

Setting medical benchmarks



by Michel D'Hooghe,
Chairman of the UEFA
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UEFA EURO 2012 will be one of next year's most celebrated sporting events, with 16 of the world's strongest footballing nations competing in a celebration of European football in two countries both eagerly awaiting their first taste of hosting a major tournament. Work continues apace within the host nations and all departments of UEFA to provide the best possible scenario for an outstanding tournament, and medical provision is a high-priority area of pre-tournament planning. For the UEFA Medical Committee, as well as Poland and Ukraine, this means ensuring highest-quality treatment and emergency provision in both countries during the tournament. Only a well-planned, well-trained and responsive medical network can ensure that all players, medical staff, tournament staff, officials and spectators enjoy the tournament in the safest possible environment.

Close cooperation between UEFA and the host nations is vital to this process, and the tournament medical strategy continues to be refined as we move into the final year of tournament preparation. All development work on medical strategy benefits from the continued close cooperation of UEFA and FIFA, with the former's experience from the successful EURO 2008 and the latter's experiences from the 2010 World Cup ensuring a wide understanding of football medicine requirements and emergency medical service provision. This experience not only benefits the host nations but also ensures that UEFA can be confident that the excellent work already put in place by both nations can mature into the provision of first-rate medical services by the time its flagship national team tournament kicks off.

In addition to the medical plan, development of the EURO 2012 anti-doping programme has also commenced, using UEFA's long-standing experience in this area and knowledge derived from the extensive programme conducted at EURO 2008. All anti-doping measures at tournaments are designed to ensure the integrity of competitive results, and a full programme of in- and out-of-competition testing will be undertaken on players prior to and during the tournament to achieve this aim. The programme will combine UEFA's well-established sample collection procedures with the highest possible analytical standards from World Anti-Doping Agency-accredited laboratories. This will provide a platform for the highest quality anti-doping programme at the tournament which, of course, UEFA hopes will be drug-free.

Aside from EURO 2012, the remainder of UEFA's club and national team tournaments continue to require medical support, and UEFA constantly strives to further the quality of emergency and sports medicine provision and administration. As part of this process, the UEFA Medical Committee is currently working on a number of new developments, such as the introduction of a medical passport for officials at UEFA tournaments, the harmonisation of players' pre-tournament medical screening procedures and wider promotion of the UEFA injury study. These and many other projects, including the planning for EURO 2012, suggest that 2011 could be an outstandingly busy year at UEFA in terms of medicine matters.

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Antidepressants in professional football

By Wilfried Kindermann

This article is based on the following study: Machnik M, Sigmund G, Koch A, Thevis M, Schänzer W; Prevalence of antidepressants and biosimilars in elite sports, *Drug Testing and Analysis* 2009, 1: 286-291. The following football-specific analysis was commissioned and supported by the German Football Association's scientific working group via the institute of biochemistry at the German Sport University, Cologne.

Mental (psychiatric) illness and competitive sport are not mutually exclusive. Athletes can perform at a high level despite some form of mental illness. In fact, it is thought to be as common among athletes as anyone else. Almost all mental illnesses can also occur among athletes.

Depression

Depression is one of the most common of mental illnesses. Its prevalence among recreational athletes seems to be below the general average, but there is no data available

in elite sport. However, the suicide of the German international footballer Robert Enke in November 2009 sparked public debate about depression in elite sport, especially professional football. The German Football Association's scientific working group consequently commissioned the institute of biochemistry at the German Sport University to

analyse the findings of doping controls (urine tests) conducted between 1999 and 2008, looking specifically at the use of antidepressants in football.

Methodology

Over a period of 10 years, almost 83,000 urine samples from athletes in various sports were analysed for antidepressants. The results have already been published elsewhere, albeit with no specific focus on football. Over a third of the samples were those of German athletes. Almost all sports were included, with 32% of the samples from footballers. All of the major antidepressants were picked up by the analysis.

Fewer antidepressants in football

Only 0.31% of almost 83,000 urine samples tested positive for antidepressants. The percentage among footballers was almost half that (0.14%). No difference was found between professional football in Germany and internationally.

Antidepressants in other sports

The number of urine samples which tested positive for antidepressants was relatively high in endurance and strength sports. Compared with football, antidepressants were found to be up to ten times more common in some sports. The overall percentage of elite athletes who tested positive for antidepressants (0.31%) was well below the percentage of ordinary Germans of a similar demographic prescribed with antidepressants (approx. 2.25% of 15 to 34-year-olds).

Which antidepressants?

The majority of antidepressants found in the urine samples were selective serotonin reuptake inhibitors (SSRIs). This was the case across all sports and in football specifically (74%). SSRIs were followed, albeit in much fewer cases, by tricyclic antidepressants (13%), the side effects of which include weight gain. SSRIs (e.g. fluoxetine) increase the concentration of serotonin in the brain, which has various effects. Among other things, it is a transfer agent in the central nervous system and can effect a person's mood, for example, hence being known by some as a happy hormone. There have been a few scientific studies into the effects of SSRIs on performance, but as yet no correlation has been proven.



