

# **MEDICAL RESOURCE FOR BASKETBALL TEAM PHYSICIANS**

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**PREPARED BY THE FIBA MEDICAL COMMISSION**

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## Introduction by FIBA Secretary General

Basketball friends,

It is with pleasure that I present to you the first FIBA Medical Resource produced by members of the FIBA Medical Commission.

FIBA has embarked on an ambitious and exciting strategy to expand and develop basketball around the world. Already, basketball is one of the most widely played sports globally. To capitalise on this popularity, FIBA has dramatically expanded its international competition platform so that we now have:

- A World Cup;
- Continental Cups;
- Home and away qualification games;
- 3x3 basketball as an Olympic discipline; and,
- U17 and U19 World Cups.

We are truly excited about the future of our game.

The FIBA Medical Resource has been developed to assist team medical personnel with their work in their basketball teams. It is a relevant document for team doctors, physiotherapists, sports scientists, soft tissue therapists, sports trainers and other essential members of the sports medicine team overseeing the health care of basketball players. The Medical Resource is to be used as a reference for all professionals working in all levels of basketball but particularly at the international level.

The Medical Resource highlights those aspects of FIBA's Regulations where a medical professional has a particular function or those regulations that may impact their work in the team environment. This is particularly so during a game and at FIBA events.

The health and welfare of players is a key priority of FIBA. FIBA relies on team medical personnel to deliver some of its key aims – a safe sport, free of integrity challenges such as doping. The work of health care professionals in basketball is an essential one. Without their work, a basketball team would not function efficiently and players would be at greater risk of injury and illness.

Most elite basketball teams operate with multi-disciplinary health care teams. This is a huge bonus for basketball and FIBA. The integration of the multi-disciplinary team into the broader team environment has its challenges but is important for the safety of basketball players and officials.

This Medical Resource is the work of the FIBA Medical Commission. FIBA is greatly supportive of the Commission's work and is particularly thankful for the work of the members of the Medical Commission whose endeavours have made basketball safer.

FIBA also acknowledges the essential support healthcare professionals brings to its sport and thanks all those professionals that make our great game safer.

Patrick Baumann  
FIBA Secretary General

## FIBA Medical Commission

By Dr Heinz Günter, Austria, and Dr Peter Harcourt, Australia

The FIBA Medical Commission's key roles are to promote:

- safe basketball for players and officials; and,
- a clean game, free from doping.

The Medical Commission achieves this role by supporting team medical personnel and advising FIBA on health and doping issues. To facilitate this role the Medical Commission is developing resources to help doctors manage the demands of supporting teams.

### History

During the 1977 European Championship in Liege, while at a reception in the Town Hall, the team doctors got together and discussed medical problems, including proposals for improvements. This 'accidental' get together gave Dr Jacques Hugué from France the idea of a FIBA Medical Council. That same night the first meeting was held in the Polish team doctor's room. They discussed:

- presence of a doctor and physiotherapist as essential team members;
- the LOC providing adequately sized beds, quality food and sufficient drinks;
- prevention of injuries caused by the court facilities;
- gender controls only conducted once per player;
- doping controls conducted in a timely way;
- published annual medical review; and,
- official role for a Medical Council to support FIBA.

After the first meeting, and in the absence of official status, the members would meet at basketball tournaments where they would accompany their teams and correspond between events. During this time Dr Jacques Hugué continued to lobby Mr Borislav Stankovic, the FIBA Secretary General, for recognition and support.

The first official group comprised: Dr Jacques Hugué (France), Dr Juan Corbalán (Spain, current player), Dr Philip Resout (France), Dr Ivan Fatorinin (Croatia), Dr Heinz Günter (Austria) and Dr Frank Horan (United Kingdom).

At a basketball medical conference in Paris in 1986, the first official FIBA Medical Council came together and had representation from around the world. Annual meetings have been conducted since 1986. To assist with the business of the Medical Council, meetings were initially conducted away from basketball tournaments, usually in the home country of a member of the Council.

These meetings were marked by a strong sense of fellowship and commitment to the cause under the leadership of the first President, Dr Huguet. He set the tone for the strong bonds between members that continues to today.

In 1994 the Council had 24 members, including representatives from all the FIBA Zones – Europe, Africa, Oceania, Asia, North America and South America. In 2003, as the status of the group achieved greater recognition, there was a name change to FIBA Medical Commission, trimming of membership to 12 members and a stronger global representation through the FIBA Zones.

### **Achievements of the FIBA Medical Commission**

- Initiatives in anti-doping, injury prevention, healthcare and education, for example illicit substances, nutritional supplements, nutrition and travel medicine;
- Initiating the successful move to smoke free basketball arenas;
- Blood management rules for the game to prevent infectious diseases transmission;
- Backboard padding to prevent injuries and the safety controls for court surface decals;
- Game officials rule interpretation guidelines to prevent elbow caused facial injuries during rebounding;
- Representation on the International Team Sports Medical Representatives Group;
- Representation on IOC Medical and Anti-Doping meetings;
- Global anti-doping messaging and campaigns over a number of years – ‘No Doping’, ‘We Are Clean For Basketball’;
- Formation of the FIBA Anti-Doping and Therapeutic Use Committees; and,
- Medical and Anti-Doping supervision and support at FIBA events.

There have been many other topics managed since the inception of the first ‘unofficial’ medical meeting in 1977.

### **Presidents**

Dr Jacques Huguet (1986 - 2006)

Dr Costas Parisi (2006 - 2010)

Dr Heinz Günter (2010 - 2012)

Dr Peter Harcourt (2012 - 2019)

## **Roles and responsibilities of a National Basketball Team Doctor**

By Dr Dragan Rodovanovic, Serbia

### **Introduction**

A team physician in basketball has a leadership role in the organisation, management and provision of health care of players and team officials. It is the team physician's primary duty to protect the health and welfare of players.

A national team physician's responsibilities during FIBA competitions and other international competitions are different compared to the club competition environment. Their activities are confined to pre-participation preparation, competition support and post-competition evaluation and reporting to the club team physicians. Their activities between national team commitments include the monitoring of players health during their club season, providing support to the club team physicians and informing the coaching personnel regarding fitness and availability.

A team physician needs to understand and follow rules and requirements of the FIBA regulations with respect to health care of athletes and officials during FIBA competitions and qualifying games. See the section on Medical Aspects of FIBA Regulations.

A team physician needs to establish a network of medical specialists and institutions, covering a range of professional disciplines, in order to provide optimal medical service (1, 2).

An important role of a team physician is the provision of evidence-based education for athletes and entourage and the promotion of ethics in sport medicine and science, including anti-doping.

<http://www.fiba.basketball/healthcare/information-for-medical-staff>

### **Qualifications**

The team physician must be a fully qualified medical practitioner, be registered (medical licence), participate in continuing professional education and have adequate professional indemnity insurance.

A team physician's education, post-graduate training and sporting experience should be adequate to provide optimal medical service to players. The integration of expertise from external medical consultants is essential to deliver best medical practice to players (1, 2).

Post-graduate sports medicine qualifications are desirable and should include musculoskeletal medicine, emergency medical care, concussion management, spinal injury management, orthopaedics, wound management, psychological care and general medicine including the management of infectious diseases, extreme climate conditions and travel medicine (1, 2).

Injury and illness prevention, anti-doping, the needs of special groups (females, children and athletes with a disability) are essential aspects of the role.



## **Responsibilities**

The team physician is responsible for the medical care of players during training and games.

In international competitions and games, the home team physician has obligations to support the visiting team medical personnel with access to external health care support compatible with their own network of specialist support. This may include the organisation of other medical services at an event or game.

At the competition venue, there is the requirement for a fully equipped medical room and other medical support personnel, such as an ambulance and emergency medicine.

See the section Medical Requirements for FIBA Events.

## **Injuries**

Despite its origins as a noncontact sport, basketball has evolved into a physical game with significant contact between players (6, 7). There has, therefore, been an increase in the incidence of injuries.

This incidence of injuries is also affected by the length of a competition season, additional international games, a greater number of games per week, increasing speed of the game, a tendency for players to be bigger and stronger and older (7).

See the section Injuries in Basketball.

## **Injury prevention**

In such circumstances, injury prevention program becomes important and a priority of the team physician. Prevention of illness and injury is now an essential aspect of an international athlete's healthcare. Information regarding the incidence of injury will be in planning injury prevention programs.

An injury prevention program can be complex, most effective when ongoing and should follow a proven process such as the steps following AAOS (8). This may include physical fitness preparation, sport specific skill development, pre-participation screening (including cardiac screening), correct equipment (footwear, taping, braces, mouth guard and other protective devices, etc.), the appropriate training facilities and the management of safe return to sport.

## **Medical Records**

It is essential that a team physician keeps complete and contemporary medical records of all player and team official medical consultations. This can be difficult at times due to the demanding nature of basketball competition and travel. The medical record may relate to a separate illness and injury data base maintained by the National Federation but should not replace the doctor's own record. The incidence of injuries will be an essential aspect of the team physician's prevention program for the team.

See the section Ethical Considerations for a Team Physician.

## **Anti-doping**

All participants in FIBA events including the players, coaches and team support officials must be made

aware and educated on antidoping processes and risks.

The team should be informed regarding the role of the WADA Code and Prohibited List and how these relate to FIBA's Anti-Doping Regulations. Particularly important is communicating the implications of the principle of 'strict liability' and the responsibility of the athlete for whatever substance is ingested.

Anti-doping processes that the team and players must be aware of are the doping control procedures, therapeutic use exemptions, whereabouts requirements (including whether a player is a member of a registered testing pool), the athlete biological passport, inadvertent doping risks such as supplements and illicit substances and how athletes need to ensure that they are not ingesting a prohibited substance.

FIBA is strongly committed to ethics in sport and in the fight against doping in sport. The team physician is obliged to educate and inform all the aforementioned team participants of a FIBA competition about anti-doping issues and uphold the values of FIBA.

See the section Anti-Doping.

### **Team relationships**

Establishing and maintaining good relationships in a team environment is important for the success of a team physician. This includes relationships with all members of a basketball team. Their role in providing professional guidance and psychological support should not be underestimated even if it is sometimes unseen.

A key aspect to successful team relationships is in the extended multi-disciplinary health care team itself. Understanding and respect for the different health care professional roles is important. The team physician as the natural professional leader of the health care team and this adds additional requirements such as the ability to listen, support of others and the development a consensus approach. How the health care team (doctor, physiotherapist, massage therapist, osteopaths, fitness, etc) are perceived by the players and coaching staff is very important for the success of the team physician and the team.

At the heart of these relationships are respect, full disclosure, respecting athletes' privacy and consent.

Problems with the smooth functioning of the health care team will emerge in difficult medical fitness decisions, the management of sensitive and confidential illness, alignment of rehabilitation goals between the health care and fitness personnel and difficult medical and rehabilitation decisions.

See the section Ethical Considerations for a Team Physician.

### **Return-to-play decisions**

Return-to-play decisions are worth specific comment as they can cause particular difficulties in the smooth running of team injury management and the harmony of the health care team. Decisions regarding the fitness to compete, return to play during a game and playing with an injury raise a number

of ethical and competency questions. These are some of the most difficult decisions a team physician will need to make for a basketball team (1, 2).

The team physician should always be aware of the principles of 'do no harm', full disclosure and player consent. Always bear in mind the risks and health consequences of a premature return to basketball competition. Understand those circumstance where the risk assessment will be influenced by the importance of the current competition such as an Olympic games or FIBA World Cup.

