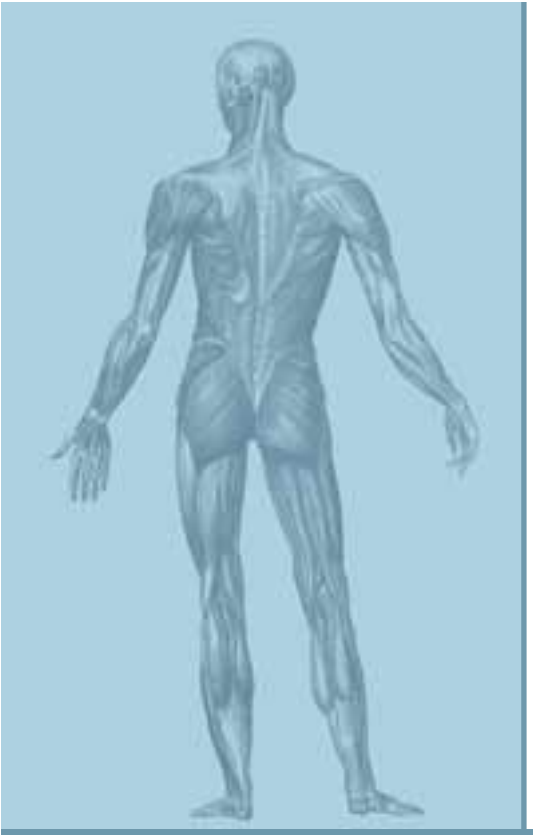
MEDICINE Matters

DECEMBER 2004 – No.10

IN THIS ISSUE

PUBLISHED BY UEFA'S FOOTBALL DEVELOPMENT DIVISION



EDITORIAL

EURO 2004 AND UEFA'S GOLDEN JUBILEE HAVE ALREADY BEEN CONSIGNED TO THE HISTORY BOOKS

By Dr Urs Vogel

The European Football Championship in Portugal was uplifting in many respects: we were treated to great football, fair play, good refereeing, excitement and surprises. The celebrations that took place, particularly after the home team had won a match, were passionate and exuberant. What's more, there was no violence.

Dr Urs Vogel, Chairman of the UEFA Medical Committee.

One favourite after another had to pack their bags early and return home. Virtually no one could have predicted the line-up for the final itself. Who would have put their money on Greece winning the championship before the tournament got into full swing? Football is a team game, as the Greeks demonstrated so impressively. Congratulations to everyone, and thank you for such great, fair and clean matches.

Despite intensive controls (all teams were tested at every match, and out-of-competition testing was also carried out), there were no positive doping cases to be reported.

Thanks to the cooperation of the players and team doctors, hardly any problems arose. Our new doping regulations – adapted to WADA's requirements and harmonised with FIFA – stood up to the test, but still need some fine-tuning. Something that can be put into practice right away at such major events cannot be transferred to our club competitions just like that. A qualified, experienced doping control officer has to be allowed some flexibility, and the circumstances on the spot have to be taken into account.

Any improvements to the regulations must be discussed with the competent FIFA bodies. This delicate issue requires a uniform approach.

At major events, it is not only the doctors who ask for detailed injury statistics. It is in the interests of the organisers to gather information about all of the effects of their competition if possible. This includes not only cost analyses, security matters, etc., but also the effects on the players' health. In this respect, an injury study was carried out during EURO 2004, the results of which are now available. The work and comments of our member Professor Jan Ekstrand are worth examining. New findings always emerge from such studies, which can be of benefit to our game.

When we carry out a study of this kind, we are especially dependent on the cooperation of the team

COVER
All of the EURO 2004 teams (like finalists Greece and Portugal) participated in the injury study before and during the tournament.
PHOTO: A. SABATTINI

UEFA MEDICAL COMMITTEE

Left to right, seated:
Dr Pedro Correia Magro
Alan Hodson
Dr Urs Vogel (Chairman)
Dr Jacques Liénard

Standing:
Prof. Jan Ekstrand (Vice-Chairman)
Dr Alfonso Moreno Gonzalez
Prof. Wilfried Kindermann
Prof. Paolo Zeppilli
Dr Mogens Kreutzfeldt
Prof. Mehmet Binnet

Absent:
Prof. W. Stewart Hillis (Vice-Chairman)

doctors. As far as EURO 2004 was concerned, we have to applaud and thank everyone concerned in this respect. Thanks to their efforts, we can – as Prof. Ekstrand says in his article – do a remarkable job with relatively modest financial means.

The aim of all these studies is to design ways in which injuries can be minimised. It is always a catastrophe for those concerned when an injury stops them from practising their sport and, in the case of professional footballers, renders them unfit for work. Unfortunately, such injuries can never be prevented altogether, but with experience and knowledge, and by abiding strictly by the rules, they can be kept to a minimum.

The Swiss national team is currently without a highly talented 18-year-old player for several months as a consequence of a tackle from behind in the middle of the field. Regrettably, the gross, stupid foul that resulted in a torn anterior cruciate ligament was only sanctioned with a yellow card. Thanks to accurate injury statistics and their analysis, we doctors can draw attention to particularly hazardous situations on the field of play and the rules can be amended if necessary. It is then up to the referee to follow the rules properly. As every football fan knows, this is not an easy job.

Time and again we are shocked to hear about healthy young athletes suffering "sudden heart failure". The question of what preventive measures can be taken and of what examinations are important is considered by Professor Kindermann in his article.

Nowadays, it is quite legitimate to talk about the cost-benefit effect of medical examination methods. The question of what one can afford and what one should afford is related to the generally bemoaned explosion in health costs, even though a closer analysis of the last 30 years reveals simply a rise that is in line with the general increase of costs.

These last few years, UEFA has been running "Progress Courses", particularly for East European football associations. Our Danish member, Dr Mogens Kreutzfeldt, has devoted a lot of time to these courses and gathered a wealth of experience. The "Meridian Project" offers additional direct aid to African football associations. In his article, Dr Kreutzfeldt answers a series of questions on the course he gave in Ethiopia last summer. The transfer of knowledge to footballers from such emerging nations is very important in all medical aspects, from raising awareness of drug abuse to the need to abide by the rules of fair play.

I would also like to thank our former member Professor David S. Muckle for his contribution. His vast experience speaks loudly in his article. He shows us how important it is to look further for the causes of relatively local complaints. We know how complex spinal problems can be in this context. And the numerous possible causes of groin strain, sports hernia, show that a wholly local approach is quite wrong.