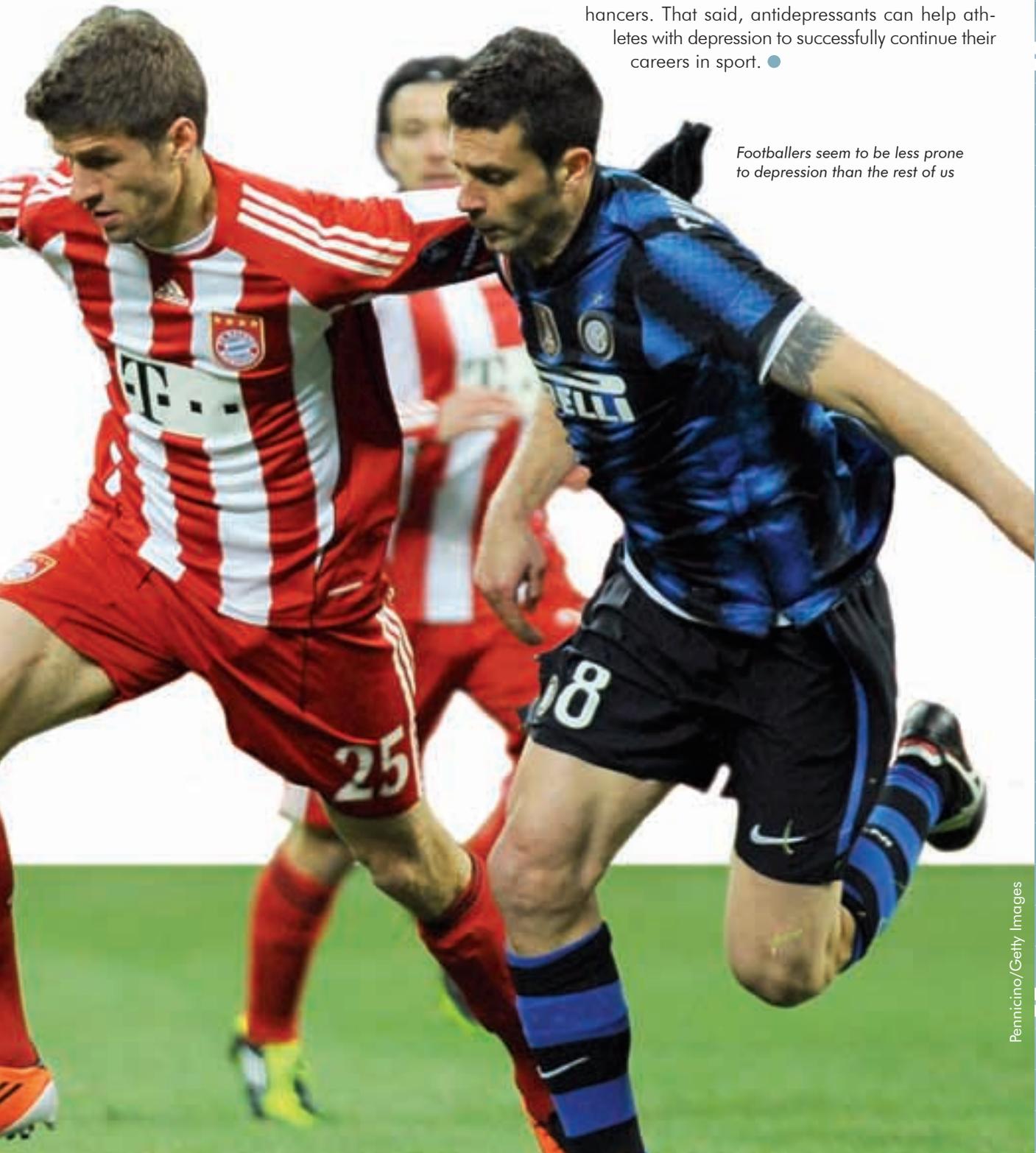
Are footballers less affected by depression?

Compared with the general population, but also the majority of other sports, the number of footballers who tested positive for antidepressants was below average. Only 6 in 4,400 urine samples in German football tested positive for antidepressants over the 10-year period. It is tempting to conclude from this that depression in elite sport, and especially in football, is less common than in the general population. To draw such a conclusion, however, systematic studies into the use of these substances would be needed and, as yet, no such studies have been conducted. It is likely that the data available underestimates the real proportion of depression in elite sport. An obvious assumption is that professional athletes who suffer

from depression or other psychiatric problems and illnesses avoid medication because of the possible side effects or negative impact on performance. It must also be borne in mind that some athletes deny or ignore the symptoms because of the personal stigma they attach to mental problems requiring psychiatric treatment.

On the other hand, the data available suggests that abuse, for example taking antidepressants as neuroenhancers, is not a problem in professional football. Known by some as brain doping, this means using psychotropic drugs such as SSRIs to sustainably enhance mental capacities such as alertness, concentration, learning and memory. It should be noted, in this regard, that there is currently no knowing whether these high expectations can even be met, bearing in mind the possible risks of such drugs. Antidepressants belong in the hands of doctors and should not be used – or rather abused – as neuroenhancers. That said, antidepressants can help athletes with depression to successfully continue their careers in sport. ●

Footballers seem to be less prone to depression than the rest of us



Anterior cruciate ligament injury – a career threat?

By Markus Waldén, Martin Hägglund, Henrik Magnusson and Jan Ekstrand

In the January 2011 issue of the journal of the European Society of Sports Traumatology, Knee Surgery and Arthroscopy, the UEFA injury study group presented a study of elite level football players with injuries to the anterior cruciate ligament of the knee (ACL injuries).

Football-related knee injuries are common and constitute a serious problem regardless of gender or playing level. The injury that probably draws the most attention is a tear to the anterior cruciate ligament. A complete ACL tear usually causes a long absence from football and may even end a player's career. In the long term, an ACL injury is associated with an increased risk of new knee injuries and early development of osteoarthritis.

An ongoing injury study was initiated by UEFA in 2001 on men's professional football in Europe (UEFA Champions League injury study). A total of 1,367 players representing

28 teams from the top leagues in 11 national associations were followed over a varying number of seasons from 2001/02 to 2008/09. Briefly, data was collected through three different forms: a baseline questionnaire, an attendance record and an injury report form. Player age, leg dominance and basic medical history were reported by the club medical staff for each player in the study. Club officials registered all club and national team training sessions and matches during the season as well as all injuries resulting in absence from football (time loss). Injury cards and attendance records were sent to the study group once a

Injuries can happen without physical contact





Before...

month. After each reported ACL injury, the club medical team was sent an additional ACL injury card to fill in. A player was considered injured until the team physician allowed full participation in all types of training or match play.

During the study period, almost 6,000 injuries were recorded and about 400 of these were knee ligament injuries (7%), including 43 ACL injuries (0.7% of all injuries). This means that, statistically, a men's elite team with a squad of 25 players can expect an ACL injury every second season. The ACL injury risk was more than 25 times higher during match play compared with training.

All ACL injuries were primarily examined with magnetic resonance imaging (MRI), with an average of only 1.4 days to form an established diagnosis. It is well known that in clinical practice ACL injuries are often misdiagnosed immediately after injury, but since injuries were examined by experienced club medical practitioners, including liberal referral to MRI, we believe that we have been able to include all ACL injuries that occurred during the study period.

