’. In Ireland the law on Good Samaritans was passed in 2011 and states that a person is not personally liable for anything done when they are assisting an ill person, someone injured, or in danger. However, the law of the Good Samaritan does not offer protection in the case of malice or gross negligence (The Government of Ireland 2013).

### **Case 2**

You are a physiotherapist employed by Manchester United football team. One of the players’ performances has not been up to standard lately. He admits to you that he is

drinking heavily at the weekends, despite being in season. As a member of the team employed by the manager to aid in the team achieving its goal of topping the league-should you report to manager?

**Possible outcome:** In this case, despite being an agent of the club, your responsibility towards the player's confidentiality means you should not inform the manager. The difficulty arises because, as the physiotherapist is employed by the club, your role is to serve its interests (topping the league). However, as a medical professional you also owe confidentiality to your patients. This conflict of loyalties can lead to difficulties and it is therefore important to be clear on your responsibilities. How much information should be given to the manager? Just the player's injury status or information that could be influencing his recovery time (this player's heavy drinking)?

Until recently there was no commonly held code of ethics amongst doctors and physiotherapists. In the past, as Waddington *et al* (2002) discovered, this often resulted in discrepancies between how ethical dilemmas such as these were handled. The conflict of loyalties in some cases, lead physiotherapists and doctors to report confidentially given information to the team manager, seeing the manager as their employer and feeling that they owed them this responsibility. As a result of this the British Olympic Association, the British Medical Association and the English Football Association all published guidelines clarifying that **the maintenance of the player's confidentiality was paramount** and that no information should be passed to the manager without the player's consent (Waddington *et al* 2002).

**Ethics are a personal moral philosophy. The concepts presented through these case studies are ideas of possible issues that can arise and possible solutions. However, it is up to each individual to decide where their personal stance on such opinions lies.**

## Case A

A player on the soccer team you are acting as physio for, tells you in strict confidence that they are Hepatitis B positive.

What do you do?

## Case B

You walk in on an athlete taking a banned substance. He states that because you are his physio, you are required to keep the information confidential.

What would you do?

## Case C

It is 3 days prior to your team's championship final, the last game of the season. One of the key players comes to you seeking advice. He has had severe plantar fasciitis which has been impairing his play. He is thinking about getting a pain-killing injection to get him through the match. He does not care what the ramifications are for the post season and start of next season as long as he can get through the final. You know that while his absence or impaired ability would lessen the team's chances of winning, the injection could lead to a possible plantar fascia rupture requiring surgery and a prolonged lay-off period.

## *Examination of the Evidence:*

In examining the evidence in the area of ethical decision-making, it must be remembered that this area of study does not lend itself to the application of RCT or other ‘high level’ quality designs.

<b>Study</b>	<b>Study Type</b>	<b>Level of Evidence</b>	<b>Purpose</b>	<b>Results</b>	<b>Comment</b>
Greenfield and Jensen 2010	Expert Opinion	Level 5	Exploration of the use of a phenomenological approach to ethics.	<ul style="list-style-type: none"> <li>• Discussion of the phenomenological approach to ethics.</li> <li>• Provided a case study and applied the phenomenological approach to assess it.</li> </ul>	<p>Provided an interesting discussion and practical example of the application of the phenomenological approach to ethical decision-making. Higher quality RCTs are not applicable to this area of research.</p>
Carpenter and Richardson 2008	Systematic Review	Level 1	To assess physiotherapy ethics knowledge published since 2000.	<ul style="list-style-type: none"> <li>• Identified 4 themes in the reviewed literature:</li> <li>• Development of physiotherapy ethics knowledge.</li> <li>• Ethical issues related to research.</li> <li>• How ethical issues are identified, managed and how ethics is taught.</li> <li>• Development of theoretical ethical decision-making models.</li> </ul>	<p>Conducted a rigorous search of 3 major databases. Assessed references of articles retrieved for missed related articles. Included 27 relevant journals.</p>