Once again, thanks to our colleagues, another interesting issue of "Medicine Matters" has been produced. Thank you to all of the contributors.

Dr Urs Vogel
Chairman, UEFA Medical Committee

EURO 2004 INJURY STUDY

By Prof. Jan Ekstrand – Vice-Chairman, UEFA Medical Committee

SUMMARY OF FINDINGS

- The total risk of injury was similar to that found in top-level league play.
- The risk of injury varied during the study period; it was lowest during the preparation period before the first match, increased during the group phase and reached the highest level during the final stages.
- The risk of injury was low at training and 11 times higher at matches.
- Many muscle injuries and fractures were recorded, which reflects the intensity of play and the high forces generated in contact situations.
- There were few ankle sprains, which indicates that the medical staff have a very thorough knowledge on how to prevent such injuries.
- There were few knee ligament injuries, possibly reflecting the high quality of playing surfaces and the high fitness and training level of the players.
- Less contact and more non-contact injuries occurred compared to the World Cup 2002.
- Few foul play injuries were recorded, illustrating the high standard of refereeing and the adherence to fair play by the teams.
- Many players left the tournament still injured.
- Players who over-performed had played fewer matches during the end of their league season.

Why was this study done?
The overall level of injury to professional footballers has been shown to be approximately 1,000 times higher than for industrial occupations generally regarded as high risk. FIFA, UEFA and national football organizations have expressed their concern about the demands being placed on the modern footballer, and the translation of these physical and mental demands into injury. In 2001, UEFA initiated a research project specifically aimed at evaluating the exposure to football and the risk of injury of top-level footballers in Europe. This project was continued over the subsequent three seasons, and the results were published in previous issues of "Medicine

The referee attends to a player suffering from cramp.

Matters" (May and December 2003). The congested match calendar and the well being of top professional footballers is a special concern for UEFA. In the UCL (UEFA Champions League) study during the 2001/02 season, we found that the star players played many matches at the end of the season with no increase in injury risk. However, at the World Cup in Korea/Japan, which began a mere two weeks after the Champions League final, many top players were injured or under-performed. These findings suggest that, under normal circumstances, players are able to cope with an intensive match program provided that they are allowed a sufficient rest period afterwards. But every second year, this rest period is replaced by another series of intense matches, i.e. the World Cup or the European Championship. We wanted to evaluate whether the findings from the 2001/02 season and the 2002 World Cup were repeated at EURO 2004.

How was the study carried out?
All 16 teams that qualified for EURO 2004 participated in the study. Each squad comprised 23 players. Three players incurred serious injuries during the preparation period and were replaced. We followed these players from 29 May to 4 July.

The study period was divided as follows:
- Preparation period (2 weeks: 29 May to 12 June)
- Group matches (12 to 23 June)
- Final matches (24 June to 4 July)

AIMS OF THE STUDY

- To evaluate the risk of injury during EURO 2004 while considering the exposure to both matches and training sessions
- To analyse injury patterns
- To compare the data with that reported for top level league play
- To compare differences in injury risk between the preparation period, the group stage and the final phases
- To evaluate the exposure to training and matches during the two weeks before the first match and to compare differences between teams
- To evaluate the correlation between exposure of footballers in top European clubs at the end of the 2003/04 season and the injuries and performances of these players during EURO 2004.

Each team doctor was provided with attendance record forms and was responsible for completing this form with data about the players' attendances at training sessions and matches. Exposure times were registered in minutes for each individual player in order to base the incidence of injury on real exposure time. The attendance records included all training sessions and matches. Only coach-directed sessions that included physical activity were recorded.

A recordable injury was defined as one that occurred during a scheduled match or training session and caused the player to miss the next match or training session. Each injury was followed until the final day of rehabilitation. The injuries were classified into four categories of severity according to the days of absence from training sessions and matches, including the day of injury:
- Slight (1-3 days)
- Minor (4-7 days)
- Moderate (8-28 days)
- Major (over 28 days).

All injuries were recorded on a special card. The injury card consisted of a single page on which all injuries were described in tabular form.

All team physicians took part in a pre-tournament instructional meeting and were informed about how to fill in the attendance records and the injury cards. Confidentiality of all player data

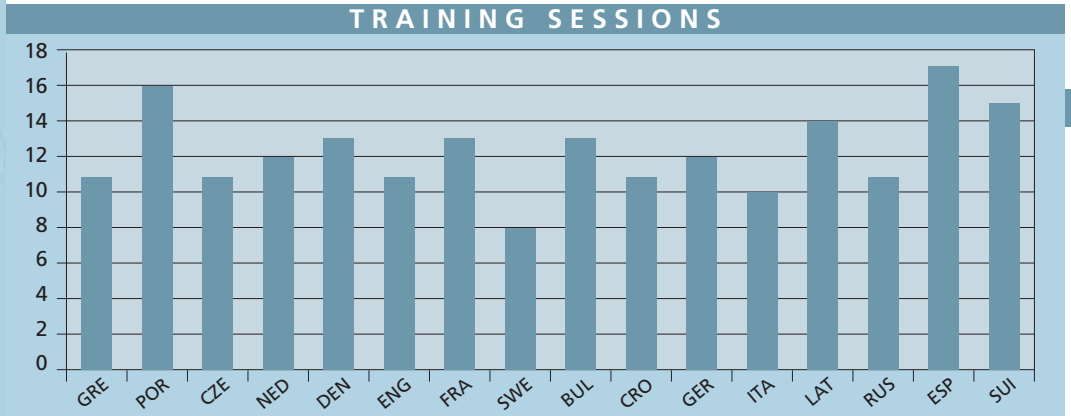


Figure 1: Number of training sessions during the two weeks before the first match.

was ensured. The completed forms were collected after each match. The methodology has previously been proven feasible. The documentation of injuries using this injury card has been implemented as a matter of routine by FIFA during several World Cup tournaments and the documentation of exposure using the attendance record has been used by UEFA in several studies of top level football.

RESULTS

Exposure

The overall exposure in this study was about 10,000 hours. During the two-week preparation period 30 matches were played, and 31 matches were played during the actual tournament.

Team activities during the two weeks before the first match

a. Training sessions

As a mean, the teams had 12 training sessions during these two weeks. There was a wide variation between the teams, ranging from 8 to 17 sessions – see Fig. 1.

There was no difference between the four final teams and the other twelve. The mean duration for each training session was 72 minutes (range 60-86).