According to one consensus statement, the decision to return to play is a process that includes evaluation of the injured/ill player, treatment and rehabilitation, gradually returning the player to modified and full practice prior to return to competition (12, 13). There is no one specific or standard protocol that will cover all injured/ill players. Individual decisions regarding the return of an injured or ill athlete to play will depend on the specific facts and circumstances presented to the team physician and the doctor must be prepared to take the ultimate accountability for the decision (12,13).

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## FIBA Regulations: Medical

By Dr Peter Harcourt, Australia

The following are FIBA regulations that may impact a team medical staff. Basketball medical staff are expected to understand the requirements of the sport and how they may impact the delivery of health care.

2017 Official Basketball Rules: <http://www.fiba.basketball/OBR2017/Final.pdf>

### Article 4 Teams

#### 4.4 Other equipment

4.4.2 Players shall not wear equipment (objects) that may cause injury to other players.

The following **are not** permitted:

- Finger, hand, wrist, elbow or forearm guards, casts or braces made of leather, plastic, pliable (soft) plastic, metal or any other hard substance, even if covered with soft padding.
- Objects that could cut or cause abrasions (fingernails must be closely cut).
- Hair accessories and jewellery.

The following **are** permitted:

- Shoulder, upper arm, thigh or lower leg protective equipment if the material is sufficiently padded.
- Arm compression sleeves of the same dominant colour as the shirts, or black, or white, but all players on the team must wear the same colour
- Leg compression stockings of the same dominant colour as the shirts, or black, or white, but all players on the team must wear the same colour
- Headgear of the same dominant colour as the shirts, or black, or white, but all players on the team must wear the same colour. The headgear shall not cover any part of the face entirely or partially (eyes, nose, lips etc.) and shall not be dangerous to the player wearing it and/or to other players. The headgear shall not have opening/closing elements around the face and/or neck and shall not have any parts extruding from its surface
- Knee braces if they are properly covered.
- Protector for an injured nose, even if made of a hard material.
- Non-coloured transparent mouth guard.
- Spectacles, if they do not pose a danger to other players.

- Wristbands, maximum 10cm wide textile material of the same dominant colour as the shirts, or black, or white, but all players on the team must wear the same colour.
- Taping of arms, shoulders, legs etc. of the same dominant colour as the shirts, or black, or white, but all players on the team must wear the same colour.
- Ankle braces of transparent colour, or black, or white, but all players on the team must wear the same colour.

Commentary: Any permitted appliance should be adequately padded so not to be an injury risk to other players. All covered equipment should not have exposed hard edges.

### Article 5 Players: Injury

- 5.1 In the event of injury to a player(s), the officials may stop the game.
- 5.2 If the ball is live when the injury occurs, the official shall not blow his whistle until the team in control of the ball has shot for goal, lost control of the ball, withheld the ball from play or the ball has become dead. If it is necessary to protect an injured player, the official may stop the game immediately.
- 5.3 If the injured cannot continue to play immediately (within approximately 15 seconds) or, if he receives treatment, he must be substituted unless the team is reduced to fewer than five (5) players on the playing court.
- 5.4 Team bench personnel may enter the playing court, with the permission of an official, to attend to an injured player before he is substituted.
- 5.5 A doctor may enter the playing court without permission of an official if, in the doctor's judgement, the injured player require immediate medical treatment.
- 5.6 During the game, any player who is bleeding or has an open wound must be substituted. He may return to the playing court only after bleeding has stopped and the affected area or open wound has been completely and securely covered.
- 5.7 If the injured player or any player who is bleeding or has an open wound recovers during a time-out taken by either team before the scorer's signal for the substitution, that player may continue to play.
- 5.8 Players who have been designated by the coach to begin the game or who receive treatment between free throws may be substituted in the event of an injury. In this case, the opponents are also entitled to substitute the same number of players, if they so wish.

Commentary: A member of the team medical staff may not enter to court area unless directed by the referee. The only exception to this circumstance would be in the case of a serious injury where urgent emergency treatment is required.

The current regulations do not mandate the management of blood on a player's uniform, medical materials or towels, etc. In these circumstances it is the obligation of the team medical staff to manage such situations according to the strictest health care guidelines, i.e. manage such materials as if being contaminated.

## Article 19 Substitution

19.3.8 If the free-throw shooter must be substituted because he:

- is injured.
- has committed his five (5) fouls.
- has been disqualified.

The free throw(s) must be attempted by his substitute who may not be substituted again until he has played in the next clock-running phase of the game.



## **Ethical Considerations for a Team Physician**

By Dr Peter Burt, New Zealand

### **Introduction**

The objective of this section is to provide the physician with a resource to aid them in practicing medicine in the basketball environment in an ethical and reflective manner, and understand the challenges the physician may face in this setting. It provides an overview of the relevant areas to consider and has links where appropriate to important documents and websites to provide a more detailed understanding if required. It does not aim to replace ethical standards of relevant professional medical organisations, but rather highlights fundamental points relevant to the practice of medicine in the basketball sporting landscape.

### **Medical ethics in general**

In general, the same medical ethical principles that apply to the practice of medicine apply in the same manner to practice of medicine in the sporting environment, that is:

1. Always make the health and well-being of your athlete/patient your first priority,
2. Do no harm and
3. Never impose your authority in a way that impinges on the individual right of the athlete to make his/her own decisions (FIMS 2017).

### **Professional qualifications**

Team physicians must have the appropriate medical qualifications (and ideally have completed post graduate sports medicine training), have appropriate medical registration, and have professional indemnity insurance (FIMS 2017).

### **Standards of Medical Care**

A team physician is expected to:

- Provide high quality medical care respecting ethical standards consistent with their professional registration body, and with that of their national sports medicine organization
- Practice evidence-based medicine, make sound clinical decisions and must not allow clinical decision making to be influenced by outside elements, including commercial interests and the athlete entourage
- Listen and consider the views of patients (including parents/legal guardians where the patient is a minor) whilst remembering that the best interests of the patient should guide management
- Communicate with their athlete-patients with empathy, honesty and respect, including



parents/legal guardians where the patient is a minor

- Not exploit their athlete-patient whether physically, sexually, emotionally, or financially

Commentary: If a physician has an existing relationship with an athlete or team management prior to taking on the role, he or she should be aware that this relationship creates a conflict of interest.

(IOC 2016; ACSEP 2017; FIMS 2017)

### **Informed consent**

A team physician is expected to:

- Inform the athlete-patient about the treatment, the use of medication and the possible consequences in an understandable way and request the player's permission for the treatment
- Be aware of legal, professional and institutional requirements for gaining informed consent from athlete-patients (including minors or those who may be compromised in their ability to consent) and be aware that competent people have the right to refuse treatment
- Fully document all matters relevant to the consent process

The overriding ethical concern is to provide information to the best of one's ability that is necessary for the athlete-patient to decide and act autonomously.

(Bukner 2012; IOC 2016; ACSEP 2017; FIMS 2017)

Commentary: It is understood that informed consent may be challenging when the athlete-patient seeks alternative information, opinions or treatments and may have pressure from other stakeholders such as family, friends, agents, management or coaches to undertake specific therapies. It is further challenging for full informed consent to be gained in high-pressure situations such as during a game and this is not always practical. This does not excuse the physician from making a good faith attempt at educating the player on the risks and benefits and documenting the discussion in the medical record.

### **Confidentiality**

The maintenance of confidentiality in the context of a sporting team is complex. While there is an obligation to communicate with the coach on healthcare matters that impact the team, this needs to be undertaken in the broader restrictive context of patient confidentiality.

In general confidentiality should be maintained where the health information has no bearing on player or team performance or is personal and sensitive in nature.

It is important that this issue is discussed with players and officials as a group so there is a clear understanding of what is reasonable and expected. Confidentiality can be particularly difficult where

there is media coverage of a player, team or event. As a general rule team medical support staff should not release player or team medical or injury information to the media without the consent of all parties. This issue should be discussed with team management preferably prior to an event or competition.

(Brukner 2012; ACSM 2015; ACSEP 2017; FIMS 2017)

### **Practicing medicine in the basketball environment**

A team physician providing medical care for basketball is expected to understand the specific physical, mental, and emotional demands associated with basketball in terms of training and competition. They are additionally expected to understand the medical developmental challenges faced by the adolescent when involved in basketball.

The team physician is expected to:

- Act with honesty and integrity and promote fair play in basketball
- Not violate the rules of basketball in order to obtain an unfair advantage
- Not fix or attempt to fix a game (or any part of a game) or use or reveal inside information for the purposes of betting

Practicing medicine in the sporting environment can be challenging when there is limited time and/or facilities to allow a complete privacy. However, it is important that where assessment or treatment must be carried out in a public environment, patient privacy will be maintained to the level it can be reasonably achieved.

(Brukner 2012; IOC 2016; ACSEP 2017; FIMS 2017)

### **The physician-athlete patient relationship**

- A team physician is expected to treat all patients according to medical need, without discrimination on the grounds of age, gender, ethnicity, disability, religion, lifestyle, beliefs, culture or sexual preference.
- The physician-athlete relationship should be based on absolute confidence, mutual respect and trust. The athlete can expect a physician to exercise professional skill at all times.
- The athlete's right to privacy must be protected.
- The physician should maintain a complete and accurate record of the patient.

(Brukner 2012; IOC 2016; ACSEP 2017; FIMS 2017)

Commentary: The physician athlete-patient relationship in the sporting environment may differ from a traditional doctor-patient relationship that occurs in a regular clinic setting as they may spend considerably more time together in team settings such as meals, travelling, training, and on social outings (Huizenga 1994).

While “camaraderie” could develop, this must never result in a team physician becomes emotionally invested in the athlete’s performance and goals. Like other members of the athlete entourage the doctor may succumb to the phenomenon referred to as the “fan syndrome” (Opie 1991; Pipe 1998; Polsky 1998; Johnson 2004; Stovitz and Satin 2006; Salkeld 2008; Devitt and McCarthy 2010).

### **The physician-team relationship**

A physician should understand that when practicing medicine in a sports team setting they are considered part of that team. They are expected to consider how their individual actions in a team social setting reflect on themselves and their profession and how this could impact on future physician patient relationship. They are therefore expected to act in a considered and professional manner during all team social activities, especially where alcohol is consumed (ACSEP 2017).

### **Conflict of interest**

There is a fundamental difference in focus between the team physician, who has the health and well-being of their athlete-patient as their priority, and that of the team whose focus is on performance and winning. This can make medical practice in the sporting environment challenging. There can be further pressures from a number of stakeholders to assist the player and/or team to winning, sometimes at the expense of the player’s long-term well-being. It is important that the physician understands these challenges and is able to make good clinical decisions not influenced by the performance outcome.

(Brukner 2012; ACSM 2013; FSEM 2016; IOC 2016; ACSEP 2017; FIMS 2017)

To ensure effective professional medical practice, the physician should establish working relationships with each member of the management group that are based on mutual respect, honesty, and integrity. This is particularly relevant to the physician-coach relationship. Establishing clear, consistent and transparent lines of communication will help to provide a positive working environment for the athlete and minimise any misunderstandings.

In particular, from early on in their involvement, a team physician should clarify the following considerations with their coaching/management staff:

- Clear lines of communication
- Duty of care and ultimate responsibilities in decision-making
- The doctor’s role and boundaries
- Appropriate channels for dealing with issues

(Brukner 2012; IOC 2016; ACSEP 2017; FIMS 2017)

### **Competing Obligations**

A team physician may be employed by a professional team or organisation. This results in a fundamental

conflict of interest between whether the physician's primary duty is to the athlete or the team.