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Delany <i>et al</i> 2010	Expert Opinion	Level 5	Proposal of an applied ethics model entitled the 'active engagement model'	<ul style="list-style-type: none"> <li>• Outline of the 3 steps involved in the model: active listening, reflexive thinking and critical reasoning.</li> <li>• Provided a case study and applied the active engagement model approach to assess it.</li> </ul>	<p>Again, higher quality RCTs are not applicable to this area of research.</p> <p>Provided an interesting discussion and practical example of the application of the active engagement model to ethical decision-making.</p>
Geddes <i>et al</i> 2005	Expert Opinion	Level 5	Proposal of a moral and legal template to aid inexperienced health care workers in ethical decision-making	<ul style="list-style-type: none"> <li>• Explanation of the proposed framework.</li> <li>• Demonstration of the inter-relationship between law, ethics and morality.</li> </ul>	<p>Proposal of a new framework on which ethical decision-making can be based-not suitable for a different study design.</p> <p>Developed the model based on several other models and frameworks but provided no discussion of theoretical ethical approaches.</p>
Swisher <i>et al</i> 2005	Expert Opinion	Level 5	Proposal of a new model of ethical decision-making named the Realm-Individual-Process-Situation (RIPS) Model	<ul style="list-style-type: none"> <li>• Discussion of how the RIPS model should be used</li> <li>• Demonstration of its use using 2 case studies</li> </ul>	<p>Unsuitable for any other type of study design.</p> <p>Included a discussion of the models' limitations and clearly applied the model to 2 cases.</p>

Study	Study Type	Level of Evidence	Purpose	Results	Comment
Stovitz and Satin 2006	Expert Opinion	Level 5	.Discussion of 'professionalism' as a guide to making ethical decisions	<ul style="list-style-type: none"> <li>• Discussion of the concept of professionalism and its links to honesty, integrity, reliability, responsibility, respect for others and doing what is best for the patient.</li> <li>• Application of the 'professionalism' approach to ethical decision making via case scenarios.</li> </ul>	An interesting discussion of sports specific examples of ethical dilemmas and how they may potentially be solved using the concept of 'professionalism'. Again unsuitable for another study design.
Waddington <i>et al</i> 2002	Expert Opinion	Level 4	To investigate how confidential matters are dealt with in English professional football clubs	<ul style="list-style-type: none"> <li>• Discovered that there is no commonly held code of ethics between doctors and physiotherapists.</li> <li>• Restated that confidentiality is owed first to the patient in any case.</li> </ul>	Conducted semi-structured interviews and completed questionnaires and provided an interesting insight into confidentiality in a specific sports area.



## *Useful Resources*

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- Dimond, B. (2009) *Legal Aspects of Physiotherapy*, ed. 2, Chichester: John Wiley and Sons Ltd.-Provides useful information on a huge aspect of law issues relating to physiotherapy, as well as information on law in specialist areas.
- ISCP website: Provides links to copies of ISCP documents outlining physiotherapists' responsibilities.
- Information pack for Chartered physiotherapists on medico-legal issues and expert witness issues (available on ISCP website): Provides information on medico-legal issues as well as a step-by-step guide of the process when a complaint is brought against a physiotherapist/called as an expert witness/requested to write a medico-legal report.
- <http://hpc-uk.org/complaints/hearings/archive/> -Provides a list of fitness to practice hearings for different professionals and their outcomes.

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# Anti-Doping and Prohibited Medications

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## *Introduction*

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Amid the Lance Armstrong controversy, the subject of doping in sport, performance enhancing drugs and prohibited medications is increasingly relevant. Use of illegal substances to enhance performance is both ethically unsound and potentially dangerous to the athlete. Athletes may also be unaware that the medications they are taking are on the prohibited or restricted list (e.g. Neurofen cold and flu). It is not a direct role of the physiotherapist to monitor players for prohibited drug usage. However, as medical professionals, we may have access to information about the medical conditions and medications of athletes. A physiotherapist may also find themselves in a position where they become aware of an athlete who may be doping. It is therefore vital that physiotherapists have a basic knowledge of the issue and are aware of the ethical and safety concerns involved. This will allow us to give basic advice and point athletes towards further sources of information if required. It also allows us the knowledge to make ethical decision in morally uncertain situations.

## *The Prohibited List*

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- The World Anti-Doping Code produces an annual list of prohibited drugs.
- This is an International standard and is adhered to by the majority of sporting bodies including the Irish Sporting Council.