Nine of the teams had two training sessions on one to six days during this period while seven teams had only one training session daily.

Among the four semi-finalists, two had only one daily training session while two had three versus six days with two sessions each day. It has been suggested that intense training sessions in the preparation period or between the matches in the tournament might create physical and/or mental fatigue for the players, thus decreasing their performance in the tournament matches. This study could not provide an answer to such a hypothesis, since we only measured the number and duration of training sessions, and not the intensity or other aspects of the training content.

b. Matches

Most of the teams (n=7) played two matches during this period. Four teams played three matches, four teams one match and one team no match at all. As a mean, the teams played one match per week during these two weeks. The four final teams played an average of 2.5 matches, compared to 1.5 and 1.8 for the teams that played in the quarterfinals or only in the group stage – see Fig. 2.

THE TOTAL RISK OF INJURY WAS SIMILAR TO TOP LEVEL LEAGUE PLAY

The total risk for injury was 7.7/1,000 hours of exposure for the whole study period (6.0 injuries/1,000 H during the pre-tournament period and 9.1 for the tournament period). The injury incidence in this study is consistent with recent studies at elite or professional level using a similar or identical definition of injury. In the UCL study reported in "Medicine Matters", during the 2001/02 season the mean injury

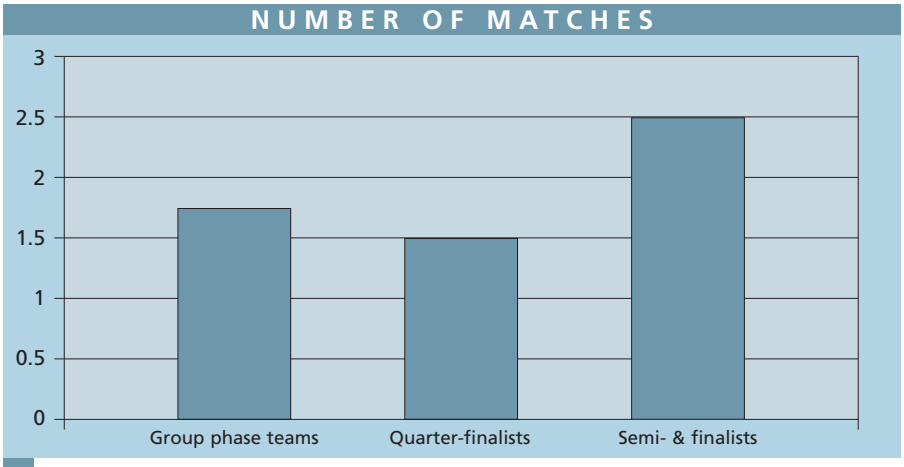


Figure 2: Mean number of matches during the 2 weeks before the first match.

During a tournament, training often focuses on recuperation, to reduce the risk of injury.

risk was found to be 9.4/1,000 hours of exposure.

Figure 3 shows that the risk of injury varied during the study period; it was lowest during the preparation period before the first match, increased during the group stage and reached the highest level during the final rounds.

Low risk of injuries at training

The risk for injury during training versus matches is shown in fig 4. The mean risk for the study period was 2.9 injuries/1,000 hours of training (3.8 for the preparation period and 1.6 for the tournament). The risk of a training injury decreased during the study period, and was lowest in the final rounds.

Previous studies on amateurs as well as professionals have shown that the risk for injury during training is approximately the same regardless of the levels of play (5-7 injuries/1,000 hours of training). The risk was lower at EURO 2004, most probably reflecting that training sessions at tournaments are often devoted to recovery and rehabilitation, with a lower injury risk.

Highest risk of match injuries during the group stage

The risk for match injuries was 32.2/1,000 hours for the study period (35.6 for the tournament). It has previously been shown that the risk for injury during match play is higher the higher the level of play (about 10-15 injuries/1,000 hours at amateur level, about 20 injuries/1,000 hours at low professional level and about 25-35 injuries/1,000 match hours at top professional level).

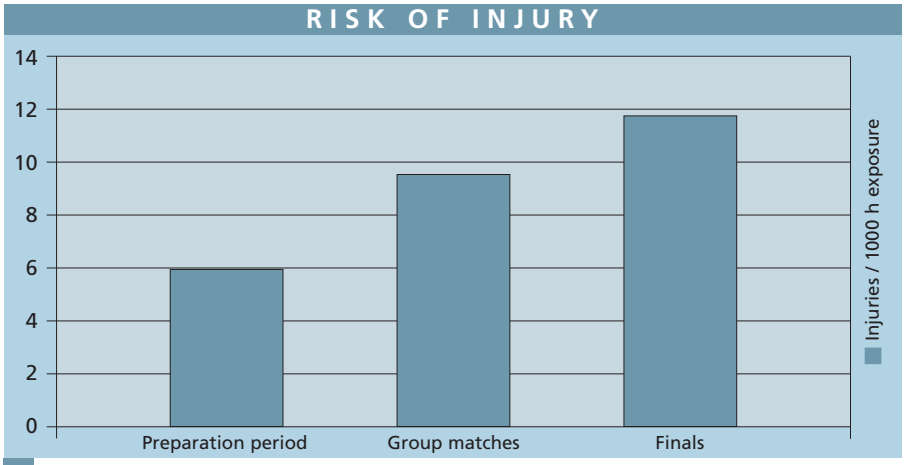


Figure 3: Risk of injury during the different periods of the study.

Hawkins & Fuller (3) reported an injury rate of 26/1,000 hours of match play in a study of four English professional football clubs, and Ekstrand *et al.* reported 30 injuries/1,000 match hours in a study on a national team.

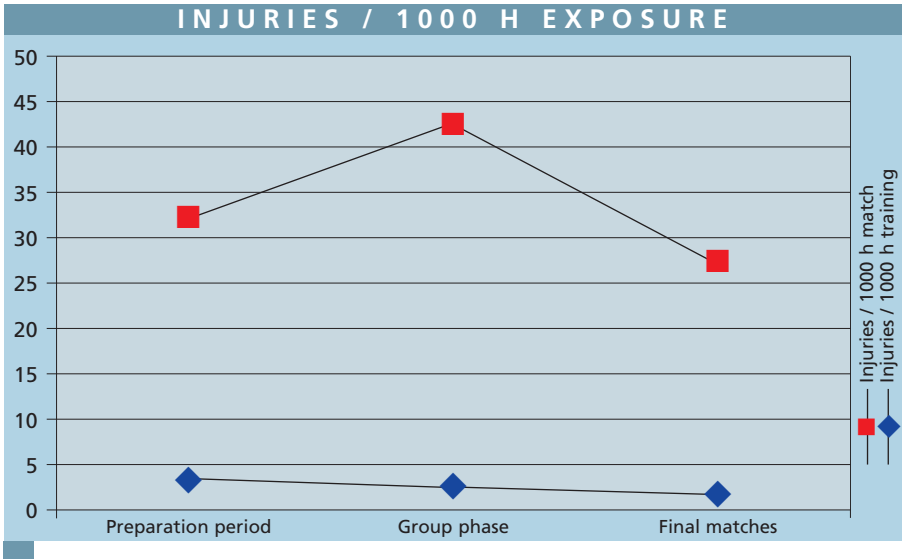


Figure 4: Risk of injury during the different periods of the study.