Most often the interests of the team and the athlete are the same, with what is best for the athlete is also usually also best for the team. However, situations can arise where short-term gain for the team may be detrimental of the athlete and their health. It should be remembered that the physician's overriding duty is always to their athlete-patient regardless of pressure the physician feels they are under from other stakeholders, including coaches, players, or family (Anderson and Jackson 2012; Brukner 2012; IOC 2016; ACSEP 2017; FIMS 2017).

To enable the sports medicine physician to undertake this ethical obligation the sports medicine physician must insist on professional autonomy and responsibility for all medical decisions concerning the health, safety and legitimate interest of the athlete. No third party should influence these decisions.

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## **Basketball Injuries**

By Dr Abdulkadir Mu'azu, Nigeria

### **Introduction**

Basketball is one of the most popular sports in the world, second only to football. According to FIBA, basketball is played by about 11% of the world population and is the fastest growing sport in the world. In addition to its popularity, the game of basketball has also undergone dramatic changes over the years, evolving from the game of "finesse" to a semi-contact sport to its current form as a high-risk contact sport, especially at professional level.

With emphasis on speed and power of its players, the game is characterised by fast pace movements, twisting, sudden stops, jumping and throwing, pivoting, cutting, running forwards and backwards, changing directions many times, and having contacts with each other. This functionality could lead to a wide variety of injuries mostly involving the lower and upper limbs. With increasing popularity and increasing intensity and pace, comes increased frequency and severity of injuries. Physiological processes of growth may predispose the young basketball players to growth related injuries.

Apart from the USA and Europe, there are not many studies published on the incidence of basketball injuries. Some studies report an overall incidence of injuries to be between 8.5 -11.1 per 1000 players hour depending on the level of play (1).

The majority of injuries sustained in basketball are mild to moderate in the form of strains, sprains and contusions. However, among professional adult players, severe injuries do occasionally occur resulting in significant morbidity and subsequent practice and game time loss. Due to the tremendous pressure exerted on the foot and ankle during Basketball practice and games, the ankle and knee are the most common sites of injury, followed by the lower back, hand, and wrist. In some studies, injuries to lower limb account for 46.4%-68.0% of basketball injuries, head and neck 5.8%-23.7%, upper limb 5.6%-23.2% and spine and pelvis 6.0%-14.9%.

### **Definition of Injury**

Sports Injury can be broadly defined as any muscular-skeletal complaint newly incurred due to competition and/or training that received medical attention regardless of absence from competition or training. This definition covers injuries ranging from mild contusion to severe complicated musculoskeletal injuries.

### **Classification of Injuries**

Injuries in basketball are generally classified as Acute or Overuse/Chronic.

### Acute Injuries

Acute injuries occur suddenly to previously normal tissue. The triggering event or mechanism is often obvious at the time of injury. Acute Injuries typically follow a force exerted on the affected tissue that exceeds the strength of that tissue resulting in tissue damage. The most common acute injuries in basketball include strains, sprains and contusions involving muscles, ligaments, tendons. Fractures and traumatic brain injuries do occasionally occur in basketball.

### Overuse Injuries

Overuse Injuries refer to injuries resulting from repetitive microtrauma without an identifiable triggering event. The repetitive microtrauma overloads the capacity of the tissue to repair leading to failure of the regenerative tissue remodelling. Overuse Injuries commonly affect tendons and bones resulting in tendinopathy and stress fracture.

To effectively manage and prevent overuse injuries, it is helpful to understand the factors causing or predisposing to the injuries.

Factors causing overuse injuries are generally categorised as intrinsic or extrinsic. Intrinsic factors are related to the player and include malalignment, leg length discrepancy, muscle weakness, muscle imbalance, lack of flexibility and lack of physical fitness. Extrinsic factors refer to factors related to the player’s environment and/or equipment such as playing surface, training issues, sports shoes and environmental conditions.

### Common Basketball Injuries

Injuries in basketball involving the lower limbs are the most common and mostly occur during landing. Half of the landing related injuries happen when a player lands on an opponent’s foot. Other lower limb injuries occur during sudden change of direction (2).

Acute ankle sprains and overuse knee injuries are the common lower limb injuries (3). Other injuries include contusions and strains affecting muscles and finger injuries.

Common Basketball Injuries	
Acute	Overuse
Ankle Sprains	Patellar Tendinopathy
Muscle Strains	Patellofemoral Pain
Finger Injuries	Achilles Tendinopathy
Knee Ligament Injuries	Rotator Cuff Tendinopathy
	Lower back conditions

## Ankle Injuries

Ankle sprains are the most common injuries in basketball accounting for about 25% of injuries. Even though the majority of ankle injuries in basketball are mild to moderate, severe injuries may occur involving the rupture of more than one of the three lateral ligaments. Severe ankle injuries can lead to serious disability and time loss. Poorly managed ankle injuries may lead to ankle joint instability and increased risk of re-injury.

The most important risk factors that have been identified in ankle sprains is a previous ankle injury. A basketball player with a previous ankle injury, especially a recent one, is five times more likely to suffer another ankle injury. Other identified risk factors include wearing shoes with air cells in the heels of the shoes and lack of adequate stretching before match or practice (1).

Injuries to the ankle happen when a player lands with the ankle in inversion and supination resulting in injuries to the lateral ligament complex which comprises of the anterior talofibular ligament, calcaneofibular ligament and posterior talofibular ligament. About half of the injuries associated with landing happen when a player lands on opponent's foot leading to an inversion injury. Other mechanisms include sudden change of direction, falls, collision and tripping.

In the case of lateral ligament complex injuries, the player often complains of feeling some tearing on the lateral aspect of the ankle. There is also pain and localised swelling, which may be evident soon after injury. Swelling may quickly worsen in the ensuing hours if not treated.

The immediate goals of treatment of ankle sprain at the acute stage are to limit bleeding and swelling, control pain, protect the ankle from further injury and aim to regain function. These goals are better achieved by employing the PRICE treatment protocol. The PRICE protocol which acronym means Protection, Rest (which may be relative), Ice application, Compression and Elevation is easy to apply and when started early has proven to be effective.

Lateral Ligament Sprain PRICE regime	
<b>P</b>	Protect- Protect to avoid further injury. Use crutches for lower limb etc
<b>R</b>	Rest – to avoid aggravating injury further. Rest could be absolute or relative.
<b>I</b>	Ice application to the injured part for 15-20mins every 2hrs helps to reduce swelling, pain, muscle spasm.
<b>C</b>	Compression limits swelling in injured area
<b>E</b>	Elevation helps decreases swelling



The PRICE Regime shall be started immediately after injury and shall last for about 72 hours. To regain function, active strengthening exercises should begin as soon as pain permits.

Strengthening exercises should include dorsiflexion, plantarflexion, eversion and inversion carried out passively and with some resistance. The goal is not only to control pain and discomfort, but to regain function early to help return to play.

Other treatment modalities in the acute stage may include the use of non-steroidal anti-inflammatory medication, electrotherapeutic modalities and use of protective ankle tapes or braces for ankle support.

Adequate functional rehabilitation of ankle injuries focusing on regaining strength, full range of motion and proprioception is critical to full recovery and the prevention of re-injury.

Multifaceted Ankle Injuries prevention programs incorporating a variety of strategies and interventions are key to preventing ankle injuries in basketball. Effective prevention programs will reduce the frequency and severity of ankle injuries and the negative consequences they impose on the players, the clubs and the national teams.

Adopting a comprehensive conceptual Injury Prevention Model of “Sequence of Prevention” (4) may prove more effective in preventing basketball injuries. The sequence of prevention model includes the determination of the extent of injuries in a defined setting, identification of the factors and mechanisms at play in the occurrence of injuries, introduction of measures and interventions that will reduce the risks or severity of injuries and finally assessing the effectiveness of the measures by reassessing the extent of injuries.

In order to determine the extent of injuries, medical staff providing medical support to basketball teams shall be encouraged to accurately record all injuries sustained by their players during practice and games. The nature, mechanism and severity of injuries shall be documented.

Good injury prevention strategy will also require the identification of risk factors both intrinsic and extrinsic in order to modify or correct the modifiable risk factors and institute target intervention to mitigate non-modifiable ones. This could be better achieved through routine comprehensive pre-competition assessment of players.

Instituting early treatment of injuries and the effective rehabilitation of injuries and wise return to play decisions will significantly reduce the risk of ankle re-injury.

Enhancing muscle strength and balance, core stability and neural control and proprioception and general physical fitness are important measures to prevent injuries and enhance the performance of basketball players.

Employing correct training by coaches with emphasis on teaching correct techniques and movement patterns and allowing for adequate recovery in between training sessions and games are important measures for injury prevention.

Good nutritional practices including adequate fluid intake and use of proper equipment including mouth guards and ankle protective devices such as taping and ankle braces are some of the measures of injury prevention.

Encouraging substituting concrete and asphalt floors with modern sports tiles floors especially in developing countries will reduce the incidence of impact injuries.

### **Finger Injuries**

In basketball, the hand serves to launch and receive the ball and is therefore susceptible to injuries. Finger injuries in basketball are common accounting for about 19% of basketball injuries (5). Finger injuries in basketball are reported to be more common in younger players partly due to inexperience and low skill level resulting in faulty pass and ball reception. Most finger injuries in basketball involve sprains of the ligaments and are mild to moderate in severity. Severe injuries involving fractures and dislocations, though rare, do happen. Common finger injuries in basketball include Mallet and Jammed Fingers.

Mallet finger usually is caused by the ball striking the finger, creating a forceful flexion of an extended Distal Inter-Phalangeal Joint (DIP). The extensor tendon may be stretched, partially torn, or completely ruptured or separated by a distal phalanx avulsion fracture.

A jammed finger occurs from a blunt impact or forced motion to the proximal interphalangeal joint (or PIP for short) of the fingers. Depending on the force of the impact, injury sustained may range from mild strain of the collateral ligament to severe injuries like fracture or dislocation of the PIP joint.

Timely and correct evaluation of finger injuries including instituting proper treatment shall remain the priority for any basketball medical staff to prevent long term complication. Medical staff shall have the skills to properly immobilise injured joints while allowing mobility of uninjured joints. For most of the injuries, instituting the PRICE protocol and correct immobilisation of the affected joint are the main treatment measures.

### **Knee Injuries**

Knee Injuries involving ligaments and tendons of the knee joint are common in basketball. The nature of the games that involves fast paced running with sudden start and stops, cutting and sudden changes of directions, jumping and landing contribute to the varieties of knee injuries seen in basketball. Knee injuries appear to account for most time loss in the games and are more likely to result in surgical intervention.

Common acute knee injuries in basketball include sprains of the knee ligaments particularly the medial collateral ligaments, injuries to the menisci and anterior cruciate ligament. Anterior cruciate ligaments injuries like in other sports is seen more frequently among female players due to gender physiologic and anatomic related factors.

The most common overuse knee injury in basketball is the so-called 'Jumper's Knee' involving the Patellar tendon. It is an insertional tendinopathy affecting its proximal attachment to the inferior pole of the patellar. This condition used to be described as an inflammation but is a degenerative condition affecting the tendon, the result of repetitive loading associated with repeated jumping and landing. Its onset is insidious and is associated with anterior knee pain that worsens with activity.

Determining the mechanism of injury and identifying aggravating activities are critical to accurate diagnosis of basketball overuse injuries.