## **Prohibited Substances at all times**

- Anabolic Androgenic Steroids or other anabolic agents e.g. testosterone
- Peptide hormones, growth factors and related substances:
  - Erythropoiesis-Stimulating Agents e.g. erythropoietin (EPO)

- Chorionic Gonadotrophin (CG) and Luteinizing Hormone (LH).
- Insulins.
- Corticotrophins.
- Growth Hormone (GH), Insulin-like Growth Factor-1 (IGF-1), Fibroblast Growth Factors (FGFs), Hepatocyte Growth Factor (HGF), Mechano Growth Factors (MGFs), Platelet-Derived Growth Factor (PDGF), Vascular-Endothelial Growth Factor (VEGF).
- Beta 2 Agonists (Bronchodilators used in Asthma and COPD)
  - Except salbutamol (maximum 1600 micrograms over 24 hours), formoterol (maximum 36 micrograms over 24 hours) and salmeterol when taken by inhalation in accordance with the manufacturers' recommended therapeutic regime.
  - Presence of excess amounts of urine is a violation.
- Hormone and metabolic modulators.
- Diuretics and other masking agents e.g. (furosemide, metolazone)

### **Prohibited Methods**

- Enhancement of Oxygen Delivery
  - Blood doping
  - Artificially enhancing the uptake, transport or delivery of oxygen
- Chemical and physical manipulation
  - Tampering, or attempting to tamper e.g. substitution
  - Intravenous infusions and/or injections of more than 50 ml per 6 hour period.
  - Sequential withdrawal, manipulation and reintroduction of any quantity of whole blood into the circulatory system
- Gene Doping
  - The transfer of nucleic acids or nucleic acid sequences
  - The use of normal or genetically modified cells

### **Prohibited Substances in competition**

- Stimulants
  - Non-specific e.g. amphetamine, cocaine,

- Specific e.g. Adrenaline, pseudoephedrine (in Neurofen cold & flu, some types of Sudofed)
- Narcotics e.g. morphine, heroin
- Cannabinoids
- Glucocorticosteroids

### Prohibited in competition in specific sports

- Alcohol
  - Aeronautic, Archery, Automobile, Karate, Motorcycling, Powerboating
- Beta blockers
  - Aeronautic, Archery (also prohibited Out-of-Competition), Automobile, Billiards (all disciplines), Boules, Bridge, Darts, Golf, Ninepin and Tenpin Bowling, Powerboating, Shooting (also prohibited Out-of-Competition), Skiing/Snowboarding

(World Anti-Doping Association 2013)

**Therapeutic Usage Exception (TUE):** This is required for any prohibited drug on the list which the athlete may require for medical purposes e.g. salbutamol (ventolin inhaler) or insulin. It is important that any athlete subject to randomised drug screening obtain a TUE as soon as possible.

**Whereabouts screening:** Athletes subject to whereabouts testing are required to update their location details every 3 months. Along with this they are required to submit 60 minutes at which they will be present at a certain location every day, except in the case of an emergency. This allows random out of competition screening of athletes. It prevents athletes from training in remote locations to avoid screening. If an athlete completes 3 offences of failing to provide details of their location or missing a test within an 18 month period, they will face a 1-2 year sanction.

## *Recognising Doping*

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Athletes using anabolic steroids may show one or many the following:

- Quick weight gain
- Acne
- Hair loss
- Becoming more masculine (for females) such as body hair growth and deepening of voice
- Development of abnormally sized breasts (males)
- Evidence of injections (needle marks)

Other signs and symptoms of substance use:

- Mood swings
- Aggressive behaviour
- Sudden increase in training regime
- Signs of depression
- Difficulty concentrating
- Difficulty sleeping
- Quick weight gain or loss
- Red eyes (indicative of marijuana)
- Particular smell (indicative of marijuana)

### **Vulnerability factors**

Some athletes display certain personality traits, characteristics or behaviours that may indicate they are at risk of engaging in doping activities. These predispositions include:

- Low self-esteem
- Results-driven
- Body image dissatisfaction / concern about weight maintenance
- Unruly, disrespectful of authority
- High ego orientation

- Low task orientation
- Impatience with obtaining results
- Propensity for cheating / bending the rules
- Willingness to use prohibited methods or substances if they were legal
- Willingness to use prohibited methods or substances if they could ensure success in sports
- Belief that everyone else is doping
- Disbelief in harmful effects of doping
- History of substance abuse in family
- Admiration for achievements of known doped athletes
- Thrill-seeking/At-risk behaviours
- Use of other substances, alcohol or tobacco
- Non-discretionary use of dietary supplements
- Relying on untrustworthy or misinformed sources
- Frequenting fitness centres where steroids can be obtained
- Setting unrealistic goals
- Self-medication
- Engaging in other risk-taking behavior
- Frequent reading of muscle/fitness magazines