In total, 38 of the ACL injuries underwent surgery (reconstruction of the ACL). The average absence time after ACL reconstruction was almost seven months (202 days) to the first training session and an additional three weeks to the first match appearance (224 days). The most reliable cut-off for calculating absence from football is probably the medical clearance for participating in full team training for the first time after injury, whereas return to match play is also influenced by several non-medical factors, e.g. coach selection, off-season holidays, transfer, end of career, etc. In our survey, all 38 ACL-reconstructed players returned to training, but two players did not participate in match play (one player terminated his career after returning to training at the end of the season and another had further knee surgery and was then released from his contract) resulting in a return to match play success rate of 95%. Interestingly, the majority of ACL-reconstructed players returned to training within 8 months after surgery (92%) and participated in a match within 12 months after surgery (92%). In contrast to other studies investigating players from variable settings and playing levels that have reported difficulty in returning to play after ACL injury, at least at the same



...and after treatment

level as prior to the injury, this does not seem to be a problem at professional level. There is probably no single underlying reason for this high return rate, but important factors to consider, compared with the ordinary non-professional athlete with an ACL injury, are quick diagnostic procedure, state-of-the-art surgery by well-known knee surgeons all over the world, and individualised best-practice rehabilitation by club medical teams.

ACL injury seems to affect both knees to a similar extent (24/43 injuries affecting the right knee), which is perhaps not surprising since the two most com-

monly described injury situations in football are trunk rotation with either foot fixed to the ground and landing awkwardly from a jump. Most football-related ACL injuries result from a non-contact injury mechanism with reported frequencies of up to 84% in literature. In our survey, 26 ACL injuries (60%) were classified as non-contact injuries, as were almost all training injuries. The separation of contact and non-contact injuries is important, since it is primarily the non-contact variety that can be addressed with preventive training programmes. ●

The full article can be read in the KSSTA journal (Waldén M, Hägglund M, Magnusson H, Ekstrand J. Anterior cruciate ligament injury in elite football: a prospective three-cohort study. Knee Surgery, Sports Traumatology, Arthroscopy 2011 19: 11-19).

SUMMARY POINTS

- ACL injury is rather uncommon in elite football, representing less than 1% of all injuries resulting in time loss.
- Statistically, an elite team of 25 players can expect an ACL injury every second season.
- ACL injury is a severe injury with a lay-off period of more than six months in general.
- The return-to-play success rate in elite football is very high and is probably due to good care by club medical teams and their consultants.
- Most ACL injuries occur in non-contact situations and could thus be targeted with preventive programmes.

94% return to elite football after ACL surgery: successful treatment or knee abuse?

By Professor Jan Ekstrand, department of medical and health sciences at Linköping University, Sweden, and first vice-chairman of the UEFA Medical Committee

The ESSKA – the European Society of Sports Traumatology, Knee Surgery and Arthroscopy – publishes articles related to these fields in the KSSTA Journal. In the January 2011 issue, Markus Waldén and his co-authors (Martin Hägglund, Henrik Magnusson and the author of this appraisal) present a study of elite level football players with injuries to the anterior cruciate ligament (ACL) of the knee. It provides some thought-provoking information.

Almost all players with a total rupture of the ACL (71/73 = 97%) were treated surgically, which reflects the general opinion among football physicians that players with an ACL injury require an operation in order to continue playing. The rationale for surgical intervention after an ACL injury is to totally restore the pre-injury activity level.

A striking finding in the study by Markus Waldén and his colleagues is the high return-to-play percentage. As

many as 94% of the players who received surgical treatment for ACL injuries returned to full elite-level training within 10 months of the operation and 89% participated in elite match play within 12 months. These findings are in contrast with previously presented data related to amateur players, which demonstrated that only 30-50% were able to return to playing after an ACL injury.

What are the factors capable of explaining the differences in return-to-play numbers between the studies of professional and amateur players? An obvious difference between the two groups is the playing level itself. The players included in the Waldén study comprise a homogenous group of elite football players in contrast to the more diverse amateur group which is a mixture of players from different lower

An injury that can put a player out of action for quite some time



football levels. There can be significant differences between the care of football players with ACL injuries at elite level compared with amateur levels in terms of diagnostic evaluation, time to surgery and post-surgery rehabilitation.

The standards of care at elite level represent, in many ways, the optimal situation. Players at elite clubs are supported by highly qualified medical teams (it is in fact mandatory to provide qualified team doctors and physiotherapists at elite-level football teams in Europe, in accordance with UEFA's club licensing rules) while teams at amateur level are normally well short of these benchmarks in terms of medical support. In the elite group, as presented by the Waldén study, the mean time for diagnosis is eight days, whereas it can take several months for players at amateur levels to have an ACL injury firmly diagnosed.

An important factor behind the early diagnosis at elite level is the frequent use of and easy access to MRI (magnetic resonance imaging).

The ACL operation, the Waldén study reveals, is typically performed in the sub-acute phase, i.e. approximately three to five weeks after injury.

Early reconstruction as compared to delayed surgery might lead to less elongation of stability structures of the knee as well as fewer secondary injuries to structures inside the knee (such as menisci or joint surfaces) due to less instability episodes. Early surgery can thus be another factor behind the high success rates at elite level.

It has been suggested that the results of surgery could be dependent on the experience and number of operations performed by the surgeon. Elite clubs normally have a wide contact network of highly skilled specialists in ACL surgery who perform a significant number of ACL operations every season – which could be a significant factor behind the high success rates in elite-level cohorts.

Another influential factor is rehabilitation after the operation. Opportunities to receive assistance from a physiotherapist also differ between elite and amateur levels. An amateur footballer can generally expect to be helped by a physiotherapist for about one hour two to three times a week following ACL surgery. A player at elite level normally receives help from a team physiotherapist for several hours every day. To what extent the more intensive rehabilitation in professional football players improves the return-to-play figures is a question which has yet to be scientifically studied.

The importance of the study by Waldén and his colleagues is that they have shown that, in ideal circumstances, it is in fact possible to achieve an outcome in excess of 90% in terms of return to football at the same

high level as before the injury – a success rate which represents the ultimate goal, not only for professionals, but also for the majority of amateur players. The care of elite players may be of great importance. Whether some of the factors outlined above are more important than others remains to be evaluated in further studies.

However, the fact that it was possible for almost all players to return to football after ACL surgery does not



The quality of rehabilitation can greatly determine how long a player is out of action

necessarily mean that return to play is always ideal from a medical standpoint. It could also be a sign of knee abuse. Waldén's team had previously reported that many elite football players suffer from swelling of the knee and other overuse injuries shortly after their comeback to football. This, it could be argued, might possibly indicate a premature return. At professional level, economy has to be admitted as an additional factor, with monetary implications increasing the desire to return to play. The high success rate of return to play after ACL surgery might reflect a satisfactory outcome but could also be regarded as a risk of further joint injury and subsequent development of knee arthrosis.