THE CLASSIFICATION OF INJURIES IS SHOWN BELOW

Sprain	**Acute distraction injury of ligaments or joint capsules**
Overuse	**A pain syndrome of the musculo-skeletal system with insidious onset and without any known trauma or disease that might have given previous symptoms**
Strain	**Acute distraction injury of muscles and tendons**
Contusion	**Tissue bruise without concomitant injuries classified elsewhere**
Fracture	**Traumatic break of bone**
Dislocation	**Partial or complete displacement of the bony parts of a joint**
Other	**Injuries not classified elsewhere. Examples: wound, concussion etc.**

Table 2. Classification of injury types.

INJURIES

During the study period, 66 players (18%) incurred 77 injuries. Thirty-two (42%) of these injuries occurred during the preparation period and 45 (58%) during the actual tournament – see Table 1.

CLASSIFICATION OF INJURY TYPES

	Training injuries	Match injuries	Total no. of injuries
Preparation period	19	13	32
Group phase	5	32	37
Final matches	1	7	8
Total no. of injuries	25	52	77

Table 1: Number of injuries during different periods of the study.

Few knee injuries

The injury locations are shown in Table 3. Eighty-seven per cent of the injuries affected the lower extremities, with the thigh as the most common injury location (22%). This is similar to results in the UCL study. The only difference in location compared to the UCL study is that knee injuries were less common during EURO 2004 (9% compared to 20%). A reason for this difference could be that recurrence of knee problems are common during a league season and players with recurrent knee problems might not be selected for a tournament.

Few overuse injuries and many fractures

Injury types and severity are shown in Table 4. Seventy-seven per cent of the injuries were caused by trauma and only 13% by overuse. This is different to the UCL study, where 27% were overuse injuries. Recurrent overuse injuries are common during a league season and players with overuse symptoms might not have been selected for EURO 2004 – the players selected therefore started the tournament without such problems. Fractures were a real problem during the tournament (6% of all injuries compared to 2% during a league season). The numerous fractures probably reflect the intensity of the matches, with many contact situations.

Muscle injuries – A problem in top-level football

The most common injury subtypes were thigh strains (14%), groin strains (13%) and ankle sprains (13%). In total, these three injury subtypes represented 40% of all injuries. These figures are similar to the findings of the UCL study, reflecting that strains (muscle-tendon injuries) are very common in top professional football. Muscle injuries might reflect the intensity and speed of top football (these injuries are "sprinter's injuries") but a muscle fatigue from intensive training or many matches may also be factors to consider.

INJURY LOCATIONS AND SEVERITY

	Injuries N (%)	Slight N (%)	Minor N (%)	Moderate N (%)	Major N (%)
Foot	8 (10)	7 (17)	0 (0)	0 (0)	1 (7)
Ankle	13 (17)	8 (20)	2 (15)	1 (13)	2 (13)
Lower leg	11 (14)	7 (17)	2 (15)	0 (0)	2 (13)
Knee	7 (9)	2 (5)	3 (23)	0 (0)	2 (13)
Thigh	17 (22)	9 (22)	2 (15)	4 (50)	2 (13)
Hip/groin	11 (14)	4 (10)	2 (15)	3 (37)	2 (13)
Back	2 (3)	1 (2)	0 (0)	0 (0)	1 (7)
Other	8 (10)	3 (7)	2 (15)	0 (0)	3 (20)
Total	**77 (100)**	**41 (100)**	**13 (100)**	**8 (100)**	**15 (100)**

Table 3: The approximations of the percentages have been made to equal 100%.

There were fewer contact injuries during EURO 2004 than during the 2002 World Cup.

Medical teams know how to treat and prevent ankle sprains
In many earlier studies, ankle sprains were reported as the most common injury in football. This was not the case, either in this study or the UCL study. The lower risk of ankle sprain found in these studies suggest that top level teams have a thorough knowledge of optimal treatment and prevention of these injuries.

INJURY TYPES AND SEVERITY

	Injuries N (%)	Slight N (%)	Minor N (%)	Moderate N (%)	Major N (%)
Sprain	16 (21)	9 (22)	4 (31)	1 (13)	2 (13)
Overuse	10 (13)	6 (15)	3 (23)	0 (0)	1 (7)
Contusion	13 (17)	11 (27)	1 (8)	0 (0)	1 (7)
Strain	24 (31)	7 (17)	5 (38)	7 (88)	5 (33)
Fracture	5 (6)	0 (0)	0 (0)	0 (0)	5 (33)
Dislocation	1 (1)	1 (2)	0 (0)	0 (0)	0 (0)
Other	8 (10)	7 (17)	0 (0)	0 (0)	1 (7)
Total	**77 (100)**	**41 (100)**	**13 (100)**	**8 (100)**	**15 (100)**

Table 4: The approximations of the percentages have been made to equal 100%.

FOUL PLAY INJURIES

In the previous UCL studies, we defined a foul injury as an injury caused by a foul according to the referee's decision (own or opponent foul). In their studies of World Cup or Olympic tournaments, in addition to the referee's judgement, FIFA also included judgement by the team physician and the injured player. To be able to compare the results at EURO 2004 with reports from World Cups by FIFA, we included both judgements in this study.

Out of the 77 injuries in this study, 52 (68%) occurred during matches and 25 (32%) during training sessions. Thirteen match injuries occurred during the two weeks of preparation before the event and 39 during the tournament (32 during the ground play rounds and 7 during the final rounds).