Other athletes, who are otherwise well intentioned and not necessarily prone to doping, may find themselves in situations that make them more vulnerable to succumbing to the temptation. They include:

**Career-related circumstances:**

- External pressures to perform, or high stakes placed on performance (by sponsors, agents, family members, sports organizations, etc.)
- Overtraining or insufficient recovery time
- Recovering from injury
- Absence or weakness of deterrents (such as doping controls, severe sanctions, etc.)
- Type of sport (weight categories, endurance, pure speed or strength)
- Lack of resources (access to competent training professionals and sports training information and technology)

### **Temporary situations:**

- Degradation of personal relationships (with parents, peers, etc.)
- Emotional instability caused by life transitions (puberty, graduation to higher education levels, dropping out of school, geographical moves, severed relationships, death of significant others, etc.)
- Upcoming career-determining events (team selection, major competition, scouting or recruitment activities etc.)
- Performance setback or plateau

Whether at-risk from personal characteristics or from situational factors, athletes showing some vulnerability factors warrant special attention. Reinforcing anti-doping messages and offering them psychological support and a personalized, scientifically-sound training regime will likely prevent them from resorting to prohibited practices. (World Anti-Doping Association 2012).

### **Coaches and Other Team Professionals**

Coaches and team professionals are expected to facilitate the doping screening process. The following actions constitute an anti-doping rule violation and can lead to sanctions ranging from a warning to a full ban from involvement in that sport:

- Possession of prohibited substances or methods
- Administration of prohibited substances or methods
- Assisting evasion of anti-doping screening
- Attempting to tamper with samples or process
- Covering up doping activities
- Encouraging athletes to dope



## Effects on Health

Steroids	Psychological Dependence Increased Agression Mood Swings Liver Disease CV disease High blood pressure Acne Sexual side effects
Cannabinoids	Physical and psychological dependence Loss of memory attention and motivation Weakening of immune system Respiratory diseases
Stimulants	Psychological and physical dependence Anxiety and depression Increased BP, increased and irregular heart rate, increased risk of stroke and heart attack
EPO	Increased blood viscosity Increased clotting Increased BP Increased risk of heart attack and stroke General weakness
Human Growth Hormone	Abnormal Growth Severe Headaches Loss of vision Arthritis Diabetes and Tumours High blood pressure and heart failure Heart enlargement Liver and Thyroid Problems

**Table 1: Negative effects of taking banned substances (World Anti-Doping Association 2012)**

## The Bottom Line

- Athletes need to be aware of what drugs are prohibited as some common medications may require a TUE.
- Intentional doping is a form of cheating and can cause serious health problems long term.
- By not reporting doping, a physiotherapist may themselves face sanctions for covering up doping.
- The World Anti-Doping Association provides an annual publication of prohibited substances which is adopted almost universally.

## *Examination of the Evidence*

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The World Anti-Doping Association (WADA) is the leading authority on doping control in sport. They produce an annual list of prohibited substances which is adopted almost universally. The Irish Sports Council adopts this list and as such it is used by the IRFU, FAI, GAA and Athletics Ireland among others. The WADA also provide the information on the roles of coaches and team professionals, the testing process, health effects and signs, symptoms and risk factors of doping.

## *Useful resources and references*

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- <http://www.eirpharm.com/sports/>
    - Irish pharmacological information site
  - <http://www.irishsportsCouncil.ie/Anti-Doping>
    - Irish sports council
  - <http://coachtrue.wada-ama.org/course/view.php?id=3>
    - Online tutorial on doping for coaches, developed by the world anti-doping association
  - [http://www.asada.gov.au/rules\\_and\\_violations/8\\_rule\\_violations.html](http://www.asada.gov.au/rules_and_violations/8_rule_violations.html)
    - Australian anti-doping association
  - <http://www.wada-ama.org/en/>
    - World anti-doping association
  - The MIMS Ireland gives information about a drugs sporting status.
  - “Med Check” an smart phone app produced by the Irish sports council provides a quick and easy way to check if a drug is prohibited or restricted.
  - World Anti-Doping Agency (2012) *Coach-True* [online], available: <http://coachtrue.wada-ama.org/login/index.php> [accessed 31/01/13].
  - World Anti-Doping Code (2013) *The 2013 Prohibited List International Standard* [online], available: [http://www.wada-ama.org/Documents/World\\_Anti-Doping\\_Program/WADP-Prohibited-list/2013/WADA-Prohibited-List-2013-EN.pdf](http://www.wada-ama.org/Documents/World_Anti-Doping_Program/WADP-Prohibited-list/2013/WADA-Prohibited-List-2013-EN.pdf) [accessed 31/01/13].
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# Appendices