While management of acute strains of knee ligaments essentially involves the application of the PRICE protocol and adequate functional rehabilitation, more severe injuries involving the meniscus and anterior cruciate ligament may require surgical treatment and prolonged rehabilitation and significant time loss.

Treatment of overuse knee injuries especially patellar tendinopathy is difficult and involves a multifaceted approach that includes relative tendon unloading, activity modification and progressive strengthening programme. It also requires patience on the part of the player and the therapist with rehabilitation frequently requiring several months of strength work.

Other treatment modalities for overuse tendon injuries may include electrotherapeutic modalities and invasive interventions in the form of sclerotherapy and local injection of platelet-rich plasma (PRP) but they do not replace the need for a long and well designed, strength program.

Use of Non-steroidal anti-inflammatory medication in degenerative tendon injuries is discouraged.

Surgical treatment shall only be considered when conservative treatment has failed and then followed by a good strength program usually under the control of an experienced physiotherapist.

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## **Basketball Concussion Management Guidelines**

By Dr Peter Harcourt, Australia

### **Introduction**

Basketball's Concussion Guidelines follow the guidance provided by the 2012 Zurich and 2016 Berlin Concussion Consensuses.

Concussion is a temporary disturbance of brain function that has been described as 'a complex pathophysiological process affecting the brain, induced by biomechanical forces' (1). It is a potentially serious injury that may have long term sequelae and therefore requires a conservative management approach.

**A player diagnosed with concussion cannot return to play in that game and must be medically cleared before fully training or playing**

Any basketball player who has a concussion diagnosed during a game must not have any further participation in that game and cannot train or play until medically cleared by a team physician or medical practitioner experienced in the management of concussion.

### **Diagnosis**

The diagnosis of concussion is a clinical one with symptoms and/or signs of acute neurological dysfunction, altered mental state or cognitive impairment that can come on rapidly, evolve over time and spontaneously resolve. The condition can present in many different ways depending on what aspect of the brain's function has been disturbed. The condition can be difficult to interpret clinically with the symptoms and signs which are largely not specific to concussion.

The current SCAT multimodal assessment protocol should be followed. This must be undertaken by a medical practitioner and include a symptoms checklist, assessment of orientation, memory, balance, co-ordination and cognitive functioning. The doctor may choose to perform additional neurological tests.

If video of the injury incident is available this should be reviewed as a part of the initial examination to determine the mechanism of injury and presence or absence of immediate signs of concussion.

From a practical perspective, a player with any neurological symptoms or signs or any evidence of a disturbance of mental status or cognitive function following trauma, is considered to have concussion.

### **Game management**

A player diagnosed with concussion cannot be permitted to continue competing in a game on that day. Because of this requirement the first focus of management is to diagnose or exclude concussion. If there is doubt the player should be sat out of the game.

If a player is directly observed (including video review) to have loss of consciousness, prolonged immobility, tonic posturing or seizure, loss of balance or ataxia, dazed with a blank stare, then the provisional diagnosis of concussion is made. The player should be removed from play and examined using the SCAT protocol.

**Immediate and obvious signs of concussion, directly observed or on video review**

1. Loss of consciousness or prolonged immobility
2. No protective action in fall to floor
3. Impact seizure or tonic posturing one or more limbs
4. Confusion, disorientation
5. Memory impairment
6. Balance disturbance or ataxia
7. Player reports concussion symptoms
8. Dazed, blank stare, not their normal selves
9. Behaviour change atypical of the player

**The player should be immediately removed from play and take no further part in the game**

If a player suffers head trauma and requires medical assessment, but there are no clear signs of concussion (listed above) the player will require a full SCAT multimodal assessment in a quiet location (not courtside) to fully exclude concussion. From a practical perspective, if during a game play is stopped by the referee and the doctor called onto the court, a SCAT assessment should be undertaken. This may be delayed to the half-time break or after the game if on sideline testing the player has no symptoms, no obvious signs observed and the player responds appropriately to memory, orientation and cognitive testing. Even so, the player should be watched carefully from the sidelines for signs of concussion and removed at any stage should these emerge.

Concussion is a clinical syndrome that can have a delayed onset or evolve over time. Therefore, any player with a head injury should be reviewed regularly during a game and formally assessed after the game and 48 hours later. The player should be instructed on what symptoms and signs to look for and instructed to report these should they occur.

All details of the clinical assessment should be kept in the normal medical notes.

### **Emergency care**

A player diagnosed with concussion should have a thorough neurological examination to exclude more serious structural injuries to the brain, head and neck. If there are signs of a more serious condition being present, then the player should be immediately transferred to a hospital.

### **Return to play**

A concussed player will require a medical clearance to return to training and competition.

Usually a player will have recovered in 7 to 10 days but this can vary from individual to individual and requires a doctor's oversight.

#### **Graded return to play – each stage to take a full day**

1. No return to play and at least 24 hours relative rest
2. Light aerobic exercise and easy basketball skills such as free throws and shooting
3. Light training for a limited time and with no body contact, e.g. half court scrimmage for 20 to 30 minutes followed by basketball skills
4. Full scrimmage with a medical clearance to train and play
5. Return to play

**Any return of symptoms requires a return to the previous level of activity for 24 hours**

A concussed player will undertake a graded return to play where the various stages of function are guided by the absence or return of symptoms.

If baseline testing had been undertaken (e.g. computerised cognitive testing such as CogState or ImPACT, SCAT or written cognitive assessment) this should also return to baseline before a player can return. This neurophysiological testing is an adjunct to a neurological assessment. Mental state assessments may also be undertaken to assist in the examination.

#### **Baseline testing**

Baseline testing of cognitive function and balance is recommended for elite and professional basketball players. Typically this involves online cognitive tools such as CogState or ImPACT as well as the SCAT balance testing.

For sub-elite basketball it is reasonable to initiate these types of tests as a part of rehabilitation without pre-concussion baseline testing.

From a practical perspective if there is no team doctor the player will require at least 2 external medical assessments. The first to confirm the diagnosis and commence the rehabilitation and the second to clear the player for full training and play.

A student may require a couple of days off school to rest and a player should not return to full training if still unable to attend school or work.

### **Difficult concussion**

If the condition continues more than 3 weeks with persistent symptoms then the player should be referred to a neurologist who is experienced in the management of concussion. More than likely the player will be referred for a full neuropsychological assessment and may require a standard MRI to exclude structural brain damage. Other investigations will be undertaken as determined by the specialist neurological examination.

In difficult cases the specialist neurologist is responsible for clearing the player to return to full training and competition.

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### **Links**

#### **Concussion consensus**

<http://bjsm.bmj.com/content/47/5/250>

[https://en.wikipedia.org/wiki/Concussions\\_in\\_sport](https://en.wikipedia.org/wiki/Concussions_in_sport)

#### **NBA**

<http://official.nba.com/2015-16-nba-concussion-policy/>

<http://www.csnne.com/boston-celtics/with-al-horford-out-nba-concussion-protocol-explained>

#### **Incidence**

<http://journals.sagepub.com/doi/abs/10.1177/0363546516634679>

#### **SCAT3**

[http://sma.org.au/wp-content/uploads/2013/08/2013\\_Sports\\_Concussion\\_Assessment\\_Tool\\_3\\_SCAT3\\_1.pdf](http://sma.org.au/wp-content/uploads/2013/08/2013_Sports_Concussion_Assessment_Tool_3_SCAT3_1.pdf)

#### **Child SCAT**

<http://sma.org.au/wp-content/uploads/2013/08/Appendix-3-Child-SCAT3.pdf>

## Anti-Doping

By Dr Souheil Sayegh, Switzerland

### Introduction

Since the 1980s, FIBA has regularly and in increasing numbers performed doping controls at its championships. As a signatory of the WADA World Anti-Doping Code, first introduced in 2004, FIBA remains strongly committed to the fight against doping in basketball.

<http://www.fiba.basketball/anti-doping>

The World Anti-Doping Code (Code) is the core document that harmonises anti-doping policies, rules and regulations within sport organisations and among public authorities around the world.

It works in conjunction with five International Standards, which aim to foster consistency among anti-doping organisations in various areas:

[https://www.wada-ama.org/sites/default/files/wada\\_anti-doping\\_aag\\_eng\\_web.pdf](https://www.wada-ama.org/sites/default/files/wada_anti-doping_aag_eng_web.pdf)

### Prohibited List

Since 2004, and as mandated by World Anti-Doping Code, WADA has published an annual List of Prohibited Substances and Methods. The List, which forms one of the five International Standards, identifies the substances and methods prohibited in- and out-of-competition, and in particular sports (not the case with basketball). The substances and methods on the List are classified by different categories (e.g., steroids, stimulants, gene doping).

<https://www.wada-ama.org/en/what-we-do/prohibited-list>

### Testing and investigations

The purpose of the International Standard for Testing and Investigations (ISTI) is to plan for effective testing and to maintain the integrity and identity of samples, from notifying the athlete to transporting samples for analysis.

### Laboratories

The purpose of the International Standard for Laboratories (ISL) is to ensure production of valid test results and evidentiary data and to achieve uniform and harmonised results and reporting from all accredited laboratories.

### Therapeutic Use Exemptions (TUEs)

The purpose of the International Standard for Therapeutic Use Exemptions (ISTUE) is to ensure that the process of granting TUEs is harmonised across sports and countries.



## **TUE Application Process**

FIBA's anti-doping regulations are compliant with the World Anti-Doping Code and its list of Prohibited Substances and Methods.

In certain cases, a player may be required to take a prohibited substance or use a prohibited method in order to treat an illness or condition. In such cases, the player shall apply for a Therapeutic Use Exemption (TUE), which, if granted, gives that player the authorisation to take the required medication containing a banned substance or use the required banned method.

Any player taking part in a major competition, who takes or intends to take medication that contains or may contain one of these substances or who uses or intends to use one of these methods, must apply for a TUE. This avoids the risk of sanctions in case of a positive test.

For all FIBA competitions, the TUE request must be addressed to FIBA, while for national championships it must be made to the National Basketball Federation or to the country's National Anti-Doping Agency (NADO).

All team physicians should know the TUE process should one of the team require approval for the use of a prohibited substance for the treatment of a medical condition.

<http://www.fiba.com/en/anti-doping/tue>

## **Protection of Privacy and Personal Information**

The purpose of the International Standard for the Protection of Privacy and Personal Information (ISPPPI) is to ensure that all relevant parties involved in anti-doping in sport adhere to a set of minimum privacy protections when collecting and using athlete personal information, such as information relating to whereabouts, doping controls and Therapeutic Use Exemptions.

### **General testing principles**

For doping controls FIBA makes the common distinction between In-Competition testing and Out-of-Competition testing.

In-Competition testing applies to and is currently defined as follows:

- For all official club competitions: 12 hours before each game through to and including 12 hours after that game of the team in question.
- For all FIBA National Team competitions: 7 days before the first game of the Event through to and including 48 hours after the last game of the team in question.

Out-of-Competition testing refers to all tests that are not defined as In-Competition. While it may apply to any basketball player of any league affiliated through its National Federation to FIBA, out-of-competition testing is mainly implemented through the FIBA Registered Testing Pools (RTP).

Please note that the above information is for basic informative purposes only. For the exact, legally-binding and most up-to-date regulations on Anti-Doping, always refer to the FIBA Internal Regulations governing Anti-Doping (Book 4).

### **Adverse Analytical Findings**

An Adverse Analytical Finding indicates the presence of prohibited substances or methods in a player's sample. An Adverse Analytical Findings may be the result of the approved use of a prohibited substance where a TUE is in place or a natural metabolic process in that player.

