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MEDICAL PRE

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COVER
The teams participating in EURO 2008 are getting ready, as demonstrated by Austria and Germany. It's all go on the medical side too, to make sure that everything is in place for the big summer tournament.

Photo: Flash Press

The European Football Championship is the big sports event of summer 2008. All football fans, and many other Austrians and Swiss, are full of pride and eager anticipation in view of the forthcoming tournament. All eight host cities (four in Austria and four in Switzerland) are expecting hundreds of thousands of visitors and have everything in place for their arrival. Public transport and accommodation is on hand and both host countries are doing everything in their power to ensure the safety and security of their visitors. That said, we are, of course, expecting respect – a notion shared by all football fans. Hooligans have no place in our beautiful countries!

On Swiss TV recently, there has been a light-hearted, entertaining competition between the host cities and I am particularly pleased to announce that Berne, my hometown and region, came out on top.

UEFA, with the support of the chairman of the UEFA Medical Committee, Dr Michel D'Hooghe, has given me the role of medical coordinator at EURO 2008 and I can confirm that UEFA has done an excellent job of thinking through and organising medical care for the spectators, teams and team staff, in accordance with UEFA Medical Committee guidelines.

The team doctors' briefing regarding their rights and responsibilities took place in Vienna. At the meeting, the focus was on four main issues:

1. **Anti-doping measures during EURO 2008,** with the aim of doping-free football and respect. For the first time, blood tests will be taken at the European Championship in addition to urine tests. Doping control officers (DCOs), who are doctors specially trained in taking blood samples, will carry out the blood tests. This move will enhance the accuracy of detection, especially where "blood-doping methods" are involved. Thankfully, doping in football is rare. For

EDITORIAL

By Dr Urs Vogel
First vice-chairman of the UEFA Medical Committee

PARATION FOR THE EURO 2008

every 1,000 players tested, four to seven test positive. The most common cases are of illegal recreational drug use (cannabis and cocaine). With more players tested and the additional blood tests, we hope to cut the number of doping culprits further still.

2. **Injury studies during EURO 2008,** with the aim of constantly learning more about the risks of injury in football so that we can make recommendations on preventive measures. For years UEFA has endeavoured to draw the most accurate possible accident statistics from all major competitions. Prof. Jan Ekstrand, member and vice-chairman of the UEFA Medical Committee, has contributed a great deal to these surveys, which are immensely valuable to all team doctors, and indeed to all players.

3. **Medical check-ups necessary for players,** to safeguard their health. Sadly we are sometimes faced with sudden deaths in sport, but also with the long-term effects of the enormous demands on players, especially among those who fail to give their injuries sufficient time to heal. This includes long-term damage resulting from muscle and joint injuries, but also problems as a result of insufficient rest following concussion.
We know that with precise testing every year, including cardiovascular tests (electrocardiogram, and an echocardiography as early as possible in footballers' careers), a number of players at particularly high risk could be identified. Even if this enabled us to prevent just one sudden death, our efforts would not have been in vain.

4. **EURO 2008 medical organisation,** with the aim of providing all team doctors with the maximum support possible.
All the stadiums in the host cities are in top condition and excellently organised, even in medical terms. Emergency procedures have been put to the test and provisions are in place for dealing even with crisis situations (additional beds will be provided for 1% of spectators, for example). All risks to spectators will be minimised to the greatest extent possible, so that fans can enjoy the football to the full.

In terms of medical care for the teams and their staff, arrangements have also been made to support the team doctors. One chief medical officer has been appointed for each host country and there will be a local medical officer for every designated 100km radius. Special clinics have been designated in each of these 100km areas with all the staff and equipment needed to guarantee the players and team staff the appropriate examinations and treatment. Team doctors can quickly get anything they need via the local medical officers, who will be on hand 24 hours a day.

So, with our preparations at an advanced stage on the medical side, we can now fully enjoy the countdown to EURO 2008.

SUDDEN CARDIAC DEATH – HOW CAN WE PREVENT IT?

Sadly, the question is pertinent. All manner of statistics can be produced to illustrate the rarity of deaths on the football pitch. But, in this case, the percentages – however small they may be – are irrelevant. UEFA is not alone in sustaining that one death on a field of play is one too many. This was the starting point for the following article by Prof. Paolo Zeppilli, a member of UEFA's Medical Committee, and Massimiliano Bianco, his colleague in the sports medicine faculty at the Catholic University of the Sacred Heart (a highly appropriate name in this context) in Rome.

It was drafted in the wake of the cardiac arrest suffered by Sevilla FC's Antonio Puerta at the beginning of the current season and, unfortunately, took on greater relevance when the 35-year-old Motherwell FC captain, Phil O'Donnell, also collapsed during a Scottish league game against Dundee United FC between Christmas and the new year. As fate would have it, one of the stands at Motherwell's Fir Park stadium is named after the club's former international Davie Cooper, struck down by a brain haemorrhage at 39 while filming a training video for young players. Antonio's partner has since given birth to the son she was carrying; Phil left a wife and four children. Such fatalities in the football family may be few and far between. But they have been regular enough to become a serious cause for concern.