Less contact injuries and more non-contact injuries compared to the World Cup 2002
In their report from the FIFA World Cup 2002, Junge, Dvorak and Graf-Baumann reported that more than a quarter (27%) of all match injuries were incurred without contact with another player, and 73% were contact injuries. They concluded that the incidence of non-contact injuries during the World Cup 2002 was higher than in other international football tournaments and suggested that the many non-contact injuries might indicate that the players had had insufficient time to recover from the demands of and/or the injuries sustained during competitions prior to the World Cup.

At EURO 2004, this scenario was even more obvious: 16 match injuries (41%) occurred in non-contact situations compared to 23 (59%) in contact situations. The high proportion of non-contact injuries indicates that players may have been overloaded by the demands of the match and may not have recovered adequately from previous competitions and/or injuries. Better preparation prior to the tournament and sufficient time to recover after injury might lead to a reduction in the number and severity of injuries in international tournaments.

Only 9 foul play injuries; the worst injury happened to a player who committed the foul play himself
According to the referees, 9 (39%) of the 23 match injuries that occurred in contact situations were due to foul play (8 opponent's foul and 1 own foul). The consequences of the foul play were 2 yellow cards and 7 free kicks. This is a remarkably low figure,

Fortunately, being stretchered off does not always mean a serious injury.

and indicates that the tournament was inspired by fair play.

The only serious injury that occurred in a foul play situation happened to a player who committed the foul himself and was given a yellow card. This player was absent from football for 58 days after his own foul.
In the FIFA World Cup 2002 study, only 21% of the contact injuries were sanctioned by the referee, compared to 39% during EURO 2004.

In the FIFA World Cup 2002 tournament there was a discrepancy between the judgement of the team physician as to whether the incident leading to injury represented a violation of the rules and the decision of the match referee (the team physician considered 50% of all contact injuries as foul play while the referee sanctioned 25% of all contact injuries).

The finding at EURO 2004 was different; little discrepancy was recorded between the judgements of the teams and the referees, despite the fact that the teams' opinions may be highly subjective.

The teams considered 13 (57%) of the 23 contact injuries to be foul play. They agreed completely with the sanctions in the 9 cases where the referee's judgement was foul play but considered 4 more injuries to be foul play. Three of these were slight or minor injuries causing absences of 3, 3 and 6 days respectively. The fourth injury was a deep wound causing 29 days of absence.

Summary of foul play injuries:
- Only 9 foul play injuries occurred during the 31 matches at EURO 2004 - a very low figure, indicating a high degree of fair play
- The most serious foul play injury happened to a player who committed the foul himself
- 39% of the contact injuries were followed by the referee's sanction (compared to 21% in the World Cup 2002)
- Better correlation between teams' and referees' judgement of foul play at EURO 2004 compared to World Cup 2002

Many players left the tournament with injuries
We continued contacts with the team doctors after the tournament to evaluate the total absence from the injuries and other consequences for the players.

Twenty-one players left the tournament with injuries – see table right. Fifteen of these players incurred major injuries causing absences of over four weeks. Nine of these injuries were muscle-tendon injuries in the groin or thigh area and five were fractures.

These serious injuries affected the players and their teams both during the tournament and at the start of the new season. In order to understand and possibly prevent such serious injuries, we contacted the team doctors to inquire about the circumstances of some of these injuries.

Case 1. Contusion of the knee – absence 54 days
Previous injury to the knee. The player made a mistake in a match; he did not observe an attack from a defender and suffered a blow to his previously injured knee. No foul involved.

Player	Diagnosis	Days of absence
1	Knee sprain	29
2	Ankle sprain	58
3	Strain lower leg	37
4	Groin strain	49
5	Groin strain	34
6	Groin strain	22
7	Groin strain	16
8	Groin strain	10
9	Thigh strain	48
10	Thigh strain	32
11	Thigh strain	29
12	Thigh strain	14
13	Contusion knee	54
14	Fracture tibia	Still injured
15	Fracture metatarsus	63
16	Fracture arm	Still injured
17	Fracture arm	48
18	Fracture rib	12
19	Deep Wound	29
20	Slipped disc	29
21	Haematoma thigh	9

Table 5:
Players who left EURO 2004 with injuries, their diagnosis and absence from football due to these injuries.

Some 87% of injuries are to the lower limbs.

Comments: The previous injury was probably the important factor in this case.

Case 2. Deep wound on the lower leg – absence 29 days
Contact situation in a match. According to the team doctor and the player, an opponent made a foul and kicked the player in the lower leg with his studs, resulting in a deep wound that needed hospital care. The player was injured after 30 minutes of the game but continued to play until half time. No sanction from the referee.
Comments: This was the only serious injury where there was a discrepancy in judgement between the team and the referee. A video analysis of the situation could be useful. The player was able to continue to play for 15 minutes, which reflects the high pain threshold of players during a match. These injuries are normally caused by studs. Did the referee notice any sharp edges on the players' studs before the match?

Case 3. Fracture of the foot – absence 63 days
The player was running in the box together with an opponent. The opponent put his foot across to make a tackle as the player knocked the ball forward. The opponent stepped on the player's foot and forced it into inversion. No foul according to the referee. The team did not consider it a foul injury at the time, but looking at the match video afterwards, they claim it was a foul. There were no predisposing factors for the player, he had no previous injury, there was no carelessness or fatigue involved. The team consider this injury as an unfortunate incidence, reflecting the nature of the play and not easily preventable. However, the team speculates that the quality of pitches could be an important factor – the pitch was very hard and lumps of soil were dislodged. A hard pitch with a loose top soil can make the feet slip.

Case 4. Fracture of the arm – player still absent (Sept 3)
This player had a fracture to his arm during the league play before EURO 2004. He incurred a re-fracture in a EURO match. The contusion was not serious and there was no foul play involved.
Comments: His previous fracture had not healed. The new injury was a result of a previous one.

Case 5. Ankle sprain – absence 58 days
The player incurred the injury in an own foul situation. He received a yellow card himself.
Comments: This injury underlines the importance of fair play, adherence to the rules and disciplined play.

Players who played many matches at the end of the league season under-performed at EURO 2004

Fifty players from ten top European clubs in our UCL study season 2003/04 played matches at EURO 2004. Their performances during the event were evaluated by the members of the UEFA Technical Study Group.
On 4 July, these experts were given the list of these 50 players and asked to assess their performances according to the following three levels:

- **Over-performance (the player performed above his normal level);**
- **Normal performance (the player performed as expected);**
- **Under-performance (the player performed below his normal standard).**

The players who under-performed (13/50, 26%) had as a mean played 12 matches during the last 10 weeks of the league season, compared to 10 matches for those who performed above their normal level (7/50, 14%). These findings are similar to the findings at the World Cup 2002, where the players who under-performed had also played 12 matches during the last 10 weeks of the season 2001/2. Those who over-performed had as a mean played 9 matches during the same period. These two studies indicate that a congested match calendar at the end of a season may leave the players fatigued, thereby increasing the risk of under-performance during the following period. One can speculate that one match per week is tolerable but more than one match per week might have negative consequences on performance during the following period.