If an Adverse Analytical Finding is a consequence of cheating then the case will proceed to a hearing and may result in an Anti-Doping Violation and subsequent sanction.

### **Anti-Doping Facility**

In order to ensure the minimal medical and security requirements necessary to perform doping control, a specific anti-doping facility referred to as a **Doping Control Station (DCS)** must be set up at the competition venue whenever in-competition sample collections are performed.

The DCS must be located inside the competition venue, close to the basketball court, players' changing rooms and the medical care room. To ensure player privacy, it must not be accessible to the public, be located away from the media and spectator areas and guarded by a security officer who may only grant access to authorised persons.

Doping control signs must be hung on the door of the DCS as well as in the corridors to indicate the way to the doping control area. The signs should be in English and French.

<http://www.fiba.com/en/anti-doping/facility>

### **Dietary supplements**

Under the FIBA Internal Regulations governing anti-doping, it is each player's personal duty to ensure that no Prohibited Substance enters his or her body. This follows the principle of 'strict liability'.

It is essential that all players and support personnel carefully review the WADA Prohibited List which is updated on January 1 every year. If a player plans to use supplements or medication it is their duty to check the substance and its' status on the WADA Prohibited List. The team physician is the best person to support the player in checking the permitted or prohibited status of a player's substance use.

All players should be aware that supplements are particularly prone to containing a prohibited substance that may result in an Adverse Analytical Finding and an Anti-Doping Violation.

Many websites like <http://www.usada.org/substances/supplement-411/> give the opportunity to look for information and avoid sanction.

## **Team Travel**

By Dr Abdulkadir Mu'azu

### **Introduction**

With the new FIBA competition format of home and away games by national teams, management of international travel will assume even greater significance for team physicians and medical support personnel providing medical support to national basketball teams. For many team physicians and medical support personnel specially travelling in developing countries, conditions of airports, flight connections problems which may be associated with long transit times, low standard hotels, poor quality water supply, adverse climatic conditions and security challenges may all add to compound travel related stresses and fatigue. For many teams competing in many regions for qualification for the world championships, travelling may not be long-haul involving the crossing of many time zones, however, there may be situations when teams will travel for many hours crossing many time zones when participating in major international sporting events like the Olympic Games and World Championships. Such travel will be associated with jetlag in addition to travel fatigue.

It is important for team physicians to appreciate the many challenges to be encountered and to be capable of successfully managing them to minimise their negative effects on the performance of their teams.

### **Travel Plan**

Adequate and timely planning greatly assist in ensuring successful trip. Planning should include good flight arrangement to minimise long stopovers, researching the destination, figuring out needs for medical supplies based on the size of contingent, duration of travel, and destination health care system. Good planning should also involve determining the health insurance status of the members of the team and consulting the coaching staff and the team administrators on possible non-medical roles for the for medical staff during the trip.

### **Pre-Departure Preparation**

- Part of pre-departure preparation involves getting to know the health status and or medical conditions of the team members. The team physician should identify any team members with any pre-existing medical conditions or injuries and take steps to implement the necessary intervention before travel.
- The team physician or medical support personnel should seek to know all that needs to be known about the destination; climatic conditions, altitude, security situation and possible threats, the destination health system and the level and quality of possible medical support.
- The team physician or medical support personnel should be versed about disease patterns of the destination including the presence of any epidemics. When travelling for single away games

in malaria endemic areas, team physician or medical support personnel may arrange to carry mosquito repellent lotion or spray or impregnated mosquito nets as an added measure for malaria prevention.

- Plan to provide timely malaria prophylaxis to members of the team requiring prophylaxis in accordance with the current recommendation of World Health Organisation (WHO) and or the travel advisory of public health authorities.
- Determine the vaccination status of members of the team and ensure timely and appropriate vaccinations of the team members in line with the recommendation of the WHO or the travel advisories of appropriate public health authorities.
- The team physician or medical support personnel should liaise with the federations secretariat or administrator to obtain the name and telephone number of the host's federation medical contact person if possible or feasible. This could facilitate getting information about the availability of specialist diagnostic facilities and specialist care.
- The team physician or medical support personnel should determine host country's regulatory requirements regarding importation of drugs and medical supplies and taking out unused quantities of drugs and medical supplies out of the country.
- The team physician or medical support personnel should obtain information about the nature, type and location of the hotel accommodation. It is also important to obtain information about food and feeding arrangement and determine the possible availability of preferred food options.
- Based on the size of the contingent, the medical conditions of members of the team, the health system of the destination, the nature of competition, the duration of stay and the presence or absence of possible medical support, the team physician or medical support personnel should plan and obtain adequate and sufficient medical supplies and equipment for the trip. It is often recommended that physicians should "plan and prepare for the worst and pray for the best".
- Plan and pack a carry-on medical bag containing basic and essential medications and first aid materials to carry on the plane.

### **Pre-departure Briefing**

It is advisable to organise a pre-departure briefing for the team with the approval and help of the Head Coach. During the pre-departure briefing, which may take place at a pre-departure camp, the team physician should seek to:

- Provide relevant information to members of the team about the destination such as hotel; forecast weather conditions; food and water quality; measures for malaria prevention etc.
- Provide information on flight arrangement; stopovers and feeding arrangement during stopovers.

- Provide information about allocation of seats in the plane and possible arrangement made for supplemental meal or fluids during flight.
- Offer advice on measures to minimise travel fatigue and possible negative effects of jet lag if traveling on long haul flights and crossing multiple time zones.
- Offer advice on measures to be taken for the prevention of gastrointestinal infections and possibly distribute hand sanitisers.
- Ascertain vaccination status of team members.

### **Public Health Issues and Vaccinations**

In the recent past, many countries especially in Sub-Saharan Africa, Middle East, Asia, South and Latin America were confronted with outbreaks of epidemics that had devastating effects on their population. The outbreaks of Ebola in West and Central Africa in 2014, Zika Virus in Brazil spreading to many South and Latin American countries and the Middle East Respiratory Virus Syndrome (MERS-CoV) easily come to mind. The outbreaks of some of these epidemics prompted the WHO to declare Public Health Emergency of International Concern. Ebola outbreaks led some international sports federations to restrict travel by sports teams to and from the affected countries. The Zika virus epidemic raised some concern over the Rio Olympics Games and led to the issuance of serial health advisories by WHO, CDC and the Olympic Games Organising Committee. It is advisable for team physicians and other medical support travelling with teams to refer to travel health advisories on intended countries of travel and take appropriate measures to protect their team members.

It is important that athletes and officials travelling for qualifying matches or otherwise major games receive timely and appropriate vaccinations. Teams travelling from non-malaria endemic countries to malaria endemic countries should be made to take malaria prophylaxis in accordance with current recommendations. It is also advisable to take necessary precautions and measures to minimise exposure to mosquitoes. For many teams travelling and playing games within south east Asia and Africa, sanitary conditions of hotel accommodations, water and food safety will be of concern. Common-sense measures of drinking only sealed quality brand bottled water, avoiding eating outside hotels, frequent handwashing, thoroughly washing and peeling fruits before consumption could minimise the risk of food related gastrointestinal infections especially the commonly encountered Traveller's Diarrhoea.

### **Travel-related Stress, Fatigue and Jetlag**

Air travel even of medium duration may be associated with stress leading to tiredness and fatigue that may negatively affect the performance of athletes. These stresses due to the demands of air travel result from sometimes chaotic airport check-in procedures, airport security formalities, long stopovers during flight connections, adverse in-flight microclimate of dry air and mild hypoxia, cramped seating conditions in planes and inactivity. Cramped seating conditions and immobility during long haul flights can also predispose players to Deep Venous Thrombosis (DVT) and possible attendant Complication of Thromboembolism (see section on DVT). These may all result in tiredness and possibly fatigue on arrival

at destination. The team physician or support medical personnel should be familiar with negative effects of jet lag arising from long haul flight and crossing many time zones and be capable of its management to minimise its detrimental effects on the performance of the team.

### **Travel-related stress and Fatigue**

In addition to the usual demands imposed on athletes during air travel, air travel even within developed and more secure countries can be associated with many discomforts and even psychological stress. The prevailing security situation and threats of terrorism in many regions of the world add to some psychological burdens associated with modern day travel. It is essential that the team physician or medical support personnel involved with basketball teams travel recognise all possible and potential risks and work with their team officials to take steps to mitigate them.

### **Jet Lag**

In certain occasions basketball teams' travel may involve long haul flights and crossing of many time zones. As is well known, crossing many time zones during long haul flight disrupts the normal circadian rhythm. The disruption of circadian rhythm and the body's inability to rapidly adapt to the shift in time zones and the loss of synchrony of the internal body clock with the environment results in jet lag. The main symptoms of jet lag are sleep disturbance, daytime fatigue, mood changes, poor coordination and some gastrointestinal problems. The degree of body rhythm disruption and jet lag symptoms are said to be worse when travelling from west to east than travelling from east to west. Other factors such as fitness level, poor health status, stress, dehydration, sleep deprivation, age and dietary over-indulgence may worsen jet lag symptoms. As a rule, it takes one day to acclimate for each time zone crossed. It is advisable that preparations to aid time zone adjustment by travelling team members begin prior to commencement of travel.

The following are suggested strategies to prevent or minimise the severity of jet lag symptoms:

- Adjustment to new time zone by adjusting watches and clocks.
- Retiring to bed and waking up earlier in the days leading to the day of travel when travelling from west to east.
- Light exposure techniques to improve alertness.
- Possible administration of melatonin may help to induce sleep and reset of internal body clock.
- Encourage light physical exercises soon on arrival at the destination.
- While on the flight, athletes should be encouraged to drink adequately, avoid caffeinated beverages and get some sleep.

## **Traveller's Diarrhoea**

Team Medical support staff shall be familiar with the clinical manifestation, management and prevention of Traveller's Diarrhoea (TD).

Traveller's Diarrhoea is one of the commonest travel-related illness. It is reported to affect 30-70% of travellers to Africa, South East Asia, Middle East and Latin and South Africa. Poor hygiene at restaurants in these regions appears to be the greatest risk factors for TD. While variety of pathogens including viruses and protozoa are known to cause TD, bacterial are far the most common pathogens. TD is reported to occur equally in females and males, but more common in younger adult populations which makes our players particularly more susceptible.

TD typically presents with sudden troublesome gastro-intestinal symptoms ranging from mild cramps and loose stool to severe abdominal pain, vomiting, fever and bloody diarrhoea. Clinical presentation, severity and course of TD generally determined by the causative factor, but usually lasts between 2-5 days.

Treatment includes appropriate replacement of fluids and electrolytes which in the absence of severe vomiting can be accomplished by oral rehydration therapy using oral rehydration solutions (ORS). Antimotility drugs such as Loperamide provides symptomatic drugs by reducing bowel motions. For mild non-mucoid, non-bloody diarrhoea, fluid and electrolytes replacement and anti-motility medication may be sufficient to treat TD. Empirical use of antibiotics is recommended in severe dysenteric cases or when there is no improvement in 48 hours. Fluoroquinolones, such as ciprofloxacin or levofloxacin are the recommended first line anti-biotics. Indiscriminate use of anti-biotics for the treatment of TD especially in developing countries where antibiotics are available without prescription is strongly discouraged because of concerns for development of resistance and reported side effects associated with the use of Fluoroquinolones.