Although cases are, mercifully, rare, the sudden death of a professional football player has a devastating impact on the sport's community. If it occurs during a major event, the traumatic effect, magnified by media coverage, is even greater. Citing examples, we can recall the death on the pitch, during a FIFA Confederations Cup match, of 28-year-old Marc-Vivien Foé, victim to hypertrophic cardiomyopathy. Or 24-year-old Miklós Fehér, who collapsed in a Portuguese league match between SL Benfica and Vitória Guimarães just as he was turning away after receiving a yellow card. More recently, 22-year-old Spanish defender Antonio Puerta suffered further cardiac arrests in the dressing-room a few minutes after apparently recovering from a syncope which had led him to collapse on the field of play. At the time of writing this article, the authors have no information on the cause of death (the media suggested arrhythmogenic right ventricular cardiomyopathy), but it is a fact that the Sevilla FC defender had suffered at least one unexplained syncope in the months before the fatal event.

Exercise-related sudden death (ESD) can be defined as *"an unexpected, fatal cardiac arrest, occurring within one hour of an exercise bout, in an apparently healthy person."* Following this definition, ESD is undoubtedly a rare occurrence with an incidence of 0.3-1/100,000 per year in males. This is the main reason why, even now, there is controversy among experts on the usefulness and cost-effectiveness of routine medical pre-participation screening in athletes.

Cardiac diseases are, in fact, responsible for 80-85% of cases of ESD. Cardiac arrest usually occurs during or immediately after a strenuous effort, and it is more frequent during official matches than training sessions. This suggests that both acute changes in the cardiac autonomic nervous system with exercise and mental involvement in a competition play a significant role in precipitating life-threatening arrhythmias in a *"vulnerable myocardium"*.

Atherosclerotic coronary disease is the dominant substrate in master athletes (marathon runners, cyclists, etc.) aged 35-40 years or more, but it is not a total rarity in football players nearing the end of their careers, as the very recent case of Scottish player Phil O'Donnell illustrates. In younger

Physical preparation must be not only intense, but accompanied by medical tests too.

athletes (<30 years old), the substrates of ESD are represented by a wide spectrum of congenital (hereditary) or acquired heart diseases, the most frequent being:

- ***Hypertrophic cardiomyopathy*** (HCM), a genetic disease with a prevalence in the general population of about 0.2%. It accounts for 30-35% of cases of ESD in the USA *(Maron NEJM, 2003),* a feature that can be explained both by its greater prevalence among black communities and by the lack of compulsory medical pre-participation screening. HCM is characterised by moderately-severe left ventricular hypertrophy (usually asymmetric) with normal-reduced cavity size. Myocardial disarray and progressive fibrosis, impairment of diastolic filling and myocardial ischemia, explain the propensity to life-threatening arrhythmias and sudden death, especially during exercise. HCM must be differentiated from the *"athlete's heart",* characterised by moderate (symmetric) left ventricular hypertrophy with normal-increased cavity size, and normal (or *"supernormal"*) diastolic filling. Athletes with HCM may be totally asymptomatic, and physical examinations may be negative. However, because the *rest electrocardiogram (ECG) is distinctly abnormal in 80-90%* of cases, the disease can be easily diagnosed or suspected by routine electrocardiographic examination. In general, a well-conducted echocardiogram (ECHO) and cardiac magnetic resonance imaging (MRI) are all we need to confirm the diagnosis.

- An ***anomalous origin of a coronary artery*** (AOCA) is very rare in the general population, but implies a high risk of dying during effort *(Corrado D et al., JACC 2003).* The most malignant form is the origin of the left main trunk in the right sinus of Valsalva, particularly when its course to the usual position is between pulmonary artery and aortic root. Unfortunately, an AOCA is rarely diagnosed. Despite histologic features of acute and chronic ischemia in the autopsies, only a minority of cases have warning symptoms in life, in particular chest pain, palpitations or syncope on effort. Moreover, physical examinations, rest and stress ECGs are frequently negative, or may show non-specific findings. Nevertheless, when warning symptoms are present, an attempt to exclude an AOCA is advisable.

Gennaro Gattuso, AC Milan and Italian international midfielder, undergoes a check-up during training.

Lab tests complement the series of tests on the field.

ECHO can be useful as a first diagnostic approach in experienced laboratories but, nowadays, angio-MRI and angio-coronary computed tomography (angio-CT) can help doctors to solve doubts on coronary artery anatomy.

- ***Arrhythmogenic right ventricular cardiomyopathy*** (ARVC) is a genetic disease causing progressive fibrosis and fatty infiltration of the right ventricular myocardium, causing moderate-to-severe cavity dilation. Athletes with ARVC may be asymptomatic or complain of palpitations, pre-syncope/syncope, at rest and/or during effort. Physical examinations may be negative, but the ECG is often atypical, showing one or more of the following anomalies: incomplete or complete right bundle branch block, negative T waves from V1 to V3-V4, and ventricular premature beats/ventricular tachycardia with left bundle branch block QRS morphology. ECHO and MRI allow us to better confront diagnostic suspicions.