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## *(A) Medical Screening Questionnaire*

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### **Patient information**

**Name:** .....

**Date of birth:**.....

**Address:**.....

.....

**Telephone number**.....

**Doctors name and surgery**.....

If you are not registered with a doctor – please state this on the form

### **Emergency contact information**

Name:

Relationship:

Telephone number

### **Sports specific information**

Sport and position:.....

Others sports played:.....

**Personal health history:** If yes please explain further in the box provided

### **Condition**

1. Illness requiring medical attention in the past year? YES NO
- 2 Any recent surgery in the last 2 years? YES NO
3. Are you under observation by a doctor for a problem? YES NO
4. ECG's in the past? History of abnormal ECG? YES NO
5. Heart murmur or irregular or extra heart beats? YES NO
6. Have you had any chest pains, dizziness, shortness of breath, excessive fatigue during exercise? YES NO
7. Have you ever fainted or lost consciousness during exercise? YES NO
8. Diabetes? YES NO

- 9. High or low blood pressure? YES NO
- 10. Asthma/exercise induced asthma? YES NO
- 11., Loss or problem with any paired organs (e.g. eye, testicles, kidneys YES NO
- 12. Has anyone in your family suffered from high blood pressure, sudden death, heart attack or any hereditary disease? YES NO

**Head Injury**

**Condition**

- 1. Have you ever had a concussion YES NO
- 2. If yes how many?
- 3. When was you last concussion?
- 4. Ever you ever lost consciousness? YES NO
- 5. If yes for how long?
- 6. Have you ever been kept out of sport with a concussion? YES NO

Please explain further if answered yes to any of these questions

**Sports/non sports injuries**

Please detail any injuries that you have had in the last 2 years. Please include dates and whether you had any treatment

**Allergic reactions**

- 1. Do you have any allergies? (e.g stings, bites, food) YES NO
- 2 If yes what are you allergic to and what reaction do you develop?
- 3 Do you carry an epi-pen? YES NO

**Medications**

Are you currently taking any medications? Yes/No

Steroids/Blood-thinners/Inhalers/Other

Please elaborate further if yes

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Have you ever been on any long-term steroids? Yes/No

I have read and fully understand this entire form. I have answered the questions thoroughly and accurately. I understand that it is my responsibility to inform the medical team of any changes to the medical form