Even though the axiom of "boil it", "cook it", "peel it" or "forget it" remains an important preventive strategy, in many situations, travelling teams have no control over how the food served team members in local hotels and restaurants is prepared. Notwithstanding the many challenges, team medical support personnel shall endeavour to do whatever is practicable to ensure hygienic handling and preparation of meals for members of the team at destination hotels. It is also advisable for the team physician to assume responsibility for feeding during travel and educate team members of the common-sense measures of hand washing, avoiding vegetable salads, and when possible to boil, cook, peel or forget it.

## **Altitude**

Even though most basketball games during qualification matches on home and away basis will take place at altitude that do not pose any health risks to players, some national teams may be required to travel and play games at venues located at high altitudes.

As is well known, the lower ambient oxygen and increased radiation can adversely affect both health and performance. Individuals at altitude are said to be more susceptible to increased levels of fatigue, compromised immune system and overtraining (1).

Individual responses to altitude depend on many factors which include rate of ascent, altitude level, chemo-sensitivity to hypoxia, pre-existing fatigue, fitness level and genetics. Because of individual variations, altitude illness can present with a wide variety of symptoms and severity.

### Classification of Altitude and Clinical Characteristics <sup>1</sup>

Altitude	Definition and Clinical Characteristics
0–500m	Near sea level. No adverse effects.
500–2000m	Low altitude: minor impairment of aerobic performance becomes detectable.
2000–3000m	Moderate altitude: mountain sickness starts to occur and acclimatisation is increasingly important for performance.
3000–5500m	‘High altitude’: mountain sickness and acclimatisation become clinically relevant; performance is considerably impaired.
Above 5500m	‘Extreme altitude’: prolonged exposure leads to progressive clinical deterioration.

### Clinical Manifestation and Management

It is important for all basketball medical support personnel, especially team physicians to determine the altitude of venues of their scheduled competitions or games well ahead of time and take the necessary measures to minimise the adverse effects of high altitude on the health and performance of their teams. Team Physicians shall be familiar with the clinical manifestations and management of altitude illnesses and the principle of their management.

Even though the key measures recommended for minimising the risk of altitude illnesses and optimising performance is to plan and arrive at the venue of competition or site of equivalent altitude well ahead of time (at least two weeks) for acclimatisation, the measure will be difficult to implement for most away games during the qualification for the world championships. In such circumstances, the best advice to team medical personnel whose teams are scheduled to play their away games at venues located at high altitude is to ensure that their players are physically and medical fit before the games.

### Reference

1. Michael S. Koehle, MD, PhD, Ivy Cheng, MD, and Benjamin Sporer, Canadian Academy of Sports and Exercise Medicine Position Statement: Athletes at High Altitude; *Clinical Sports Med.* 2014; 24: 120-127.

### Link

<http://www.who.int/ith/en/>



## Prevention of Basketball Injuries

By Dr Ilker Yucesir, Turkey

### Introduction

Prevention is the basis of medicine. If we can prevent injuries and illnesses we no longer need to treat and players are more available to perform for their team. This should be the first priority of the team physician who have the access to follow players throughout long periods of time whether this be for national or club teams.

Hygiene, proper nutrition, training, rest and mental readiness are keys for team performance and form the basis for preventing athletic injuries and illness. In addition to striving to ensure these basics, a team physician can minimise other risks like training facilities, equipment, individual predisposition(s) of players to particular injuries.

The new FIBA international competition format for national teams means national team doctors, physiotherapists, trainers, nutritionists and coaches an opportunity to improve their prevention initiatives.

### General causes, preventive strategies

Players unfit for the physical requirements of the game are prone to injuries. For basketball players, physical fitness is the state of health and wellbeing to perform to the demands of the game and the capability to exercise at an elite level. This can only be achieved with proper training, rest and good nutrition. Good training includes individual physical preparation in addition to team practices. Ill prepared players are prone to poor technique, muscle (strength, length, elasticity) imbalances, postural deficiencies, limb alignment issues, poor balance and coordination and fatigue. This all translates to a higher risk of injury.

Equipment and environmental factors can also crucial in determining injury risks in positive or negative ways - old or poorly fitting shoes, inappropriate clothing, hard or slippery floors, commercial branding on the playing surface can be risk enhancing examples. Alternatively, the use of protective equipment such as mouth guards, ankle or knee braces and taping can reduce the injury risk.

Short and long-term planning of preventive measures are important and should be on the agenda for the entire healthcare team. Building a multidisciplinary stepwise individual strategy for individual 'at risk' players and that of the team are important. These initiatives should be in consultation and cooperation with coaches, trainers and managers. These initiatives will encompass a preseason medical and musculoskeletal examination which provide useful information in planning and monitoring of training for individual players and the team. This information will especially serve to individualise training hence achieving desired performance levels in a faster and safer way.

In addition to individually planned workout programs, general important steps to reduce the injury risks include:

- proper warm-up and cool down before and after practices and games;
- footwork exercises for basketball specific skills, including pivoting, direction change, cutting, acceleration, deceleration, jumping, landing, etc., to prevent lower limb injuries, prominently foot, ankle and knee, also useful for hip and groin;
- strengthening exercises of core muscles to prevent lower back and hip/groin injuries;
- strengthening exercises of upper body, neck, shoulder, arm muscles to prevent upper body and extremity injuries;
- proprioceptive balance and coordination drills;
- stretching exercises to achieve and maintain optimal elasticity and ROM; and,
- proper rest for recovery to avoid overuse injuries.

## **Prevention of common basketball injuries**

### **Ankle**

Ankle sprains are the most common injury in both male and female basketball players. An NCAA study reported 26.6% of men's and 24% of women's basketball injuries to be ankle ligament sprains. Unfortunately, even by medical personnel, the importance of prevention of ankle injuries can be undervalued. This is further emphasised with the high incidence of ankle re-injury. Prevention should commence before the first injury!

To reduce ankle sprains in basketball, players need to do additional stabilisation and proprioception exercises specific to ankle joint. Wearing good fitting shoes, playing on appropriate surfaces, taping and ankle braces are all reported to decrease the incidence of ankle injury.

Once an ankle sprain occurs, a patient and comprehensive rehabilitation program should follow to prevent chronic ankle instability.

### **Knee**

Knee injuries are some of the most frequent seen injuries in basketball players. A 17 year overview of injuries in the NBA shows that separately recorded knee and patella injuries together reach a higher rate than ankle injuries. Strains, knee ligament sprains and meniscal pathologies result from supra-physiological forces applied on these structures whilst playing. Overuse injuries, mainly tendinopathies, are due to repetitive micro-trauma and inadequate rest. These two groups of knee injuries are frequently observed in basketball.

To avoid or reduce the incidence of both, appropriate training and rest are essential. This is especially true for the muscles involved in knee movement. Related soft tissue must be strengthened to tolerate the excessive forces and repetitive micro-trauma occurring during the games and training. A variety of knee braces can help for different conditions. Medial and/or lateral supported braces help to support ligaments and may be useful in some circumstances. Patellar bracing may improve patellar alignment. Padded braces will help to absorb contact forces.

A special emphasis must be placed on Anterior Cruciate Ligament (ACL) injuries, since a torn ACL can be a career threatening injury and at the very least require months of rehabilitation prior to safe return to sport.

Female players are more susceptible to ACL injury. An NCAA study reported that female basketball players experience 3.5 times more ACL injury than men (1.4% men, 4.9% women of all basketball injuries). Other sports report female athletes to experience 4-6 times more ACL injuries than their male counterparts. This is said to be due to anatomic and neuromuscular differences of the genders, primarily knee alignment, relative power and tissue strength. Special ACL prevention training programs, in addition to regular basketball practices, have been shown to be effective in preventing ACL injuries in female players. Important elements of these programs were training in high risk situations and mechanisms, biomechanical technique feedback, proprioceptive coordination exercises and plyometric power training.

### **Lower back**

Lower back pain is a common condition in basketball players. Generally, bigger players are more prone. Twisting, reaching, load lifting, excessive bending and rotation may cause acute back pain due to forces applied on back and torso during these actions. Injury can occur to surrounding soft tissues as well as to vertebral discs.

Prolonged sitting in a wrong posture during daily activities (e.g. long travel, computer work) may also increase the risk of lower back injury. Strengthening core muscles and maintaining stability are important to prevention. Stretching exercises of the lumbar and dorsal spines and thigh muscles hamstrings are also essential. Flexibility of the hips and upper legs helps to correct alignment of pelvis and lower vertebrae and reduce injury.

### **Head and face**

Injuries of head and face are reported to occur 17.4% in male 14% in female players in a European study. Concussion is the most important head injury having short and potential long-term outcomes. A special chapter is dedicated to concussion in this manual. Covering backboards, referees table, commercial panels and boards around the playing venue with softened material can help to reduce head injuries.

Facial injuries usually happen during play and are not easy to prevent. Head to head collisions, elbow hits and other traumatic mechanisms are accidental and unavoidable most of the time. Mouth guards are the only widely used protective equipment that will assist.

### **Hand, wrist and fingers**

Studies on basketball injuries report hand and wrist injuries to account for roughly 10-15% of all injuries. Hand, wrist and finger injuries are not easy to protect. Taping of wrist and finger joints can prevent some of the sprains and may be useful to prevent re-injury.

## Deep venous thrombosis and pulmonary embolism in basketball: prevention

By Dr Charo Urena Duran, Spain

### Introduction, objectives and definitions

Deep venous thrombosis (DVT) is not common in basketball, but if not diagnosed early, can lead to pulmonary thromboembolism (PE) that has serious consequences for the health of basketball players.

Both, deep venous thrombosis and pulmonary embolism can be confused with other conditions which players can tolerate for a long time and the diagnosis can be delayed.

For this reason, the main objective of this article is to summarise the key points in the prevention of deep venous thrombosis and remember the symptoms to be taken into account to make an early diagnosis, avoiding pulmonary thromboembolism.

DVT occurs when a blood clot forms in a major vein, usually in the leg. This blood clot stops blood from flowing easily through the vein.

PE occurs when a blood clot travels to the lungs, most often from the legs. It often starts as a DVT. A piece of the blood clot can break off and be carried to the lungs where the flow of blood can be blocked causing serious damage to the lungs and affecting a person's ability to breath. This can lead to serious injury and death.

### Aetiology, risk factors and Incidence

The DVT is a multifactorial disease in which it is important to emphasise that genetic factors play a very important role (60%), and it will be the exposure to prothrombotic environmental factors that will determine the onset of the episode.

The pathogenesis of DVT involves three factors known as the Virchow's triad:

1. Damage of the venous wall: the endothelium loses the ability to inhibit coagulation and initiate the fibrinolysis process.
2. Venous stasis: inhibits the clearance and dilution of activated factors of coagulation.
3. Hypercoagulability, congenital or acquired thrombophilic states promote the thrombotic process.

The triggering causes of DVT are, among others:

Major factors	Risk estimation	Minor factors	Risk estimation
<b>Immobilisation with plaster</b>	36.5	<b>Long trip of more than 5 h</b>	2.8
Major Orthopaedic Surgery	16.2	<b>Intake of NSAIDs</b>	2.5
General Surgery	9.5	Obesity	2.3
<b>Severe trauma</b>	4.8-8.6	<b>Infections</b>	1.7-2.7
Bed Immobilisation	5.6	Hospital admission	1.9
Autoimmune disease (outbreak)	3.9-16.4	Any serious illness	1.7
		Chronic renal failure	1.6-1.9
		<b>Black, African or Afro-Caribbean</b>	1.6
		Environmental pollution	1.5
		COPD	1.4-1.6
		<b>Varicose veins</b>	1.4
		Mellitus diabetes	1.4
		<b>Oral Contraceptives</b>	1.3
		<b>Smoking</b>	1.1-1.5

The state of dehydration and age increases any of the above criteria.