Another important finding in the Waldén study is that the average absence from full team training was six to seven months after surgery. This means that, even with optimal care and resources, this is the time span on which expectations can be based. As pointed out in the study, there might be examples of shorter rehabilitation periods. However, publicising such 'successes' could be counterproductive if high-profile media coverage induces the public to believe that such quick return to play is the standard. Statistical values, like the ones presented in the Waldén study, are therefore of major importance in that they provide a firm basis for knee surgeons to enlighten their patients – and not only the footballers, but also coaches and club administrators – about the real prospects. ●

Platelet-rich plasma treatment in football injuries

By Andrea Ferretti, professor and chairman of the Department of Orthopaedic Surgery and Kirk Kilgour Sports Injury Center, Sant'Andrea University Hospital, Rome, Italy

A February 2009 article in *The New York Times* raised public awareness of platelet-rich plasma (PRP) by detailing its use to treat an injured Pittsburgh Steelers American football player before the 2009 Super Bowl. In actual fact, the use of PRP to help heal wounds dates back to the early 1980s, while its use in orthopaedic surgery and sports medicine to promote or accelerate bone and soft tissue healing has been advocated since the beginning of the century. Although literature is replete with studies documenting the safe, successful use of PRP in a wide variety of fields, including sports-related injuries, a lack of consensus exists about the actual effects of this treatment, because many studies may or may not have controls, have small sample sizes and do not define a standardised preparation of PRP, a therapeutic protocol or proper rehabilitation. The purpose of this article is to focus on clinical applications of PRP in orthopaedic and sports medicine, presenting the author's experience in using this procedure on footballers.

Physiology of platelets and growth factors

Blood contains plasma, red blood cells, white blood cells and platelets. Plasma is the liquid component of blood, made mostly of water and acting mainly as a transporter for cells. Red blood cells help pick up oxygen from the lungs and deliver it to the whole body, while removing carbon dioxide. White blood cells fight infections, kill germs and carry off dead cells. Platelets are responsible for haemostasis, construction of new connective tissue and revascularisation. Platelets are small discoid blood cells made in bone marrow with a life span of seven to ten days. They lack nuclei but contain organelles and granules containing more than 30 bioactive proteins, including "growth factors", many of which have a fundamental role in haemostasis and tissue repair. Platelets function as a reservoir for releasing those factors that are essential to the repair of injured tissues. Disruption of a vascular structure, as a result of injury, leads to the formation of fibrin and platelet aggregation; a stable blood clot is formed by blood coagulation.

Platelets become activated and release several growth factors into the injured tissue promoting and supporting healing and tissue formation.

PRP is defined as a volume of the plasma fraction of autologous blood having a platelet concentration above baseline. As the normal platelet concentration is 200,000 platelets per microlitre (μL), studies have shown that clinical efficacy can be expected with a minimum increase of about three to four times this baseline. PRP can potentially enhance healing by



Separating a blood sample into its different components

delivering various factors from the granules contained in the platelets. The healing of injured soft tissue occurs in three phases (inflammation, proliferation and remodelling) and factors released by platelets play an active role in each, including cell proliferation, cell chemotaxis, angiogenesis, cellular differentiation and extracellular matrix production, eventually resulting in healing.

Clinical application with special emphasis on sports-related injuries

There is extensive documentation of animal and human studies with widespread applications, demonstrating the safety and efficacy of PRP. However most are pilot studies with small sample sizes, thereby providing only mild evidence of efficacy. Beside the use of PRP in oral and maxillofacial surgery, plastic surgery and general surgery, current orthopaedic and sports medicine clinical applications of PRP include tendinopathies, muscle injuries, acute ligament injuries, cartilage repair, delayed bone union and intraoperative augmentation in several procedures.

PRP preparation and administration

PRP is extracted by an autogenous blood sample following slightly different preparation steps but essentially accomplishing similar goals. About 10 to 60ml of venous blood is drawn using an aseptic technique from the antecubital vein. An 18 or 19g butterfly needle is advised, to avoid irritation and trauma to the platelets, which are in a resting state.

The preparation of PRP begins with the addition of citrate to whole blood to inhibit the clotting cascade. This is followed by one or two centrifugation steps in order first to separate red and white blood cells from plasma and platelets and second to further concentrate the platelets. In order for platelets to release growth factors, they must be activated. Thrombin and calcium have historically been used to activate platelets. This combination results in the formation of a gel that may be used in open surgery but cannot be injected even through a large-gauge needle. Thrombin and calcium activation results in rapid release of the contents of the granules within platelets. Platelets, however, can be slowly activated by exposure to tendon-derived collagen. This can produce *in vivo* activation and allows for PRP to be administered through a small-gauge needle. There are different commercially available systems for the preparation of PRP, most of them resulting in a considerable growth factor release. The whole procedure requires 20 to 30 minutes.

Injection procedure

The injured area is marked, taking into account the clinical examination and data from imaging studies such as MRIs, ultrasounds and radiographs. It is recommended to use dynamic musculoskeletal ultrasound to more accurately localise the site to be treated. Under sterile conditions, the patient receives the PRP injection with or without a prior local anaesthetic (lidocaine 1%) injection. Activated gel can only be used for augmentation in some surgical procedures or in a large joint space. The optimal volume and number of injections is still unclear. It seems logical that these should be tailored to each patient, taking into account the severity and location of the injury and the clinical response.

Author's preferred method of PRP preparation

PRP gel is supplied by the immuno-haematology and transfusion unit at the Sant'Andrea hospital in Rome. PRP is obtained by a single centrifugation of whole blood to isolate platelets using MyCells® Autologous Platelet Preparation System (KayLight Corporation, Kreuzlingen, Switzerland). The PRP preparations have a mean volume of 4 to 6ml and a mean platelet concentration of 890,000 to 1,100,000/ μ L (three to five times the baseline concentration).

PRP preparation is done using the recover platelet separation kit, in accordance with the system instructions. Ten millilitres of venous blood is collected from the cubital vein. The whole blood is mixed in a disposable sterile tube with acid-citrate-dextrose to prevent early clotting. After blood collection and ten minutes of centrifugation at 1,500g, PRP is obtained. One millilitre of this PRP is sent to the laboratory for analysis of platelet concentration, while the remaining 3 to 5ml is given to the patient via injection without activation. When activation is needed, calcium gluconate is added to the syringe. In general we perform two to three ultrasound-guided PRP injections weekly on an outpatient basis. Anaesthetics are not administered, unless specifically requested by the patient.