- ***Myocarditis*** (MYOC) is an inflammatory condition of the myocardium, usually due to viral infection. It may have an acute beginning, with angina-like chest pain and cardiac failure, but athletes with MYOC may complain of more subtle symptoms (exercise intolerance, resting tachycardia and excessive heart-rate increase in exercise, palpitations), appearing days or weeks after a flu-like illness. The ECG may show repolarisation abnormalities, conduction disturbances and atrial/ventricular arrhythmias. Since either active or healing MYOC may be responsible for ESD, an early clinical diagnosis and full recovery are mandatory for a safe return to sport.

- ***Wolff-Parkinson-White (WPW) syndrome*** is characterised by the presence of one or more congenital *accessory electrical pathways* in the heart. Depending on the electrophysiological characteristics of the pathway, atrial impulses, bypassing the atrioventricular node, can reach the ventricles more rapidly and, in the case of paroxysmal atrial fibrillation, desynchronisation of ventricular electrical activity deteriorating into ventricular fibrillation may occur. The WPW prevalence in the general population ranges from 0.15% to 0.2%, but the risk of ESD regards only very few cases. An invasive or transoesophageal electrophysiological study is mandatory in athletes showing symptoms of palpitations or presyncope/syncope on effort.

- ***Primitive electric cardiac diseases*** are due to genetic anomalies of ion channels *(channelopathies).* They include rare, but potentially malignant conditions, such as long and short QT syndromes, Brugada syndrome, polymorphic catecholaminergic ventricular tachycardia, etc. However, in the large majority of cases, diagnosis can

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The UEFA Medical Committee at its November meeting.

be obtained simply by an accurate analysis of an ECG.

- ***Drugs and doping:*** both amphetamines and cocaine have a pro-arrhythmic effect, which may be increased by dehydration, dyselectrolytemia and, especially, by the presence of a concealed heart disease. Anabolic steroids may cause pathologic cardiac hypertrophy, myocardial fibrosis andaccelerated atherosclerosis, which may lead to acute myocardial infarction, life-threatening arrhythmias and death. ESD has also been linked to erythropoietin abuse, probably because of increased blood viscosity and thrombogenesis.

- ***Commotio cordis*** (CC) is a fatal electrophysiological event caused by chest impact which may occur in individuals with a normal heart. Blows delivered just over the precordium, and within a narrow electrically vulnerable period of the cardiac cycle, may start ventricular fibrillation (or, more rarely, complete atrio-ventricular block). CC has been reported in baseball, softball, ice hockey and lacrosse. To our knowledge, at least one death has occurred in football due to CC: a goal-keeper in the Argentinian league who, in blocking a penalty kick, received a violent impact when the ball hit his chest and fell unconscious.

This means that exercise-related sudden death in football players can be due to different cardiac diseases. In order to prevent (or to limit) this type of fatality, team doctors should assess with great care any player who presents warning symptoms (chest pain, palpitations, presyncope/syncope during effort), heralding potentially fatal cardiac conditions. Equally importantly, players must be educated to *report* any such symptoms to the team doctor even if they appear off the pitch or away from the dressing room.

Furthermore, since most of these conditions are hereditary and present at post-pubertal age, routine pre-participation medical screening is advisable in young players starting their footballing careers – and not only when they achieve professional or first-team status. Although the effectiveness of screening largely depends on the know-how of visiting doctors, a simple and low-cost procedure involving careful medical and family history, a thorough physical examination and a rest ECG, can identify a significant number of subjects at risk. Further non-invasive investigations (ECHO, stress ECG, Holter monitoring, MRI and angio-CT) can be usefully pursued when any diagnostic doubt arises.

Gene/AFP/Getty Iamges

LIQUID ASSETS

Hydration is a topic which has been broached in previous issues of Medicine Matters and it is all too easy to associate its importance with high temperatures. But a research project undertaken in Belgium underlines the relevance of the topic, even in matches played under less torrid conditions. At the same time, it highlights the need for messages to be persistently delivered to younger age groups of football players in order to promote 'best practice' as a routine and provides compelling medical evidence to support those messages. The research was conducted by Jean-Pierre Van Biervliet, Karel Watteyne and Pieter D'Hooghe of Club Brugge KV's football academy, along with Stéphanie Van Biervliet (Paediatric Gastroenterology & Nutrition, UZ Gent), Dirk Bernard and Michel Langlois (both from the Clinical Chemistry Lab at AZ St-Jan, Brugge). If any readers are interested in obtaining full copies of the paper, complete with references, please email the corresponding author *jp.vanbiervliet@skynet.be.* Here, in abbreviated form, are the team's findings:

In medical literature, only limited information on the hydration of sporting children is available. Body weight loss by sweat and insensible water loss have an impact on physical and mental performances. That is why we studied the effects of pre-event hydration and immediate pre-event fluid intake on fluid balance during matches. The study involved male football players aged 15. An unannounced evaluation of current practice was performed immediately prior to kick-off, during the match and after the final whistle.