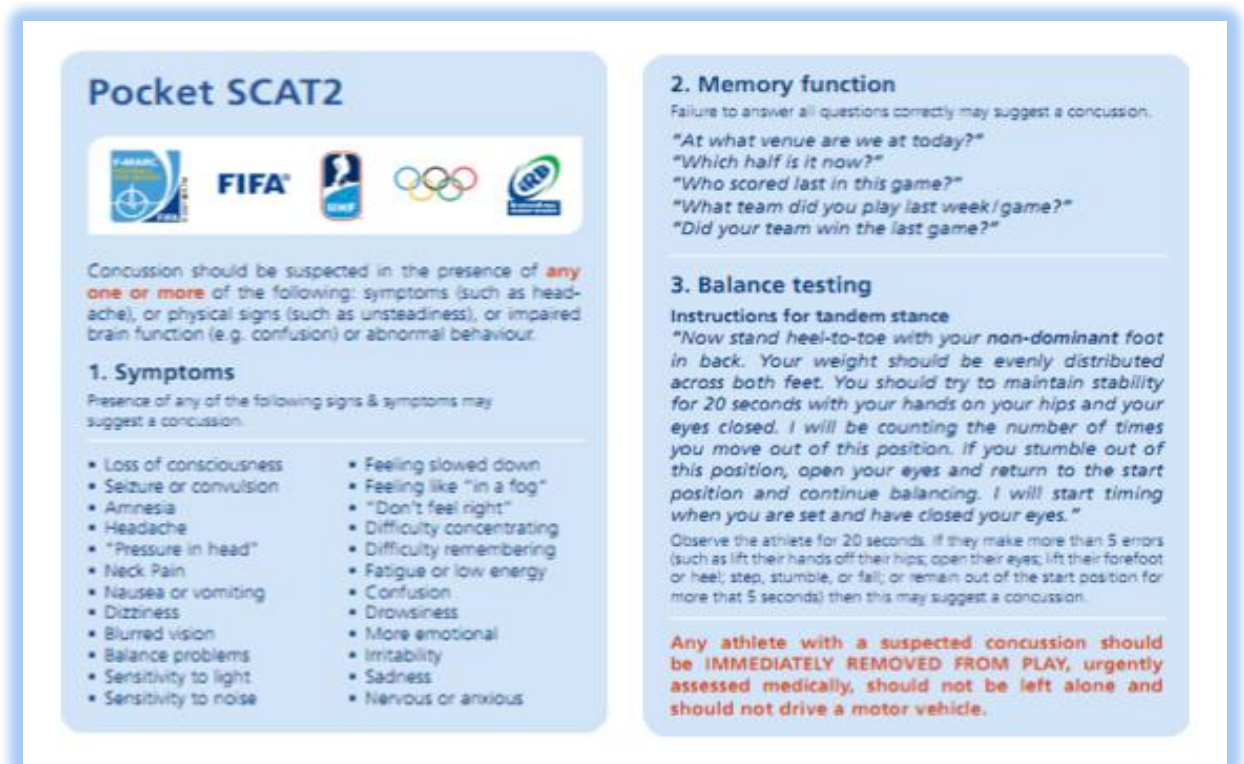
Signed:.....

Date:.....

Signature of parent/guardian(Under18).....Date:.....

Signed (therapist).....Date:.....

*(B) SCAT2 (Sports Concussion Assessment Tool 2)*



**Pocket SCAT2**

Concussion should be suspected in the presence of **any one or more** of the following: symptoms (such as headache), or physical signs (such as unsteadiness), or impaired brain function (e.g. confusion) or abnormal behaviour.

**1. Symptoms**

Presence of any of the following signs & symptoms may suggest a concussion.

- Loss of consciousness
- Seizure or convulsion
- Amnesia
- Headache
- "Pressure in head"
- Neck Pain
- Nausea or vomiting
- Dizziness
- Blurred vision
- Balance problems
- Sensitivity to light
- Sensitivity to noise
- Feeling slowed down
- Feeling like "in a fog"
- "Don't feel right"
- Difficulty concentrating
- Difficulty remembering
- Fatigue or low energy
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious

**2. Memory function**

Failure to answer all questions correctly may suggest a concussion.

"At what venue are we at today?"  
"Which half is it now?"  
"Who scored last in this game?"  
"What team did you play last week / game?"  
"Did your team win the last game?"

**3. Balance testing**

**Instructions for tandem stance**

"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. You should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

Observe the athlete for 20 seconds. If they make more than 5 errors (such as lift their hands off their hips, open their eyes, lift their forefoot or heel; step, stumble, or fall; or remain out of the start position for more than 5 seconds) then this may suggest a concussion.

**Any athlete with a suspected concussion should be IMMEDIATELY REMOVED FROM PLAY, urgently assessed medically, should not be left alone and should not drive a motor vehicle.**