Despite case reports, no estimates are available for the incidence of DVP in basketball.

One study detected 15 cases of thromboembolism in professional basketball players (NBA and ACB) after reviewing scientific literature and media. The observed incidence is slightly higher than that of the general population of the same age and sex group observed in two studies conducted in the United States and Norway. Of the 15 cases detected, the majority were men (66.7 %) with a mean age of 28.8 years for men and 20.4 for women.

Other studies, observe that men (especially for very tall men) have a higher risk of both initial and recurrent DVT. A recent study in Netherlands suggests that DVT risk for very tall men is increased nearly four times over men of average height. It also reviews the data suggesting that long-haul flights increase the risk for tall men, perhaps because they may sit in a more cramped position, with greater compression of their popliteal vein.

Basketball players could be considered as a risk group, because they are more exposed to risk factors of the general population or with a different frequency:

- Repeated traumas and chronic inflammation process
- Dehydration, altitude training or hypoxic training
- Frequent and prolonged travel
- Recent surgeries, post injuries immobilisations
- Treatments, such as: ACO, AASs, ESAs , cortisol, prolactina ( doping) and RTP
- Additional circumstances: hemoconcentration

### **Diagnostic: risk assessment, clinical evaluation and complementary explorations**

The individual risk of the player should be known:

- Family history
- Personal history of previous DVT or other chronic diseases
- Interventions and use of drugs (oral contraceptives). Can't be forgotten the use of supplements or forbidden substances such as steroidal anabolic steroids, growth hormone, transfusion of hemoconcentrates, use of erythropoietin)
- Others

### **Clinical evaluation**

Signs and symptoms of DVT include inflammation (with tumour, flushing, heat), pain and oedema that are increased with provocative manoeuvres.

Pain is usually the first symptom. Initially insidious or spontaneous and with a sensation of heaviness or tension in the limb. In many cases it is accompanied by functional impotence. The location is variable, depending on the affected area. In the case of the lower limbs, it usually manifests in the twin region and on the deep venous paths (popliteal hollow, Hunter's canal, inguinal region).

The oedema initially is soft and with fovea, affecting the territories distal to the venous obstruction. When palpating the muscular masses, especially in the twins, a characteristic hardening is observed. This feeling should not be confused with oedema of subcutaneous cellular tissue typical of other affections that have nothing to do with venous pathology.

Low grade fever, venous distention, increased limb circumference, extremity cyanosis and tender palpable cords may be noticed.

Since DVT symptoms and signs are typical of other conditions such as fibrillar rupture, cellulitis and lymphedema; anamnesis and careful examination should be performed, accompanied by other complementary methods to facilitate the diagnosis.

Complications of DVT include, pulmonary embolus (PE), recurrent DVT, post-thrombotic syndrome (PTS) and death.

### **PE symptoms and signs include:**

- Sudden shortness of breath (onset of dyspnoea and / or tachypnoea at rest or at small effort)
- Chest pain
- Coughing up blood (haemoptysis),
- Rapid or irregular heart rate

### **Complementary explorations**

#### Doppler ultrasound of the lower limbs

Doppler ultrasound is the initial test of choice because it is non-invasive, and it has high sensitivity and specificity, especially in the proximal venous sector. The most direct and reliable sign is the impossibility of complete collapse of the venous walls when compressed with the ultrasound probe in transverse projection.

If initial ultrasound (US) results are negative and DVT is strongly suspected, ultrasound should be repeated in 3 to 7 days. Additionally, computed tomography (CT) venography or magnetic resonance (MR), angiography can be used to confirm the diagnosis.

#### Other investigations

Electrocardiogram, chest X-ray, basic analysis with blood count, biochemistry and coagulation tests determining the D-dimer.

### **Treatment**

The treatment in DVT is the same for players as for the general population.

- It is treated with vitamin K antagonists with an INR therapeutic range (2 to 3), new oral anticoagulants or low molecular weight heparin
- Elastic stockings (medium compression) up to the affected limb root
- In some cases, it may require analgesia and relative rest according to evolution.

The duration of the treatment must be individualised according to the risk of each player and their evolution.

Players with acute DVT and anticoagulant therapy should not participate in collision or contact sports as basketball, but they should maintain a physique activity according to their evolution.

### **Return to play**

When players have completed their treatment of anticoagulation and a hypercoagulability laboratory evaluation (as needed for a positive family history of VTE or personal history of recurrent idiopathic VTE) is negative, return-to-play with gradual increase in intensity is recommended with careful monitoring for recurrent VTE.

Strong recommendations should be given to the player about the possible triggering factors that may have led to the initial event so that appropriate preventative measures can be instituted.

Return-to-play should follow a structured program of gradual increased activity as tolerated by the player.

More study is needed to examine the safe timing of return-to-play in the VTE recovery process.

## Prevention

Team doctors should plan a preventive program:

1. For players and technical staff who are considered at risk. For these individuals, it will be important to educate on the early warning signs and symptoms of DVT. This is so they will promptly report on their painful calf or other localisation and doctor could make an early diagnostic and prevent PE.
2. Preventive measures are universal and should be used according to individual risk
  - Seats that allow leg extension;
  - Hourly aisle walks;
  - When sitting, do flexion and extension movements of the knees and ankles;
  - Not crossing legs;
  - Wearing of loose clothing;
  - Hydration with water or juices, no alcoholic drink;
  - Consuming low-fat meals.

### Risk group actions

- Wear progressive compression stockings;
- Low Molecular Weight Heparin (LMWH) should be considered for prevention of DVT recurrence or when there is a big risk.

### Other considerations

- Discard DVT prior to performing manipulations or techniques involving a risk;
- Injuries requiring immobilization greater than 3 d should receive early prophylactic anticoagulation;
- Prophylaxis with Low Molecular Weight Heparin (LHWH) in surgeries;
- Monitor the supplements or treatments of risk.

**"Prevention, Early diagnosis and treatment of DVT can save lives"**



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## Cardiac screening – Basketball

By Dr Andrew Pipe, Canada

### Recommendations

1. All international-level basketball players should have an initial cardiac screening examination which should be performed by a physician experienced in the care of the athlete and familiar with cardiac screening. Such an examination should include a targeted history and physical examination and a 12 lead ECG. The history should include questions regarding history of syncope, near syncope or seizure, and family history of syncope or sudden cardiac death. Physical examination should include blood pressure measurements in both arms, cardiac auscultation and palpation of the femoral and radial arteries.
2. The ECG should be interpreted by a physician with specific knowledge and distinct experience in the interpretation of ECG's in elite athletes. It is preferred that such testing be performed at the National level, in order that abnormalities, if identified, might be evaluated initially in the home setting of an athlete where appropriate referrals and follow-up can be arranged.
3. The identification of electrocardiographic features suggestive of a condition known to place at high risk of SCD should prompt further, specialised evaluation – typically the most important next investigation is an echocardiographic examination.
4. It is very important that such investigation is performed by a physician with specific experience and expertise in the recognition and interpretation of: a) the echocardiographic findings typically reflective of the cardiac adaptations associated with participation in elite, high-performance sport; and, b) the echocardiographic features of those characteristic structural anomalies and abnormalities associated with conditions known to predispose an athlete to a higher risk of SCD.

## **Sudden Cardiac Death and the Cardiac Screening of International Basketball Players**

### **A Position Statement endorsed by the FIBA Medical Commission**

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## Preamble

Although sudden cardiac death (SCD) in an elite-level athlete is relatively uncommon, it is a highly visible, tragically catastrophic event. Such events attract an understandable, though disproportionate, degree of publicity given the overall rarity of these unfortunate incidents. The risk for such an event is typically the result of an inherited abnormality or predisposition – hence the importance of a carefully documented family history at the time of any pre-participation medical examination. In older athletes (> 35 years of age) coronary artery disease is the most common underlying cause. In the younger athletes (< 35 years of age) a number of less common cardiac conditions including structural cardiac abnormalities and electrical cardiac abnormalities should be considered (Table 1).

In a survey of NCAA University athletes in the USA, the athletes with the highest mortality rates were basketball players (1). Although accidental death far outnumbered cardiac death in the University athlete, cardiac death was the second most common cause of death (1). In the years 2004-2008 the incidence of sudden cardiac death in all NCAA athletes was estimated at 1:43,770 and in elite athletes (Division 1) the incidence of SCD was estimated at 1:29,186. The SCD rate was highest in male basketball players and estimated at 1:6,993 whereas this was substantially higher in Division 1 and estimated at 1:3,126 (1). Other investigations have identified that Black and African-American athletes may be at higher risk of SCD. For these reasons it would seem prudent to perform cardiac screening in elite basketball players in order to identify those at risk and, to the extent possible, reduce the risk of SCD in such individuals.

## Cardiac Screening

There are many approaches to cardiac screening and differences of opinion as to what type of screening should be performed in order to reduce the rate of SCD among athletes. In most jurisdictions a targeted personal history, family history, and careful physical examination are considered the minimum. The specific features of the cardiovascular examination of the athlete have been carefully described. (Figure 1) Many European jurisdictions also recommend an ECG as part of an initial cardiac screening of all intending to participate in sport. The ECG is extremely useful in identifying hypertrophic cardiomyopathy (HCM), the most common structural heart abnormality associated with SCD in elite athletes (2,3). The ECG is also useful in identifying other potentially dangerous conditions including: arrhythmogenic right ventricular cardiomyopathy (ARVC) and other cardiomyopathies; long and short QT syndromes; conduction disease; Brugada syndrome; Wolff-Parkinson-White syndrome; and prior MI. Since the highest SCD rates occur in basketball players and since HCM is the single most common cause of SCD in this population it would seem prudent to incorporate ECG testing into the pre-participation screening of all elite basketball players. Since the introduction of mandatory pre-participation screening of young athletes in the Veneto region of Italy (which has an unusual and extremely high incidence of ARVC) in 1982, Corrado and colleagues have documented that the annual incidence of SCD has declined by 89% in screened athletes (4). In North America the systematic performance of ECG examinations in athletes is not commonplace outside of professional sport organisations.

It must be acknowledged that many of the normative data regarding the ECG of the high-performance athlete have been assembled on the basis of studies involving Caucasian athletes. There is a need for

the development of normative data from other populations. This is of obvious significance in seeking to develop recommendations for the screening of high-performance basketball players that might be applied globally. It must also be recognised that there may be variability in accessibility to those with the specific experience essential for the screening of high-performance athletes and the interpretation of the ECG's and other subsequent investigations which may occur as part of an initial screening programme. In this respect, FIBA will make best efforts to facilitate the introduction of such screening programmes and to assist, where necessary, with the initial interpretation of ECG examinations performed on elite, international-level basketball players.

### **ECG Interpretation**

Interpretation of the ECG in elite athletes may be problematic as many training related ECG anomalies may be seen and be misinterpreted when in fact they are common in the trained competitor while representing an abnormality in the untrained individual (5). For this reason, new electrocardiographic criteria have been developed to identify ECG findings which are more likely to be indicative of cardiac disease in the trained athlete (5,6). These have been validated and it has been shown that sport physicians can be trained to read these appropriately (7).