A team (n=13; not all playing a full match of 2 x 40 minutes) was examined and urine collected at three points: just before kick-off, at half-time and after the final whistle. They played at 2pm in cool (6°C), humid (85%) conditions far removed from those which are traditionally considered to be problematical in terms of fluid loss and the need for re-hydration.

Before the match, intake of water and/or sports drinks was normal. Urine osmolality and specific weight were determined, and volume (Vol_U) was derived from its weight and specific weight. Some players could not always void on request. The impact of start hydration on Vol_U and Osm_U was studied by splitting the cohort into two subgroups, based on T_0Osm_U: ≥ 300 mOsm/kg water, called *'bad start'*, and <300, *'good start'*. Body weight was measured before and after the match. As growth patterns among 15 year olds differ, data are given per m^2 of body surface. The sweat weight was calculated as [pre-match body-weight after voiding – full-time body weight before voiding + volume fluid pre-match to final whistle – Vol_U]. Results are given as medians and interquartile ranges (IQR). Pairwise linear correlations, Wilcoxon rank and M-W U-tests were performed.

The results were interesting. Heights and body weights of the players were within normal parameters. At half-time, the Vol_U was very low and it increased at full-time. The loss of body weight was 0.22 (IQR 0.13) kg/m^2 or 0.61 (IQR 0.36) per cent of pre-match body weight. The volume of sweat and insensible water loss was 0.34 (IQR 0.27) L/m^2. Individual fluid losses varied substantially.

In terms of quotient fluid intake / urine output, the total group quotient pre-match fluid intake / half-time urine output (I/O) was high at half-time and the I/O ratio decreased significantly by the end of the match (P'= 0.011 Wilcoxon). Differences in the I/O ratio existed between the *'good start'* and *'bad start'* groups at half-time and full-time. Among the *'bad starters'*, the I/O decreased from half-time to full-time whereas in the *'good start'* group, no differences between the quotient at half-time and full-time were detected.

Readings of urine osmolality and osmolar excretion were also relevant. Despite lowering Osm_U, the total osmolar excretion / period increased from 11.74 (IQR 15.6) mOsm/m^2 at half-time to 24.19 (IQR 34.9) mOsm/m^2 (Wilcoxon P'= 0.02) after the final whistle, which points to decreased renal clearing during the first half. In the *'bad start'* group, the half-time Osm_U was higher. Decreases in full-time Osm_U were confined to the *'bad starters'*. The Osm_U among the *'good start'* group

Plenty of water to rehydrate the players.

was low and remained low – indicating the value of good pre-event hydration for maintaining normal renal functions.

The project indicated that, even in cold weather, adolescent players lose substantial amounts of fluid. From the measuring of the weight decrease, we can derive that, for the group, about 900 mL/m^2 fluids over the Vol_U would be necessary for full compensation of body weight loss. Individual needs differ significantly due to differences in sweat production and energy expenditure. The sweat volume in professional players ranges from 1.69 ± 0.45 L (m ± 1 sd) in cold weather, to 2.19 ± 0.36 L per match in warmer environments. Rehydration fluids are essential for events of 60 minutes of more. Starting with near-maximal urine concentration is a prelude to early dehydration and compromised performance. Drinking only plain water increases risks of hyponatremia and heat cramping during sweating.

In all players, the half-time Vol_U was lower than the full-time Vol_U, regardless of pre-event hydration and pre-match intake. In the half-time Vol_U, the excreted electrolyte and osmole mass was lower. This can be explained by a redistribution of central blood flow from splanchnic and renal vascular beds to peripheral muscles and skin during exercise. Renal plasma flow and glomerular filtration rate decrease during intense exercise. Secretion of anti-diuretic hormone during exercise also contributes to low half-time Vol_U but increased aldosterone production also alters Vol_U by modifying reabsorption of sodium. The increased full-time Vol_U, despite a lower I/O ratio, could be explained by the altered workload (there was already a comfortable advantage for one team at half-time) on which the secretion of plasma vasopressin, aldosterone and plasma renin activity depend.

In the *'bad start'* group, fluids taken prior to kick-off prevented any further increase in half-time Osm_U, but half-time Vol_U remained low. In that group it was clear that sweat loss, combined with peripheral water retention, could result in decreased circulating extra-cellular fluid volume, causing early fatigue.

This highlights the importance of monitoring pre-event hydration by measuring body weight, Vol_U and urine concentration. Urine colour is a rough guide to concentration. Body weight loss should be monitored and re-hydration during games should be encouraged. This behaviour pattern should be implanted by stressing – starting with very young age groups – the importance of re-hydration during training sessions.