CLINICAL USE IN FOOTBALL-RELATED INJURIES

Tendinopathies

Tendinopathy is a generic term indicating various pathologies affecting human tendons including inflammatory (peritendinitis) and degenerative (tendinosis) diseases, as well as mixed forms. Tendinopathies can also be classified as mid-portion and insertional, the latter usually being more resistant to conservative treatment. Subcutaneous ruptures usually occur as a result of a long-lasting, often asymptomatic, degenerative process.

Tendon healing occurs in three phases: inflammation, proliferation and remodelling. It has been argued that PRP initially inhibits excess inflammation while stimulating proliferation and maturation, as well as synthesis of extracellular matrix proteins and angiogenesis, providing a rationale for its use in a clinical setting. Tendinopathies affecting footballers mainly affect Achilles and patellar tendons. Plantar fasciitis has been considered a tendinopathy as well. Rotator cuff tendinopathy can affect goalkeepers.

Achilles tendinopathy

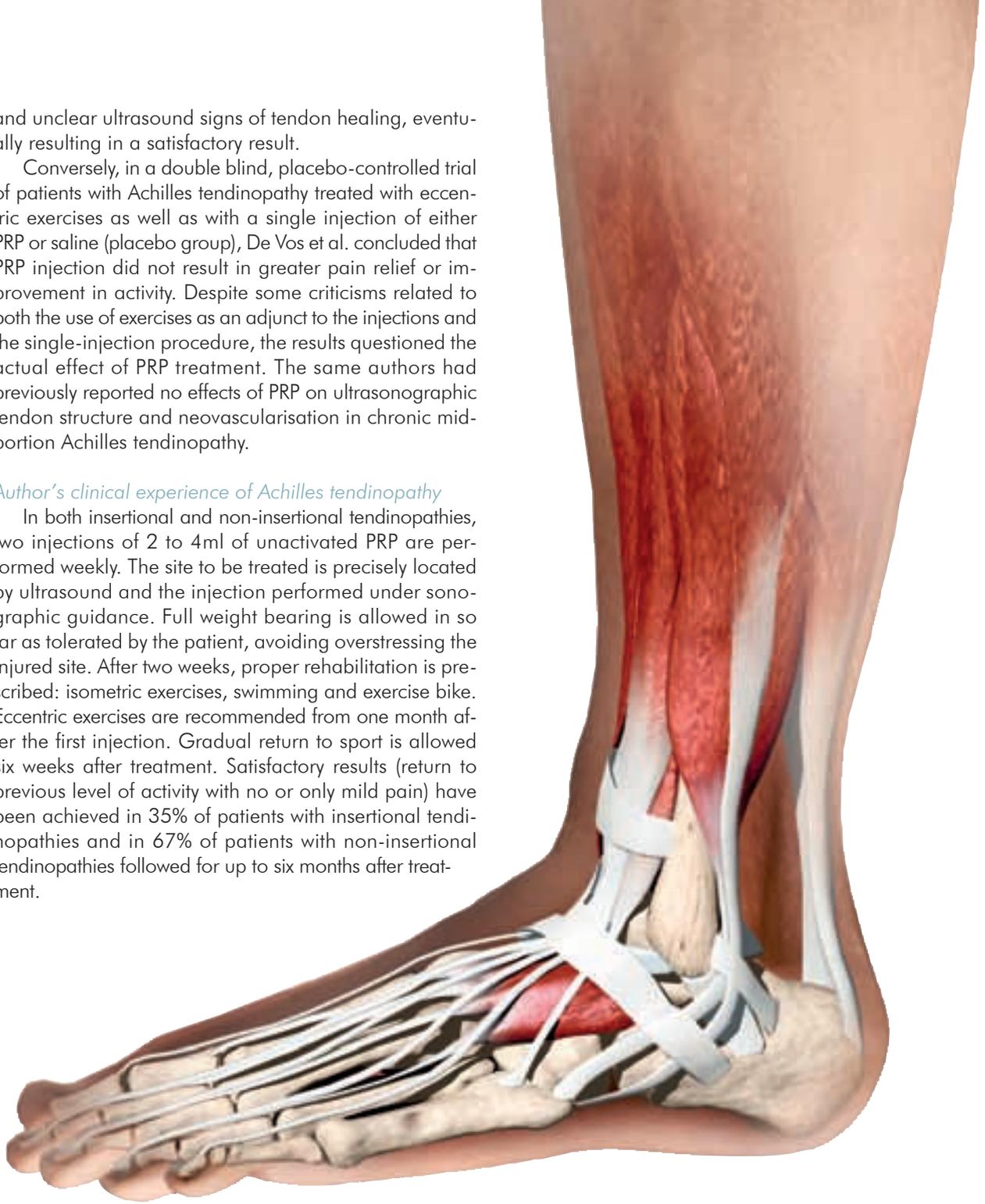
Besides the effect on inflammation, proliferation and remodelling, PRP was shown to specifically promote differentiation of tendon stem cells into active tenocytes. Moreover, recent studies evaluating the effect PRP on tendon healing in horses have shown positive results, as compared with a placebo, providing stronger and more elastic repair tissue. Although several studies are ongoing worldwide, clinical studies performed on athletes are less conclusive. In a study conducted on 15 tendons in 14 athletes affected by mid-portion Achilles tendinopathy and treated with a single injection of PRP followed by a long period of rest and rehabilitation, Gaweda et al. reported good results in terms of pain relief, return to sport and ultrasound appearance of the tendon tissue. In six cases, the injection was repeated due to persistent symptoms

and unclear ultrasound signs of tendon healing, eventually resulting in a satisfactory result.

Conversely, in a double blind, placebo-controlled trial of patients with Achilles tendinopathy treated with eccentric exercises as well as with a single injection of either PRP or saline (placebo group), De Vos et al. concluded that PRP injection did not result in greater pain relief or improvement in activity. Despite some criticisms related to both the use of exercises as an adjunct to the injections and the single-injection procedure, the results questioned the actual effect of PRP treatment. The same authors had previously reported no effects of PRP on ultrasonographic tendon structure and neovascularisation in chronic mid-portion Achilles tendinopathy.

Author's clinical experience of Achilles tendinopathy

In both insertional and non-insertional tendinopathies, two injections of 2 to 4ml of unactivated PRP are performed weekly. The site to be treated is precisely located by ultrasound and the injection performed under sonographic guidance. Full weight bearing is allowed in so far as tolerated by the patient, avoiding overstressing the injured site. After two weeks, proper rehabilitation is prescribed: isometric exercises, swimming and exercise bike. Eccentric exercises are recommended from one month after the first injection. Gradual return to sport is allowed six weeks after treatment. Satisfactory results (return to previous level of activity with no or only mild pain) have been achieved in 35% of patients with insertional tendinopathies and in 67% of patients with non-insertional tendinopathies followed for up to six months after treatment.