Two players per team (selected by means of a draw) were tested at each EURO 2004 match.

NO POSITIVE TEST AT EURO 2004

As in the past, anti-doping controls were conducted during the final round of the European Championship in Portugal.

For the first time, **all 16 teams** were tested during the weeks preceding the tournament. Sixty-four players (4 from each team) were tested, including for EPO.

Doping controls were conducted at all 31 matches during the competition. At every match, 2 players from each team were tested. In total, 124 players underwent testing at the matches. EPO analyses were conducted at key-times throughout the event.

Several targeted controls were also carried out.

Of the 188 tests, one positive result was reported but this was found to be due to a doctor forgetting to submit a Therapeutic Use Exemption (TUE) request.

Anti-doping controls during the event were performed jointly with doctors from the Instituto do Desporto de Portugal. The cooperation with the Portuguese doctors and the Laboratory of Lisbon was excellent.

For the first time, players were escorted by chaperones straight from the pitch to the anti-doping control station. This new procedure was well understood and accepted by all players and team doctors.

"These results are very encouraging", stated Dr Martial Saugy, head of the Lausanne anti-doping laboratory. "It is rare that sports federations design such a credible and objective anti-doping programme. UEFA is to be congratulated on the approach adopted at this prestigious tournament."

New Prohibited List 2005
WADA has published the new Prohibited List, which will come into effect on 1 January 2005. This list will also apply for UEFA's competitions from 1 January. To view the list please consult the WADA website, **www.wada-ama.org**

Each selected player is now accompanied by a chaperone from the field to the doping control room.

Within the framework of the Meridian Project, UEFA offers direct aid to two African football associations over a two-year period. This time, Ethiopia and the Central African Republic are the beneficiaries of direct aid, which has focused on training and education in different areas such as refereeing, coaching and medicine. Dr Mogens Kreutzfeldt (member of the UEFA Medical Committee since 1998 and doctor for the national team of Denmark) travelled to Ethiopia to share his vast knowledge and experience of sports medicine with the participants.

DIRECT AID IN ETHIOPIA

By Dr Mogens Kreutzfeldt

1. How many people attended the course in sports medicine?
Sixteen selected educated doctors representing the different provinces of Ethiopia participated in the course. They were extremely enthusiastic, eager to learn and were present at all times. Only one of the sixteen was female, although this was to be expected, as Ethiopia has a national women's team but no national women's football championship.

2. How experienced were the participants?
Five of the doctors worked in clinics or hospitals in Addis Ababa, and the knowledge of sports medicine was higher than expected, although there is still a considerable need for education and equipment. There is a shortage of doctors and trained medical personnel in Ethiopia and the basic health problems are overwhelming.

3. How many of the participants were involved in football on a regular basis (e.g. working for a club/football association)?
None of the doctors worked regularly in clubs. All had a special interest in sports medicine but the clubs do not have the funds to develop a health sector. The clubs are dependent on doctors who are willing to help them in case of injury to players.

4. What topics were covered?
Physiology, children's and sports injuries, muscle injuries (including demonstrations of stretching exercises), shoulder, knee and ankle injuries (including taping demonstration), physiology, doping, nutrition and various medical diseases and infections, including AIDS.

5. Were the participants interested in doping matters? Were they aware of the WADA Anti-Doping Code?
All participants were very interested in doping matters, and a lot of time was spent on this topic. The knowledge of the WADA Code was very low, and most of the doctors lacked basic information about prohibited substances and doping control procedures.

6. How is medicine organised in Ethiopia? What is lacking?
Hospital standards are low, especially in rural areas and distant provinces. There are a number of private clinics of a superior standard in the capital. The medical problems are overwhelming. Medicine and equipment are seriously lacking: techniques that are widely available in Europe, such as arthroscopy, MRI-scans and ultrasound, are unavailable in Ethiopia. The average life expectancy is 45 years (compared to 73 in Switzerland). Approximately 8% of the entire population is infected with HIV, but the percentage is much higher among young people (up to 20% according to recent studies and surveys). Access to relevant medical literature is difficult. The government is working intensively to tackle these problems, but they will take time to solve.

7. What is the average monthly salary of a medical doctor in Ethiopia?
USD 150 per month for a young doctor.

8. Did the participants feel the course was beneficial?
The participants were grateful and delighted to follow the course and found the information presented very useful. They all expressed a desire for further courses in the future.

9. Do you have any further recommendations as to the direct aid programme?
All participants requested that we continue to assist them to develop sports medicine in their country. Medical equipment, medicine, further education, literature and articles on prevention and treatment of sports injuries are sorely needed. UEFA's assistance was highly appreciated, and I would strongly recommend continuing the programme in future.

Dr Mogens Kreutzfeldt gives a demonstration.

CARDIOLOGICAL SCREENING FOR THE PREVENTION OF SUDDEN CARDIAC DEATH

By Prof. Wilfried Kindermann

What is sudden cardiac death?
Sudden cardiac death is a common medical phenomenon, entailing unexpected death due to cardiac arrest. Unrelated to any injury, it occurs within one hour of symptom onset. Sudden cardiac death is considered to be triggered by sport if it occurs during or within one hour of sporting activity. Cardiac arrest is usually preceded by ventricular fibrillation. The fibrillating heart twitches very rapidly in an uncoordinated manner. It ceases pumping because it cannot contract. The corresponding ECG shows so-called fibrillation waves, which sometimes resemble hairpin bends (see diagram 1).

The athlete suddenly falls unconscious. Cardiac arrest can also take place, however, if the heart's natural pacemaker, the sinus node, fails and the transfer of the impulse from the atrium to the ventricle is suddenly interrupted (asystole).

Cardiac arrest does not necessarily mean death. Survival chances are good if immediate resuscitation is attempted. This is particularly true of ventricular fibrillation, which can be dealt with successfully through defibrillation. In such cases, the victim is said to have survived sudden cardiac death.

How common is sudden cardiac death?
Sudden cardiac death affects between 0.5 and 1.0 in 100,000 athletes per year. The risk, which increases with age, also depends on the athlete's level of fitness and the intensity of their training. Men are more commonly affected than women.