The study confirmed that, even in low ambient temperatures, sweat and insensible water loss are substantial in adolescents. The necessity of pre-event hydration and avoidance of *'bad starts'* with high urine concentrations should be stressed. Performances will be better and secondary risks prevented if isotonic drinks are taken during events. This is a message which needs to be delivered and repeated in order to promote best practice during formative sporting years.

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VISUAL FUNCTION AND SOCCER

By Gail Stephenson, head of Orthoptics, University of Liverpool

Success for any sportsman is based upon skilled decision-making. As some of the information necessary to make such a decision will be obtained from the visual system, it is clear that a detailed assessment of the visual system will provide useful indicators of performance for many sports. The sum of the ability of the visual system to respond to a visual stimulus can be described as visual function.

The visual system can be divided into three parts: the part responsible for receiving the information from the visual world (cornea, lens, retina), the part responsible for conducting the stimulus to the brain (retina, optic nerve, visual cortex), and the part which interprets the electrical stimulus into perceptions of objects (visual cortex). In addition there are six eye muscles which produce movements of the eye. In the same way as the ability to run is the result of a number of physiological processes, 'vision' is a term often used to described a range of physiological visual functions – each one very specific but in some cases interacting with other visual functions and within activities such as sport interacting with other physiological processes.

MAXIMISING VISUAL POTENTIAL

In football, a vision scientist with a knowledge of visual physiology can make a valid contribution in terms of undertaking detailed visual assessments of players, with emphasis being placed on the elements of vision most relevant to football and by maximising visual potential. To date, this role has been developed to encompass the development of visual training for players to improve future potential, to provide baseline measurements as part of overall medical records, and to evaluate and manage players following head trauma, episodes of migraine or any other visual symptoms.

With human evolution, the use of our visual system has been modified. In assessing the visual ability of a non-sports-playing cohort, it was found that, in this group, the visual system was used to approximately 50% of its potential. Skilled sportsmen on the whole use their visual system to a higher level but, in many instances, specific visual exercises will improve visual ability, especially if each function is assessed and improved where necessary. Improving either the quality of the information entering the visual system or the speed with which it is processed will have an effect on performance.

It must be stressed that this improvement can only be achieved in individuals with a normally developed, abnormality-free visual system and such exercises will not remove the need for spectacles or be a treatment for eye conditions such as cataract, glaucoma or retinal disorders.

SPECIFIC REQUIREMENTS

Different sports require different visual functions to be highly developed and, in football, this can be extended to specific requirements associated with playing positions within the team. From work undertaken over the past ten years at Manchester United FC, the following aspects of physiological visual function would appear to be relevant to football:

- Binocular coordination
- Stereoscopic vision
- Contrast sensitivity
- Peripheral vision
- Eye movements
- Visual reaction
- Spatial awareness

Binocular coordination is a component of several visual processes relevant to football as well as many other sports. Binocular vision is one of the most complex visual functions. Facetiously, one could say that life would be simpler if we had one eye. While this may be too simplistic, the precise coordination of two eyes, which is known as binocular vision, is so complex and influences so many aspects of visual performance that the statement is probably not too 'far-fetched'. The two eyes need to move at the same speed and be able to 'lock on' to a target situated at different distances, often rapidly changing the distance where binocular vision is required. In judging where to place a pass, footballers need to use this ability to change their position of gaze rapidly while maintaining

Empics Sport/PA Photos

Eye injuries require immediate treatment.

binocular vision so that an object is stimulating corresponding points of the two retinae. If this precise coordination is weak, it will affect the speed with which the two eyes can lock on to an object and subsequently the speed of visual reaction or accuracy of actions. While this function is controlled by the visual cortex part of the brain, it is maintained by the precise movements of the six extra-ocular muscles. Due to the muscular component of the function, fatigue also affects the accurate coordination of the two eyes. We have found that players whose control of binocular vision is weak have a poorer pass completion rate in the final 20 minutes of a game compared with the first 20 minutes. However, the control of binocular vision can be improved with specific exercises. Binocular vision is also an important prerequisite of stereoscopic vision (depth perception). In football this is involved in judging relative distance. This affects the interpretation of the player's position relative to other members of their team but also in relation to the position of the opposition. The level of stereoscopic vision achieved by players is related to the level of control of binocular coordination.

CONTRAST SENSITIVITY

Contrast sensitivity is the ability of the brain to detect differences in an object and its background – not in terms of its detail or colour but in its luminance and shade. The ability to detect contrast is especially important in lower levels of luminance. A high level of contrast sensitivity indicates a highly sensitive visual system. At times, and in certain lighting conditions, the contrast between the background and the sporting/playing area is not great. This function is particularly applicable to sports which take place under varying lighting levels or where an extremely sensitive judgment of terrain is required. In football this variation in light levels often applies to the difference between the background, which is usually the crowd, and the players on the pitch. Although the crowd, at larger stadiums, is a significant distance from the players, the contrast between background and players is still relevant in smaller stadiums.