Foot tendons and ligaments

Achilles tendon rupture

Many treatment methods (conservative and surgical) have been advocated to improve tendon healing with the aims of minimising the risk of re-rupture and shortening the time before the patient returns to the same level of activity as before. Encouraged by animal and laboratory studies, several authors have used PRP as augmentation in the surgical repair of subcutaneous Achilles tendon ruptures. PRP can be used either as a clot filling the gap before final closure of the defect or as an unactivated liquid preparation injected after definitive closure of the defect before or even after skin closure.

Sanchez et al. were the first to compare the PRP-augmented surgical repair of Achilles tendons with their historical controls, reporting that perioperative PRP treatment allows early return to sport.

On the other hand, in a randomised single-blind study using a sophisticated biomechanical analysis of elasticity modulus (RSA, roentgen stereophotogrammetric analysis), Schepull et al. concluded that PRP augmentation was not useful for the treatment of Achilles tendon rupture.

Author's clinical experience of Achilles tendon rupture

PRP treatment is used to augment surgical repair, with 3ml of activated PRP gel placed in the tendon gap between its final closure. After skin closure, another 3ml of unactivated PRP is injected percutaneously. After the stitches have been removed at two weeks, a further 3 to 4ml of unactivated PRP is injected under ultrasound guidance. Post-operatively, the leg is placed in a below-the-knee brace

with no weight bearing allowed until four weeks, when full weight bearing with a brace, active motion and swimming are permitted. At eight weeks the brace is removed and progressive rehabilitation is encouraged. Return to sport is allowed as of the third month, depending on the patient. At six months, a full return to sport is achieved in 80% of cases.

Patellar tendinopathy

Patellar tendon tendinopathy (jumper's knee) is challenging and refractory, often resistant to various forms of conservative treatment, including the most recent and advanced forms of physiotherapy. Encouraged by results obtained on animals showing increased vascularity, levels of types II and III collagen and macrophages, suggesting a positive effect on repair and remodelling, as well as on the mechanical properties of a partially resected rabbit's patellar tendon, PRP was used to treat refractory jumper's knee in athletes. While the first results published by Kon et al. were encouraging, results later presented by the same group were less satisfactory. In fact, using three fortnightly sessions of PRP injections in conjunction with rehabilitation, Filardo et al. documented no statistically significant differences in pain levels, recovery times or patient satisfaction, although a greater improvement

in sports activity was achieved by the PRP group compared with the control group (rehabilitation alone).

Author's clinical experience of patellar tendinopathy

Two 2 to 4ml injections of unactivated PRP are performed weekly following the technique used for insertional Achilles tendinopathy. Post-treatment rehabilitation protocol is the same as for Achilles tendinopathy, with gradual return to sport allowed six to eight weeks after treatment. Surprisingly, our preliminary results are very encouraging, with 80% excellent to good results at six months. Moreover, ultrasound follow-ups reveal a better structure of the tendon as compared with pre-treatment findings. The results of PRP treatment compare well with a previous, similar series of patients conservatively treated with extracorporeal shock wave therapy.

Plantar fasciitis

Following the same procedure and rehabilitation as used for Achilles tendinopathies, more than 80% of results were satisfactory at six months in a mixed population of athletes and non-athletes undergoing a combined treatment of PRP, orthoses and stretching exercises. These results compare well with a previous series of patients treated with orthoses and extracorporeal shock wave therapy.

In the heat of the action, muscle tears can easily happen



Muscle strains

Muscle strains are extremely common in football and account for significant time loss. A recent survey by Prof. Jan Ekstrand estimates that hamstring strains account for 10% of absences from competitions. The healing process is slow and re-injury common. When muscles are injured, capillary rupture and bleeding occur, haematomas form between the stumps of the myofibrils and inflammatory cells invade. Platelets arrive, adhere to the exposed collagen, become activated and release growth factors. The regenerative phase suddenly begins. Satellite cells are activated and produce myoblasts, which eventually fuse with other myoblasts resulting in mature myofibres. As regeneration and remodelling occur, other factors appear to encourage fibrosis, which is the key inhibitor of complete muscle healing. The fibrotic tissue provides an early framework for ruptured myofibres. As the fibrous tissue becomes increasingly dense, it restricts the regenerating myofibres from rejoining, thus preventing axons from creating new neuromuscular junctions. Fibres that are not innervated will ultimately undergo atrophy.

There have been many attempts to speed up and improve muscle healing. Ice, compression and rest are the mainstays of initial treatment, while rehabilitation, including stretching and eccentric exercises, in association with various forms of physiotherapy has been advocated. Moreover, in Europe there was great enthusiasm for a combination of Traumeel S, Actovegin and local anaesthetic injections, despite poor clinical evidence of their efficacy and little theoretical scientific foundations. Although the use of PRP has its rationale, due to the high concentration of platelets that play an important role in muscle healing, as confirmed by some interesting *in vitro* and animal studies, studies on human muscle are few and of limited methodological quality. Wright-Carpenter et al. and Sanchez et al. reported shorter recovery times with PRP treatment compared with their previous experiences with more traditional measures. Conversely, in a recent paper presented at the 2011 meeting of the American Association of Orthopaedic Surgeons, Bhadra et al. did not

report any difference in return-to-sport in a series of American football players treated with PRP injections under ultrasound guidance compared with a similar group undergoing conventional treatment.



A ruptured Achilles tendon

Author's clinical experience of muscle strains

We are using PRP in case of vast haematomas following muscle strain requiring aspiration. Using echographic guidance, after aspiration of the haematoma, 3 to 5ml of unactivated PRP is injected using the same syringe left in place. An elastic compression bandage is applied and restricted movement (use of crutches) is recommended for one week. The procedure is repeated one to two weeks later if the haematoma recurs. In no case do we recommend the use of PRP in the first 24 hours after injury.

In our preliminary experience, the use of PRP seems to decrease the rate of haematoma recurrence, allowing an earlier return to activity.

Anterior cruciate ligament reconstruction and other acute ligament tears

ACL reconstruction is one of the most-performed surgeries in football. Top teams can expect an ACL rupture every other season, with much greater frequency among women. If no complications occur, patients return to activity four to eight months after surgery.