### **Recommendations**

5. All international-level basketball players should have an initial cardiac screening examination which should be performed by a physician experienced in the care of the athlete and familiar with cardiac screening. Such an examination should include a targeted history and physical examination, and a 12 lead ECG. The history should include questions regarding history of syncope, near syncope or seizure, and family history of syncope or sudden cardiac death. Physical examination should include blood pressure measurements in both arms, cardiac auscultation and palpation of the femoral and radial arteries. (Table I)
6. It is most important that the ECG is interpreted by a physician with specific knowledge and distinct experience in the interpretation of ECG's in elite athletes. It is preferred that such testing be performed at the National level, in order that abnormalities, if identified, might be evaluated initially in the home setting of an athlete where appropriate referrals and follow-up can be arranged.
7. The identification of electrocardiographic features suggestive of a condition known to place at high risk of SCD should prompt further, specialised evaluation – typically the most important next investigation is an echocardiographic examination.
8. It is very important that such investigation is performed by a physician with specific experience and expertise in the recognition and interpretation of: a) the echocardiographic findings typically reflective of the cardiac adaptations associated with participation in elite, high-performance sport; and, b) the echocardiographic features of those characteristic structural anomalies and abnormalities associated with conditions known to predispose an athlete to a higher risk of SCD.

## Echocardiographic Assessment of Athletes

Echocardiography is the preferred tool in the detection of structural cardiac abnormalities in the athlete because of its low cost, non-invasive nature and availability. When assessing the cardiac structure and function in athletes, it is important to recognise the features of the “athlete’s heart” which encompass the normal cardiac adaptive changes to chronic high intensity physical activities; the nature of that cardiac adaptation may reflect particular features of specific athletic activities. In general, sport activities that include both dynamic and strength components such as cycling and rowing have the most marked adaptive changes which include increased cardiac dimensions and wall thicknesses. It is not unusual for basketball players to demonstrate changes in ventricular volume and wall thickness.

A comprehensive approach assessing cardiac structures and hemodynamics should be used to assess the athlete in accordance with published guidelines. Since hypertrophic cardiomyopathy is the most common cause of sudden death in athletes, care should be taken to assess the entire left ventricle to ensure that focal hypertrophy of the left ventricular myocardium will be detected. There are diverse manifestations of hypertrophic cardiomyopathy.(Table 2)

Left ventricular wall thickness equal to or greater than 13 mm is unusual and should be viewed with caution since it is rare for athletes to have wall thicknesses exceeding this limit. In selected cases, where echocardiographic findings may be equivocal, it is useful to assess the changes that will occur following the discontinuation of training. Adaptive cardiac changes regress with deconditioning of the athlete, while changes of hypertrophic cardiomyopathy will persist despite deconditioning. The presence of intracardiac hemodynamic abnormalities such as an intra-cavitary pressure gradient and/or the presence of mitral regurgitation should be sought. The presence of systolic anterior motion (SAM) of the mitral leaflets associated with an intra-cavitary gradient is uncommon in athletes and suggests hypertrophic cardiomyopathy.

Similarly left atrial dimension > 45 mm in female athletes and > 50 mm in male athletes are also highly unusual and generally suggest the presence of cardiac pathology.

Other entities of structural heart disease detectable by echocardiography include: arrhythmogenic right ventricular cardiomyopathy; dilated cardiomyopathy; Marfan syndrome; and, congenital aortic stenosis.

A systematic approach to assess right ventricular size and function is crucial to the detection of arrhythmogenic right ventricular cardiomyopathy. The presence of global or regional abnormalities of the right ventricle supports the diagnosis of arrhythmogenic right ventricular cardiomyopathy. Dilatation of the aorta at the level of the coronary sinuses is a typical finding in individuals with Marfan syndrome. Since high quality echocardiographic images can usually be obtained in an athlete, both the left and right coronary artery ostia should be routinely assessed. This may allow the detection of coronary artery anomalies which should be confirmed by other imaging modalities such as coronary angiography or computed tomographic angiography.

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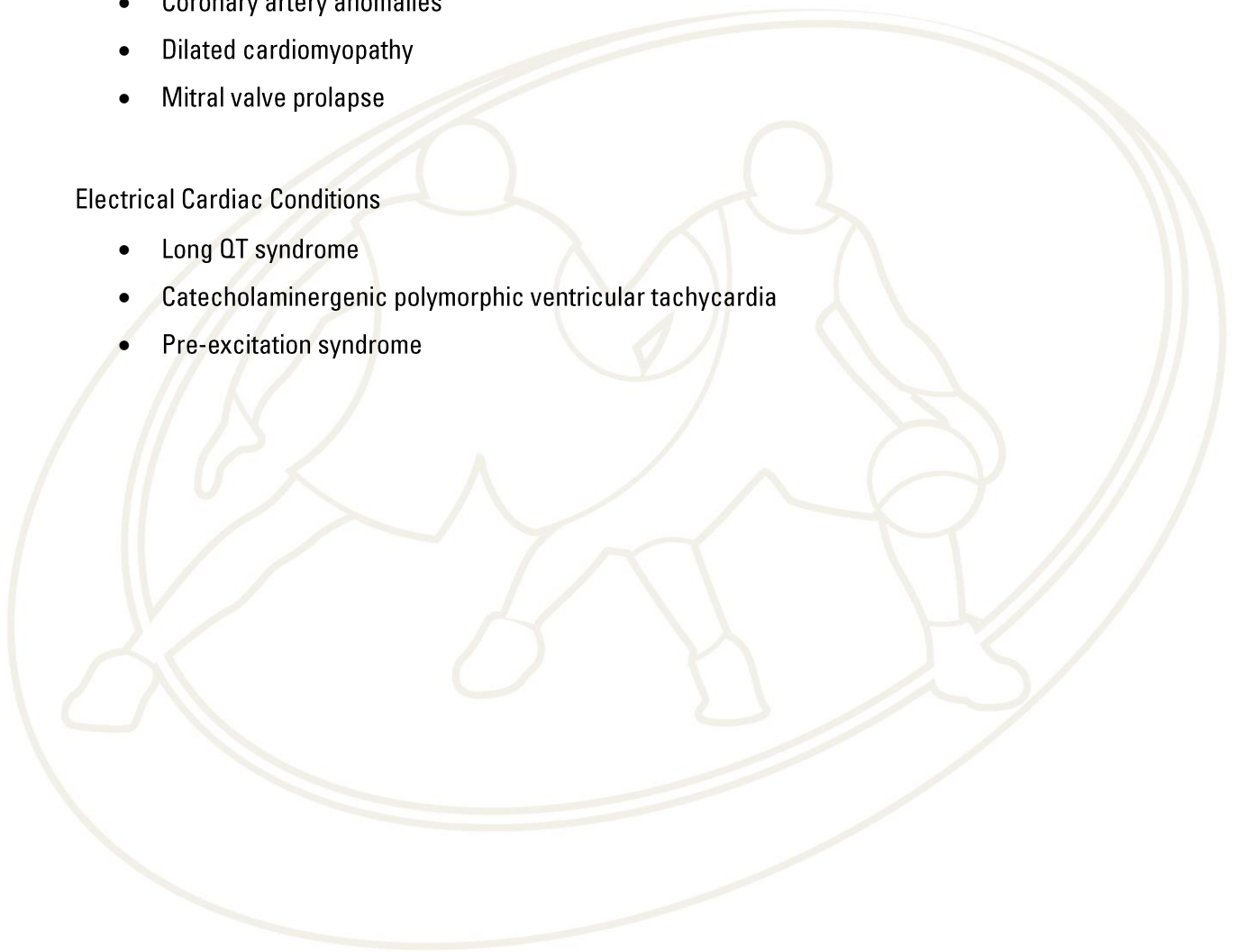
**Table 1 Causes of sudden death in young athletes**

**Structural Cardiac Conditions**

- Hypertrophic cardiomyopathy
- Arrhythmogenic right ventricular cardiomyopathy
- Marfan syndrome
- Congenital aortic stenosis
- Coronary artery anomalies
- Dilated cardiomyopathy
- Mitral valve prolapse

**Electrical Cardiac Conditions**

- Long QT syndrome
- Catecholaminergic polymorphic ventricular tachycardia
- Pre-excitation syndrome





**Table 2 Echocardiographic findings in hypertrophic cardiomyopathy**

- LV hypertrophy (focal or diffuse)
- Increase septal to posterior wall thickness ratio (> 1.3)
- Small LV cavity
- Hyperdynamic LV contraction
- RV hypertrophy
- Increased LA size
- Systolic anterior motion (SAM) of mitral leaflet
- Ventricular septal brightness at SAM contact
- Abnormal papillary muscles
- Posteriorly directed mitral regurgitation
- Mid systolic closure of aortic valve
- Subaortic systolic dynamic gradient (dagger shape CW signal)
- Mid or apical systolic dynamic gradient
- Relaxation asynchrony (prominent flow during IVRT)

*CW, continuous wave; IVRT, isovolumic relaxation time; LV, left ventricle; RV, right ventricle; LA, left atrium.*

(From Chan KL & Veinot J, *Anatomic Basis of Echocardiographic Diagnosis*, 2011)

## CARDIOVASCULAR SCREENING QUESTIONNAIRE

**NAME:**

**DoB:** dd dd / mm mm mm / yy yy yy yy

**Phone number at which you can always be reached:**

Has any close relative (brothers, sisters, parents, grandparents, aunts, uncles) died suddenly at a young age (below 55 years)? **YES NO**

If "YES" was heart disease thought to have been involved? **YES NO**

Is there any history of heart attacks in your family? (brothers, father, uncles, grandfathers?) **YES NO**

Is there any history of deafness occurring at a young age in your family? **YES NO**

Have you ever collapsed during exercise or sport activity? **YES NO**

Have you ever collapsed after exercise or sport activity? **YES NO**

Have you ever been told you had a "heart murmur"? **YES NO**

Have you ever fainted? **YES NO**

Have you ever sensed an unusually rapid or irregular heart rhythm? **YES NO**

Have you ever been told you have high blood pressure? **YES NO**

Have you ever been prevented from participating in sport for "health reasons"? **YES NO**

Have you ever had:

chest pain in association while exercising or participating in sport? **YES NO**

unusual shortness of breath while exercising or participating in sport? **YES NO**

Do you smoke? **YES NO** Do you use recreational drugs? **YES NO**

Do you take any medications? **YES NO**

Have you had a chest X-Ray in the past 12 months? **YES NO** Ever? **YES NO**

Have you had an EKG in the past 12 months? **YES NO** Ever? **YES NO**

Have you had a medical examination in the past 12 months? **YES NO**

Have you ever had an Exercise "Stress Test"? **YES NO**

Have you ever had an Echocardiogram (Ultrasound)? **YES NO**

**PHYSICIAN COMMENTS:**

**CARDIOVASCULAR SCREENING EXAMINATION:  
HIGHLY CONFIDENTIAL**

**Name:**

**BP:**

Supine:	Right:	Left:
Standing:	Right:	Left:

**Inspection, Auscultation, & Palpation:**

Apical Displacement?

Precordium:	S1	S2	Murmurs?
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Rhythm:	Sinus?	Irregular?
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Carotids:	Right:	Left:
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Abdominal Aorta:

Femoral Arteries:	Right:	Left:
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Peripheral Pulses:	Right:	Left:
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Radial-Femoral Synchrony:	YES:	NO:
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Radial-Femoral Intensity:	Similar:	Dissimilar:
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**EKG:**

Rate:

Sinus:

ST Changes?

Hypertrophy?

QT Changes:

**Further Investigations:**

Echo?	GXT?
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Holter?	Scan?
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CTA?	MRI?
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Angio?	Other?
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**Physician Comments:**

Date:

Signed:

**DISCLAIMER:**

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