Peripheral vision is the sensitivity of the eye to objects to the side of the player when they are looking straight ahead. A quantitative assessment of peripheral vision provides important information in football, where peripheral vision has been shown to be very important to the more highly skilled players. A high level of peripheral visual sensitivity will improve reaction to any stimuli from the periphery of vision. By assessing the sensitivity at varying distances into the periphery, important information can be acquired relating to an individual's awareness. For example, a player with weaker sensitivity in his right peripheral vision will be less effective when played in a position on the left side of

Daniels/AFP/Getty Images

If necessary, players can wear special glasses to protect their eyes during matches.

All eyes on the ball.

the pitch unless this reduction is improved by increasing his peripheral visual sensitivity to the right. Peripheral vision is very important to the performance of footballers in terms of pass destination and awareness of the relative position of opposing players.

FOUR SYSTEMS

There are four eye movement systems, which are responsible for moving the eyes at different speeds and/or in different situations. In football, players in different playing positions will rely on some systems more than others. An assessment of each system is therefore relevant.

The smooth pursuit system is responsible for slow following movements, restricted to the slow tracking of a moving object and therefore more a part of the goalkeeper's and defender's game than that of the midfield or forward player. Experienced players do not attempt to track a ball during its entire flight path but use their experience to view specific and relevant areas of the pitch to acquire the necessary information.

The saccadic system is responsible for fast movements between 400 and 700 degrees per second. Saccades are one type of movement in which there is some variation in the quality of the movement between skilled and less skilled groups.
The vestibular system is responsible for eye movements, which compensate for movements of the head. In football the head is rarely still. If the vestibular system is not highly developed, the quality of the visual image will be reduced due to the inability of the eye to continue to look at an object while the head is moving.

The vergence system is responsible for coordinated movement of the two eyes on an approaching object and is closely related to binocular coordination.

Visual acuity is the ability to read the letters on a standard vision chart. It provides a baseline measurement of one aspect of visual function but its importance to football is not straightforward. Visual acuity can be further divided into static visual acuity and dynamic visual acuity, static acuity being assessed with a stationary chart and dynamic acuity where the testing target is moving. Dynamic visual acuity is often referred to as an important component of visual function important to football. Dynamic visual acuity is really a combination of several functions: binocular vision, eye movements, motion detection and the ability to see detail. Detailed assessment of each of these contributing functions will provide information, especially if one of the functions is weaker. In sportsmen who have an error in the shape and size of their eye which causes them to be long or short-sighted, the assessment of visual acuity will influence whether there is a need for contact lens correction for sport performance.

FOOT/EYE COORDINATION

There are certain other features of the visual system which could affect performance. The importance of foot/eye coordination has been discussed by various sport scientists and most certainly its effect on the development of skilled footballers requires further research. The area of spatial awareness is related to this and the role of the visual system in accurately judging the position of our body in space is one which we are currently assessing. Coaching skills appear to modify the ability to judge the body's position in space in those sports where there is a requirement to move the body through space at speed.

People often talk about reaction time in relation to sport vision and to football. Reaction can be divided into the physical response and the visual response. The way this reaction is measured often influences the result of the measurement and therefore the method used has to be taken into consideration when analysing the results.

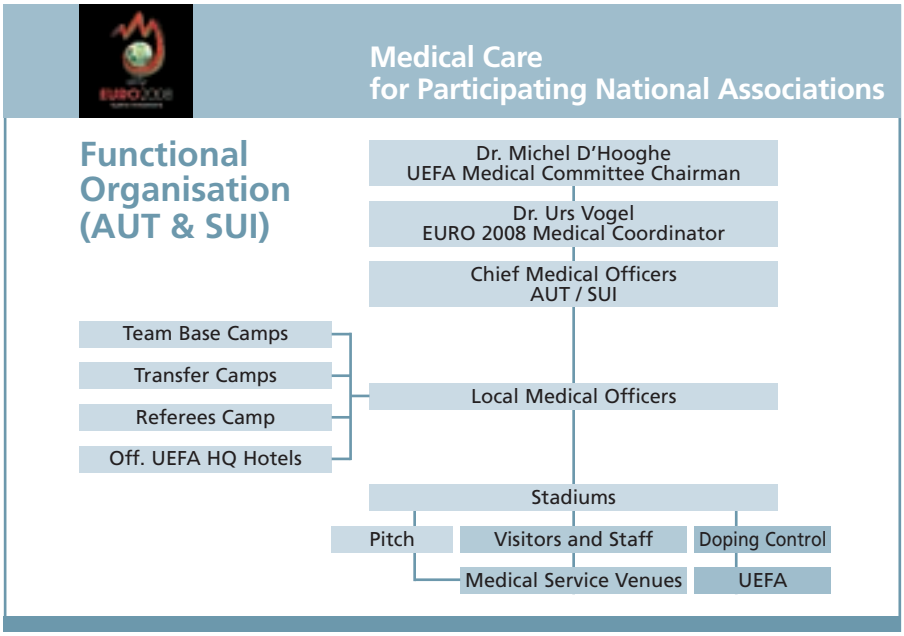
'Keep your eye on the ball' was a frequently quoted coaching war cry. With the development of more sensitive visual assessment tools and the possibility of improving the assimilation of visual information, sports vision as a part of sports science can be a useful support tool for coaches involved in player development.