**(C)- Maddocks Questions**

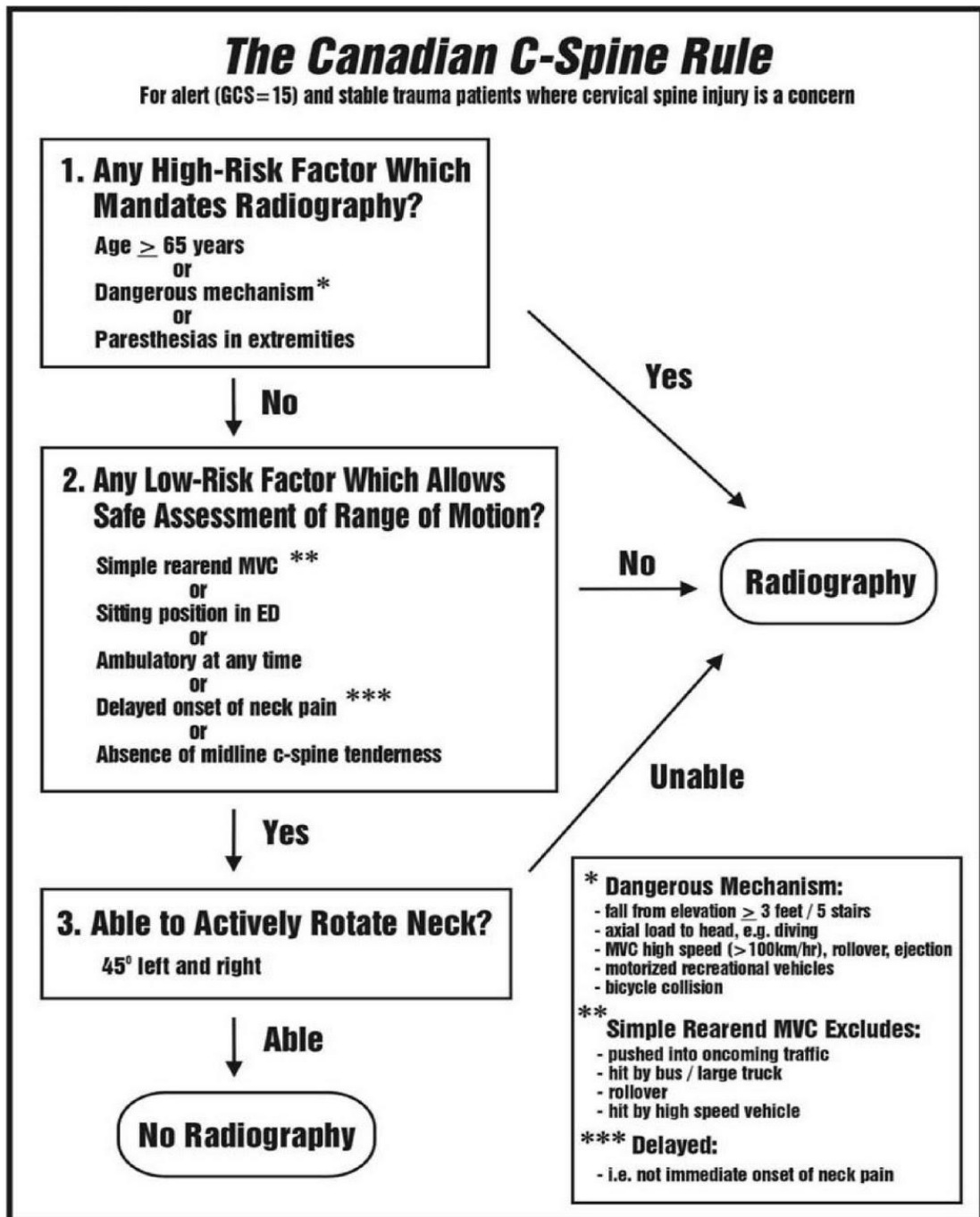
The Maddocks questions combine scientific validity with a quick simple and practical tool which can be administered either on-field or on the sidelines. Any incorrect response indicates concussion and requires removal from the playing field for further medical evaluation.

- Maddocks questions
- Which field are we at?
  - Which team are we playing today?
  - Who is your opponent at present?
  - Which half/period is it?
  - How far into the half is it?
  - Which side scored the last touchdown/goal/point?
  - Which team did we play last week?
  - Did we win last week?