Autologous grafts (central third of patellar tendon or semitendinosus and gracilis tendons) are the preferred grafts for replacing the native, disrupted ACL in athletes and have an 80 to 95% success rate. Tendon graft remodelling, also known as ligamentisation, is very important for ACL repair because it improves, to some extent, the functionality and success of the procedure. Moreover, the biological fixation at the extremities of the graft in the femoral and tibial tunnels is of paramount importance to the final stability of the reconstructed ACL. Sanchez et al. used PRP to promote ligamentisation of grafts, showing that PRP influenced the histologic characteristic of the tendon graft, resulting in more remodelling compared with untreated grafts. Similar findings have been reported by Radice et al. and evaluated by MRI. PRP has also been used to promote tendon-to-bone healing in the tunnels with encouraging preliminary results. Moreover, PRP could reduce the tunnel enlargement that frequently occurs after surgery, sometimes resulting in graft failures and problematic revision surgery.

Single PRP injections have also been used to treat grade II isolated medial collateral injuries in footballers with return-to-play shortened by 27% compared with a control group.



Author's clinical experience of ACL reconstruction

We have used PRP to promote tendon-to-bone healing in the femoral and tibial tunnels with an apparent better tendon-bone interface, as revealed by MRI imaging. However, the use of PRP did nothing to reduce tibial tunnel enlargement compared with a control group.

Goalkeeper injuries (rotator cuff tendinopathy)

Impingement syndrome with or without rotator cuff tears can affect goalkeepers, possibly resulting in their inability

Conclusions

PRP is an exciting new technology which may have the potential to serve as an alternative or adjuvant treatment to surgery for many common football injuries, the safety of which has been confirmed by several studies. Although justified by a strong biologic rationale, more evidence is needed to validate its use in a clinical setting and to support its widespread use. The majority of human studies have been performed with small sample sizes and limited controls. There is a need for prospective, randomised,



Niedermueller/Bongarts/Getty Images

to compete. The use of PRP has been extensively proposed to treat grade I and II rotator cuff tears (tendinopathy and partial tears) as a single treatment or for augmentation in a surgical procedure. The results reported by several authors are inconsistent and our experience is too limited in this field to confirm or refute their conclusions.

Anti-doping regulations and PRP

Platelet-derived preparations administered by intramuscular, intratendinous or intraarticular routes have been removed from the WADA Prohibited List for 2011, which now applies in all UEFA competitions. They therefore no longer require a therapeutic use exemption (TUE). Current studies on PRP do not demonstrate any potential for performance enhancement beyond a potential therapeutic effect.

Goalkeepers are more prone to rotator cuff tendonitis

controlled double-blind studies that meet the requirements for properly powered studies. Moreover, while great business has been generated by this new technology, any potential economic benefit for institutions and practitioners should be considered within a more comprehensive evaluation of the technique. However, although preparation methods, injection procedures and rehabilitation protocols should be standardised, the use of PRP in the treatment of football-related injuries appears to be a promising advance worthy of further investigation. ●

The ABC of hepatitis in professional football

By Michael Jacobs* of the Royal Free Hospital, London, and Ian Beasley of The Football Association

This article aims to introduce the reader to three very common viral infections: hepatitis A, hepatitis B and hepatitis C. The similarity in their names is misleading. Although they all cause hepatitis, which means inflammation of the liver, these viruses are unrelated.

Their risk to footballers differs substantially and they are prevented in different ways. The aim of this article is to promote best practice in professional football.

Hepatitis A

The hepatitis A infection is spread throughout the world. The virus is passed in the faeces of infected individuals, and thus can contaminate their hands, food that they handle

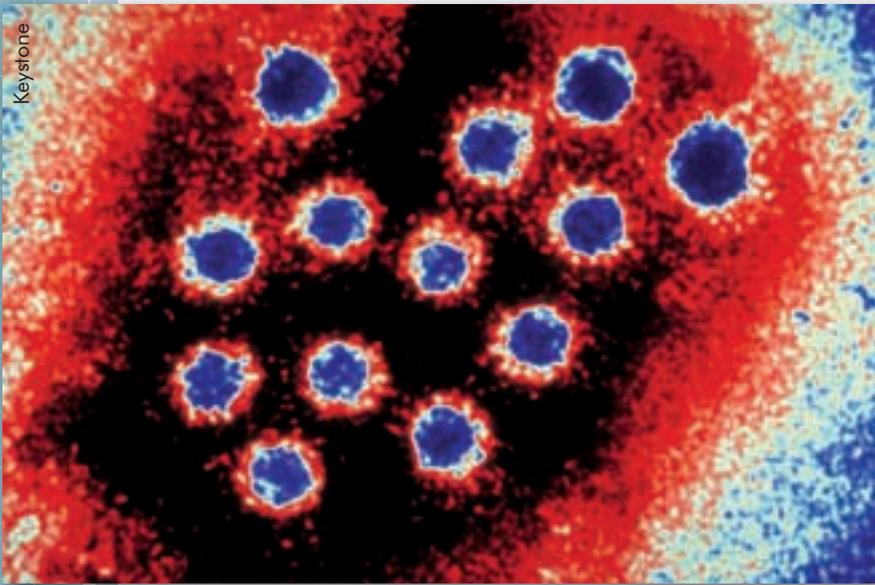
to others. Although the hepatitis A virus cannot cause chronic (long-term) infection and the great majority of infected individuals recover completely without any treatment, the illness can be prolonged: 15% of infected individuals have still not fully recovered after three months.

Implications for football players

Increased international travel for matches may increase the risk of infection in football players. Fatigue is a prominent symptom of hepatitis A infection and may last for months. Strict rest used to be advised during recovery, but current evidence suggests that this does not improve outcomes. Following hepatitis A infection, individuals can determine their own capacity for exercise, but a footballer may need to miss weeks or, rarely, months of training.

Prevention

Adherence to sanitary practices such as hand-washing is important to prevent the spread of numerous infections, including hepatitis A. A safe and highly effective vaccine against hepatitis A is widely available. Two doses given 6-12 months apart offer near complete protection against hepatitis A, and it is very unusual to suffer any adverse effects from the vaccine.