THE EURO CHECKLIST

As the editorial by Dr Urs Vogel explains, medical preparations for EURO 2008 have been meticulous and, in various ways, groundbreaking. But, of course, only 16 – less than one third – of UEFA's member associations will gain first-hand experience at the final round. So it's worth taking a slightly more detailed look at some of the topics mentioned by Dr Vogel with the ultimate aim of encouraging as many national associations as possible to upgrade their medical parameters to EURO standards. Some have already attained them. But, within Europe's footballing family, there is still a great deal of work to be done if we are to guarantee that football is a safe and healthy sport.

At the same time, some of the measures being implemented in Austria and Switzerland may be of help to associations who, in the future, plan to host a final round. In this respect, it has to be stressed that the plans drawn up for this June's event are by no means exclusively focused on providing efficient medical care for the 16 teams. There is also a '17th team' of match officials. There is a strong squad of UEFA and Euro 2008 SA staff. Visitors and guests cannot be neglected. And it would be morally unforgivable to deploy 5,000 volunteers at the eight venues without providing them with medical back-up. All of these 'target groups' are in addition to the 'public service' strategy now being put in place to cope with the influx of visiting supporters.

However, as readers of Medicine Matters are team-orientated practitioners, let's return to the medical back-up services being offered to the finalists and to the match officials. It's relevant to point out that they are not restricted to the eight venues. A total of 11 clinics (six in Switzerland, five in Austria) have been recruited as 'medical centres' for the final round and a first glance at the list raises questions about the need for such centres in areas such as Vevey and Locarno in Switzerland or Graz in Austria. The answer, of course, is that the medical centres have to be within comfortable striking range of the teams' base camps, which tend to be in relatively secluded locations at some distance from the cities where the 31 games will be played. The aim is to provide medical back-up within a short driving distance from the team hotel and, at EURO 2008, the furthest is 75 minutes away. Most are considerably closer and some are virtually 'on the doorstep'. This is also going to be a relevant item on the agenda in four years' time, when the final round in Poland and the Ukraine will also involve a wide geographical spread.



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Medical assistance must be ensured even during training.

Another priority is to make sure the team doctor feels he has *permanent* support. As Dr Vogel mentions, there will be 24/7 access to medical officers and medical centres. It's also important to have each team covered when they move away from their base camp to play a game. It goes without saying that there will be full medical facilities at each stadium. But it is also crucial to keep each team well covered when they check into a transfer hotel and, maybe, start to use different training facilities.

By the way, paperwork cannot be ignored – and it's worth pointing out that, while no temporary practice authorisation is needed by physicians in Switzerland, team doctors travelling to Austrian venues need the green light from the *Österreichische Ärztekammer* – a point which is often overlooked when national teams take part in an international tournament played in a foreign country.

All this, however, is something akin to an insurance policy. On the one hand, you aim to offer maximum cover. On the other hand, you hope it isn't going to be used. Recent on-field tragedies have underscored the importance of prevention and this is one of the major items on the medical agenda during the run-up to the final round.

With the aim of providing maximum health protection to the players, UEFA has stipulated that each finalist association is responsible for performing extensive medical examinations prior to the tournament kick-off – by the end of May, to be precise.

The medical teams working with all 16 finalists already have the documentation where the requirements are set out. Bearing in mind that participants at European Championship finals come largely from the upper strata, some will have been performing these tests – and maybe even more in-depth analyses – as a matter of routine. However, the risks are by no means confined to the more illustrious members of the footballing family. So, if the finalists' team doctors will forgive us for repeating ourselves, physicians attached to other teams or other countries might be interested in a brief summary of the mandatory requirements.

The first step is a review of family medical history, focusing on parents, brothers and sisters. The relevant areas to check are:

- Hypertension / strokes
- Cardiovascular problems / sudden cardiac death
- Vascular problems / varicosis
- Diabetes
- Allergies / asthma
- Cancer / blood disease
- Chronic muscular problems
- Hormonal problems

The next steps focus on the player. His medical history needs to be reviewed for:

- Heart problems / arrhythmias
- Concussion
- Allergies / asthma
- Recurrent infections
- Major diseases
- Severe injuries requiring surgery, hospitalisation, absence of more than one month

One of the other mandatory items in the pre-EURO test is a personal football history which emphasises the need for close collaboration between national team and club doctors. As background information, data are required on:

- Training time per week during pre-EURO preparation period
- Training time during the season
- Number of matches played during season

On a more immediate basis, information is required on current complaints such as

- Symptoms (muscular, articular pain)
- Chest pain / dyspnoea / palpitation / arrhythmia
- Dizziness / syncope
- Flu-like symptoms / cough / expectoration

The players' preparation for EURO 2008 includes thorough medical tests.