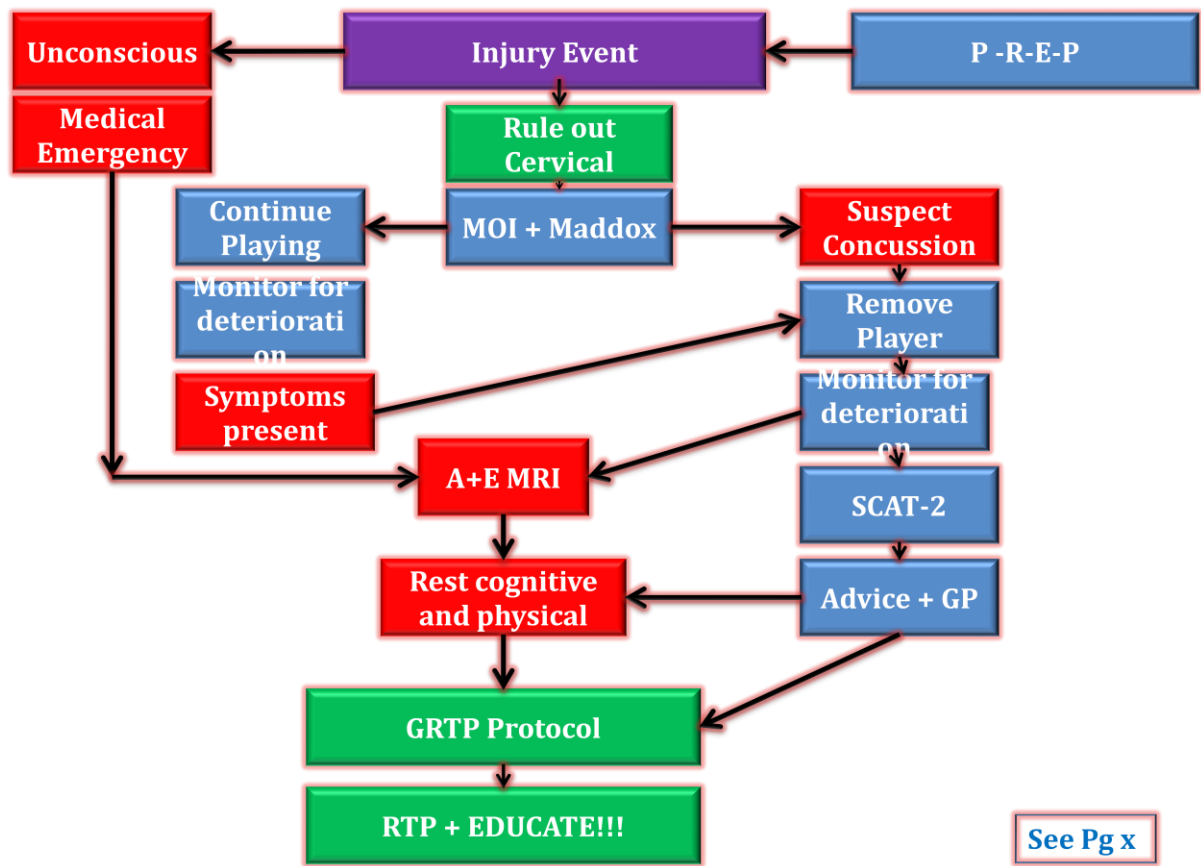
**(D) (Standard Assessment of Concussion)**

Standardized Assessment of Concussion (SAC)																																																					
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(E) (Canadian CT Head Rule)



*(F) Flowchart of Management of a Concussion*



*(G) NEXUS*

**Table 2. NEXUS Criteria For Radiographic Evaluation Of The Cervical Spine Following Blunt Trauma<sup>81</sup>**

1. Midline cervical tenderness
2. Focal neurologic deficits
3. Altered level of consciousness
4. Evidence of intoxication
5. Painful distracting injury



## (H) Glasgow Coma Scale

**Table 1: THE GLASGOW COMA SCALE AND SCORE**

Feature	Scale Responses	Score Notation
Eye opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Verbal response	Orientated	5
	Confused conversation	4
	Words (inappropriate)	3
	Sounds (incomprehensible)	2
	None	1
Best motor response	Obey commands	6
	Localise pain	5
	Flexion – Normal	4
	– Abnormal	3
	Extend	2
	None	1
<b>TOTAL COMA 'SCORE'</b>		<b>3/15 – 15/15</b>

## (I) Pulses

- Carotid: Lateral to larynx, midway to SCM muscle
- Brachial: anteromedial, can feel against middle humerus
- Radial: distal forearm, felt anteriorly against wrist
- Femoral: inner thigh, at the mid-inguinal point, halfway between the pubic symphysis and anterior superior iliac spine
- Popliteal Pulse: The patient bends the knee at approximately 124°, and the physician holds it in both hands to find the popliteal artery in the pit behind the knee
- Dorsalis pedis: located on top of the foot, between 1<sup>st</sup> and 2<sup>nd</sup> metatarsal, immediately lateral to the extensor of hallucis longus
- Tibialis Posterior pulse: medial side of the ankle, 2 cm inferior and 2 cm posterior to the medial malleolus