The hepatitis A virus

and water supplies. The virus is spread by ingestion, and therefore contact with an infected person or travel to areas of the world with poor sanitation and hygienic practices are major risk factors for infection. Eating undercooked shellfish also poses a risk. Although hepatitis A is often a trivial illness in children, it can cause a debilitating and sometimes prolonged illness in adults. The first symptoms appear two to seven weeks after infection and are characterised by feverishness and fatigue. A few days later, jaundice (yellow discolouration of the skin and eyes) may appear and, soon after, the individual is no longer infectious

Specific recommendations for professional football

All professional footballers and club staff at increased risk (for example those that travel abroad with the teams) should be offered immunisation against hepatitis A. Some players, particularly those brought up in countries with high rates of hepatitis A, may have been infected in childhood without knowing it. Although infection offers lifelong protection against re-infection, there is no need to test for prior immunity before immunisation. Also, the vaccine is effective in nearly everyone, so there is no need to test for immunity post-vaccination. Immunisation should be carefully recorded so that it is not repeated unnecessarily or inadvertently missed if an individual moves clubs.

Hepatitis B

Quite unlike hepatitis A, the hepatitis B virus is not spread through food but by contact with body fluids of an infected individual. In the developing world, the major routes of transmission are from mother to child and between young children. Most individuals infected in early life are unable to clear the virus, and hence develop long-term infection (chronic hepatitis B, CHB) that often persists for the rest of their life. There are an estimated 350 million people worldwide with CHB, and 8% or more of the population are infected in many regions of the world such as parts of sub-Saharan Africa and Southeast Asia. Most individuals with CHB are asymptomatic, but some develop progressive scarring in the liver that, over years, results in liver cirrhosis. Individuals with CHB are also at greatly increased risk of liver cancer. Hepatitis B can also be acquired in adult life through exposure to body fluids – for example through sex, injecting recreational or performance-enhancing drugs, unsafe medical or dental practices, tattooing or body piercing. Adults infected with hepatitis B frequently develop an illness similar to hepatitis A, although the incubation is longer (2-6 months). Like hepatitis A, symptoms such as fatigue may be prolonged. However, most adults infected with hepatitis B recover completely and, unlike children, clear the virus, with less than 5% developing CHB.

Implications for football players

Individuals born and raised in countries with a high prevalence of hepatitis B are at greatest risk of having CHB, which may be asymptomatic and undiagnosed. Participation of individuals with CHB in elite competitive sports is well recognised. Therefore there is potential for transmission from an infected player to another player or staff member on the field, particularly after a blood injury. It is difficult to quantify the risk, but it appears to be small and is generally acknowledged to be much smaller than the risk of acquiring hepatitis B infection during off-the-field activities, such as unprotected sex.

Prevention

Strict adherence to universal precautions when dealing with any body fluids, such as blood injuries, is essential to prevent transmission to other players and staff. Outbreaks of hepatitis B in sports teams have been described and are most likely to occur when universal precautions break down. A safe and highly effective vaccine against hepatitis B is widely available. Three doses offer complete protection against hepatitis B in the great majority of recipients, and it is very unusual to suffer any adverse effects from the vaccine.

Specific recommendations for professional football

A local policy on universal precautions should be established and widely disseminated within a football club. All professional footballers should be screened for CHB with a blood test. Players with CHB need referral for specialist care and long-term follow-up to ensure that they receive appropriate treatment if needed. Treatment for CHB is highly effective in suppressing viral replication and preventing progression of liver disease, but is generally not curative. On the balance of risks, players found to have CHB should not be prevented from playing. Other players and staff who are likely to come into contact with

body fluids (coaching staff, physiotherapists, kit men, etc.) should be immunised against hepatitis B unless they are shown to have prior immunity (from previous infection or vaccination). The response to immunisation should be checked with a blood test and specialist advice should be sought for the few who do not respond adequately to immunisation. Immunisation should be carefully recorded so that it is not repeated unnecessarily or inadvertently missed if an individual moves clubs.



Vaccination is effective against hepatitis A and B

Hepatitis C

Hepatitis C is another common infection, with approximately 170 million individuals infected worldwide. The great majority of transmission occurs through blood-to-blood contact. In the developed world, the use of injected drugs, including use of performance-enhancing drugs, is the major risk – the virus is transmitted through sharing needles and other injecting paraphernalia. Snorting cocaine can also transmit hepatitis C through blood contamination of shared straws. Tattoos and piercings using unhygienic practices are also a risk. In less developed parts of the world, unsafe medical practices (blood transfusion, reusing medical devices, etc.) remain a major route for transmission. It is relatively uncommon for hepatitis C to cause an acute illness with jaundice, and infection is often unrecognised. However, the majority of infected individuals are unable to clear the virus and develop chronic hepatitis C (CHC). Like hepatitis B, over years this can cause progressive scarring of the liver leading to cirrhosis and liver cancer. Individuals with CHC may also suffer a range of non-specific symptoms, including fatigue and poor concentration. This may limit their ability to participate in elite sports.

Implications for football players

There is a theoretical risk of transmission from an infected player to another player or staff member on the field after a blood injury. The risk is probably very small.

Prevention

Avoidance of high-risk behaviour is the mainstay of prevention of hepatitis C. Hepatitis C is less infectious than hepatitis B and sports-related outbreaks are unlikely, other

than in exceptional circumstances, such as a complete breakdown of universal precautions (e.g. using a shared bucket and sponge to treat blood injuries) or sharing equipment for injecting performance-enhancing drugs. There is no vaccine against hepatitis C.

Recommendations for professional football

Players should be educated about off-the-field activities that put them at risk of hepatitis C, which may be a career-threatening infection. Universal blood test screening of players for hepatitis C may not be justified. Instead, targeted screening of players who declare a risk factor, even in the distant past, may be a reasonable strategy. Players with CHC should not be prevented from playing. They should be referred for specialist care to consider treatment, which is prolonged (at least six months currently) and arduous but can be curative.

Concluding remarks

Hepatitis viruses are common infections that may have serious consequences for professional football players. Professional football has yet to fully get to grips with these infections. The widespread implementation of good hygiene and universal precautions has greatly reduced the risk of sports-related transmission, and these measures should be adopted throughout football at all levels. The risks to football players are substantially greater off the field than on it. Education of players and football club staff is essential to prevent infections. There is a lack of evidence to support recommendations for best practice in professional football, and further studies (such as prevalence studies among players) are needed. Until then, the professional game should

take a pragmatic approach and ensure all the available resources, including widespread immunisation, are utilised to prevent these infections and that infected individuals are identified and referred for specialist care. ●

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FURTHER READING

- <http://www.cdc.gov/hepatitis/>
An excellent web resource on viral hepatitis

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Blood contact must be avoided