- Loss of appetite / weight loss
- Sleeplessness
- Gastrointestinal problems

Note also needs to be taken of any specific medication or nutritional supplements currently being taken by the player, in addition to vaccination records for tetanus, polio, hepatitis et al, plus the date of the last medical check-up.

The general medical examination must include:

- Height / weight
- Blood pressure / heart rate
- Eyes / vision test / nose / ears / teeth / throat / thyroid
- Lymph nodes
- Chest / lungs (auscultation, percussion, expansion)
- Heart (pulse, sounds, murmurs)
- Abdomen (palpation, hernia, scars)
- Blood vessels (peripheral pulses, vascular bruits, varicose)
- Skin (and skin appendages)
- Reflexes

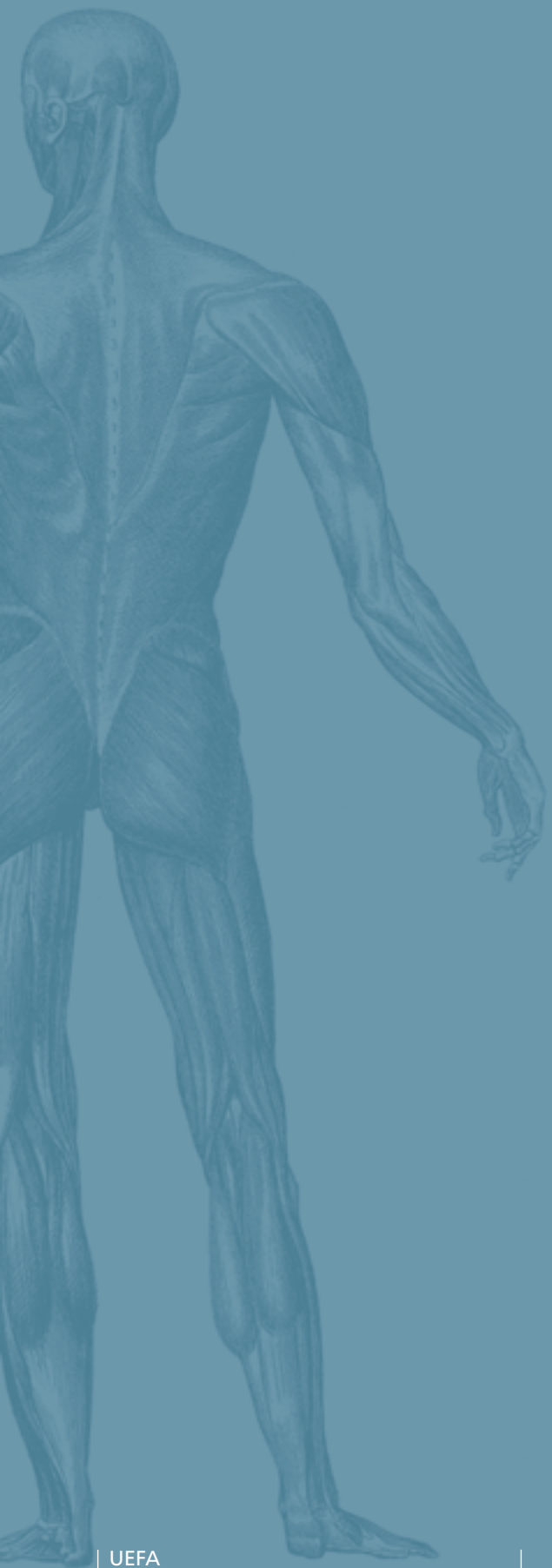
Cardiological examination is a prime requirement, based on heart rate at rest, blood pressure at rest (both arms), a 12-lead ECG conducted within the last two years and an echocardiography performed within the last three. Exercise ECG and Colour Doppler ECG are 'optional extras' on the EURO checklist. So are several items on the laboratory testing agenda: blood fats, glucose, uric acid, creatinine, aspartate aminotransferase, alanine aminotransferase, gamma-glutamyl transferase, creatine kinase, potassium, sodium, magnesium, iron and ferritin, along with blood-group and HIV testing. However, the mandatory items are:

- Erythrocyte sedimentation rate
- CRP
- Blood count (haemoglobin, haematocrit, erythrocytes, leukocytes, thrombocytes)
- Urine test

The mandatory areas on the orthopaedic examination are checks for functionality, stability and mobility on the spinal column, shoulders, hips, groin, thighs, knees, lower leg (shin splint syndrome), achilles tendon, ankle and foot. Range of motion tests on adductors, hamstrings, iliopsoas, quadriceps, gastrocnemius and soleus are not compulsory but are highly recommended, along with muscle-strength and balance testing.

A European Championship represents an incentive to conduct in-depth medical examination but, in an ideal world, this sort of testing should be conducted on a regular basis right from the moment when a player makes his debut on the international scene, normally in the Under-15 or Under-16 age bracket.

Ideally, even youth players should undergo in-depth medical tests.



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