Competitive sport increases the risk of sudden cardiac death. However, sport itself is not the cause; it triggers sudden cardiac death in people with existing heart defects. Generally speaking, regular physical exercise protects the heart. People who exercise infrequently are at much greater risk during intensive physical exertion than those who train regularly. Life expectancy among international athletes, including footballers, is certainly no lower than that of non-ath-

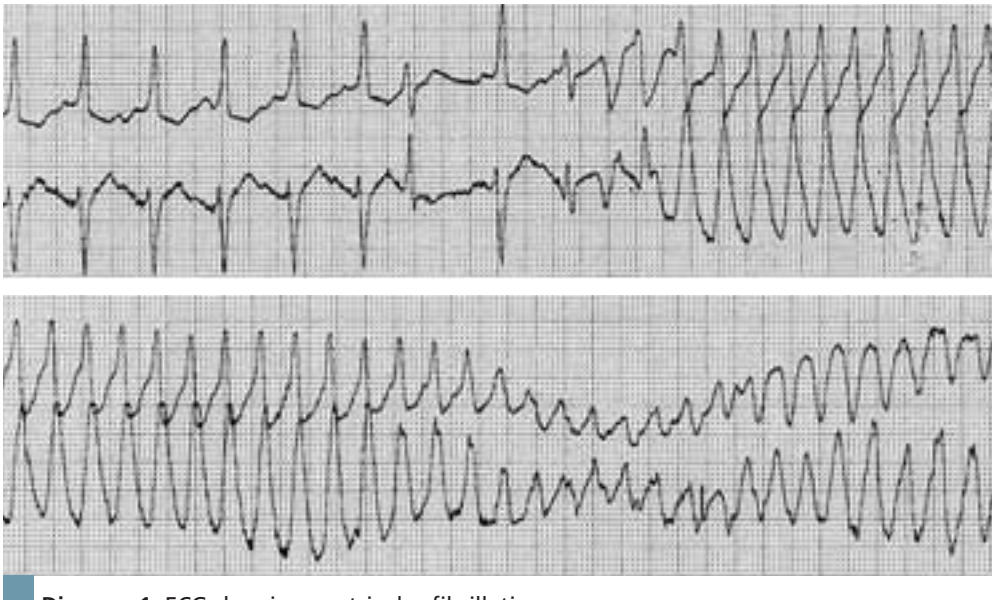


Diagram 1: ECG showing ventricular fibrillation.

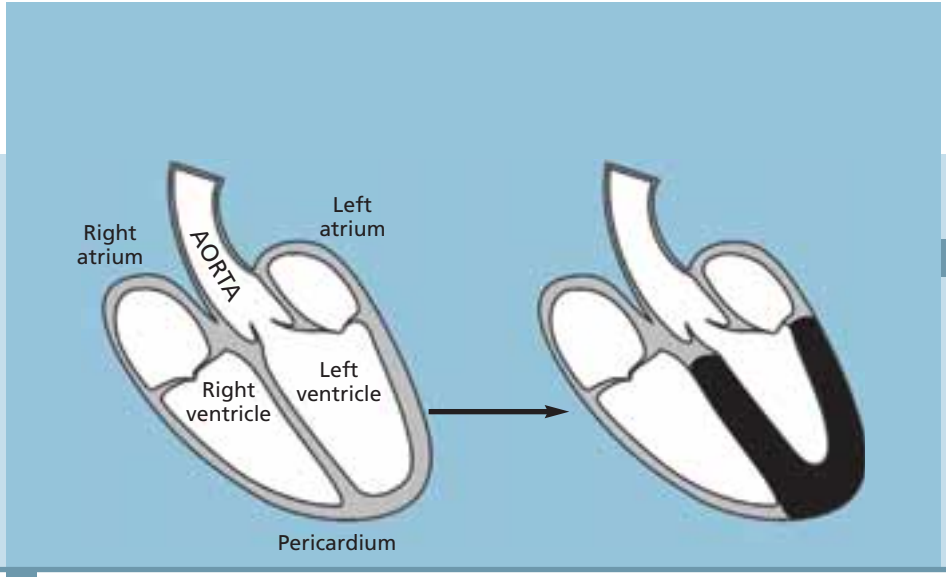


Diagram 2:
Healthy heart (left) and hypertrophic cardiomyopathy (right): the walls of the left ventricle are thicker, the interios is reduced in size.

letes, and healthy footballers are at no greater risk of sudden cardiac death.

What are the causes of sudden cardiac death in sport?
Usually, the heart is already defective, although no symptoms are apparent. In young athletes, the most common cause of death is a heart muscle defect, which is described as cardiomyopathy (see diagram 2) and is often inherited. Afro-Americans appear to be more susceptible than white people. Other relevant causes are acute and chronic inflammatory heart disease and congenital abnormalities in the coronary vessels.
In victims older than the 35-40 age bracket, coronary heart disease, i.e. artherosclerotic anomalies in the coronary vessels is clearly the most common cause. In rare cases, if the ball strikes a player's chest very hard, the coronary vessels can be sent into spasm, resulting in ventricular fibrillation. Doping can also lead to sudden cardiac death, although this is difficult to prove in individual cases. Sudden cardiac death in healthy footballers is usually caused by heart abnormalities that have often never previously been apparent.

Are there warning signs?
Abnormalities in the heart and circulatory system may have no symptoms whatsoever. The following complaints should be taken seriously and investigated:

- Raised heart rate at rest or during comparable exertion in an unchanged training routine.
- Arrhythmias, for example an irregular heartbeat or palpitations. One-off irregularities (extrasystoles) are often harmless.
- Dizziness and fainting, particularly so-called syncope (accompanied by unconsciousness). Vertigo is usually harmless.
- Breathlessness; however, sudden attacks of breathlessness are more likely to be asthma-related.
- Pain in the chest area, which can spread to other regions (arms, throat, lower jaw, back, upper abdomen). Chest complaints can also be caused by abnormalities in the spinal column.
- Performance dip; a sudden drop in performance can result from a heart or circulatory defect.
- Family history; sudden cardiac death in the family can be suspicious and requires further investigation.

Any new complaints that have no clear explanation should be investigated by a doctor.

What medical checks should be carried out?
There is a general consensus that athletes should undergo so-called pre-participation screening.
At present, there is no generally accepted standard for cardiological checks. The American Heart Association (AHA) recommends a detailed case history (personal and family history) and an equally rigorous physical examination. This screening should be repeated every two years. Further non-invasive investigations are not recommended for various reasons.
It is argued that there is always a residual risk. The cost-benefit ratio is very low because of the rarity of the condition. Finally, because

Heart-monitoring tests for top athletes.

of the changes to the heart caused by sport, the likelihood of misdiagnosis is high, leading to unnecessary exclusion of healthy athletes from competitive sport. On the other hand, checks carried out in Italy include ECGs at rest and during exercise. This screening is compulsory for all 12- to 35-year olds who take part in organised sports programmes and competitions.

In German professional football (1st and 2nd divisions), cardiological tests have been compulsory since 1999, with players required to prove their fitness. This screening takes place annually (at the start of the season) and whenever a player is transferred during the season. The range of cardiological tests performed on German professional footballers are summarised below:

- Personal and family case history
- Physical examination
- ECG (12-lead)
- Stress ECG (limited symptoms)
- Colour Doppler Echocardiography
- Laboratory analysis (blood, urine)

The ECG during exercise is based on the use of a bicycle ergometer. Spirometry is not necessary.

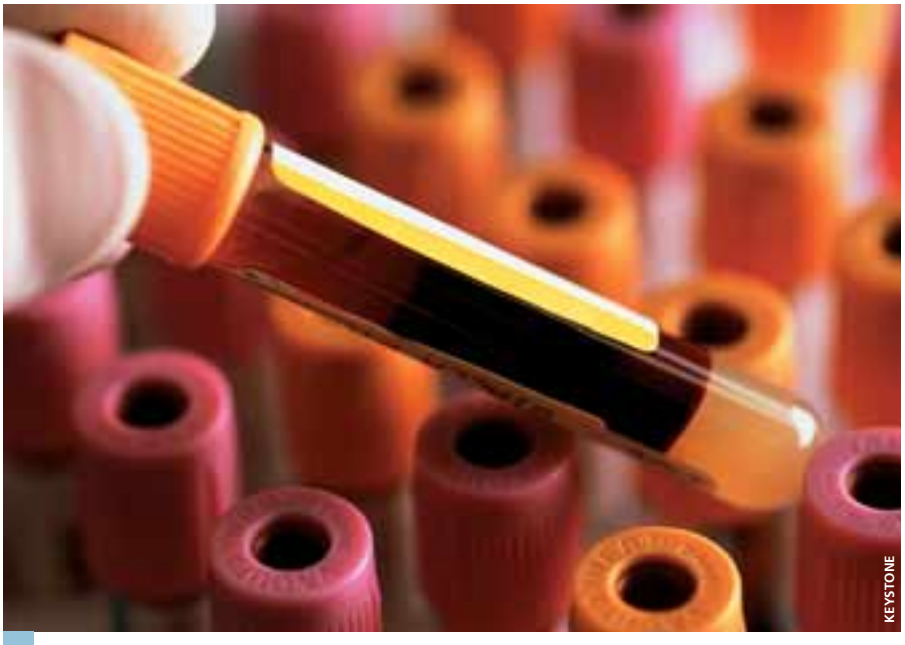
Diagnosis using non-invasive tests requires experience not only of cardiology but also of sports medicine, in order to differentiate between sports-related and pathological changes. Among athletes, around one in two ECGs deviate from the norm, but only a small proportion for pathological reasons.

Changes in the ventricle apex often lead to diagnostic difficulties (see diagram 3).

In our own investigations, we found that such changes were particularly common in black African footballers. Since so many athlete ECGs are "abnormal", it is particularly important to be aware of the individual athlete's ECG result while they are in good health, in order to avoid serious misdiagnosis if they do develop heart problems. It should also be stressed that the ECG is not a suitable basis for the assessment of an athlete's level of fitness.

Echocardiography is the most common method of ruling out cardiac muscle and valve problems (often known as heart defects). As mentioned above, thickening of the cardiac muscle (cardiomyopathy) is one of the most common causes of sudden cardiac death in athletes. Unfortunately, misdiagnosis is very common. Enlarged "athlete's hearts" – many footballers have an "athlete's heart" – are sometimes thought to be diseased, while changes such as thickening of the heart are wrongly interpreted as being caused by sport. A correct diagnosis is usually no problem for an experienced sports cardiologist.

The cardiological tests are supplemented with laboratory analysis of relevant blood levels and urine. Monitoring of blood lipid levels, for example, helps to prevent diseases which might result from



Heart-monitoring tests are complemented by blood tests.

Good physical condition is crucial, combined with regular and intensive training.

established risk factors. If a disease develops, it is easier to diagnose if the individual's normal levels are already known.

Further tests are only necessary if some kind of disease is suspected. A routine chest X-ray is inappropriate for the assessment of an athlete's heart and lungs, particularly since echocardiography picks up heart problems much more easily. An ambulatory ECG is only useful if significant arrhythmias need to be investigated. Stressechocardiography, myocard scintigraphy, magnetic resonance tomography of the heart and heart catheter investigations, including heart muscle biopsy, are expensive and should only be used in special cases. However, inflammation of the heart muscle, which can result from an infection, can only be diagnosed with sufficient certainty through tissue examination (heart muscle biopsy).

Different medical tests are carried out on young footballers at the German Football Association's youth academies. In the U12-U15 categories, the tests comprise a case history, a physical examination and a 12-lead ECG at rest. For the U16 to U19 age groups, tests are the same as for professional footballers, since the number of matches per season can be high and some players train and may even play with professionals.

Athletes in other sports who belong to the national A, B or C squads are entitled to annual checks as part of a sports medicine health programme. The cardiological tests are similar to those used for professional footballers. The tests are carried out in centres licensed by the German Sports Federation, mostly sports medicine institutes, and are funded by the Federal Ministry of the Interior. In Germany there is an information leaflet about sudden cardiac death. It was written especially for athletes and offers information and advice about sudden cardiac death and its prevention.

What must footballers do to protect their heart?

During illness, including infections, they should rest. "Sweating it out" by exercising can be dangerous. Following illness, players should resume exercise cautiously. Normal blood levels do not necessarily mean maximum resilience. If in any doubt, the doctor should be consulted immediately. In order to prevent infectious diseases, vaccinations should be carried out, particularly before travelling. Regular visits to the dentist can prevent hidden inflammations and their consequences. The body's defences are vulnerable during periods of repeated physical exercise. Sufficient recuperation after matches or tournaments is therefore also an important preventative measure against disease.

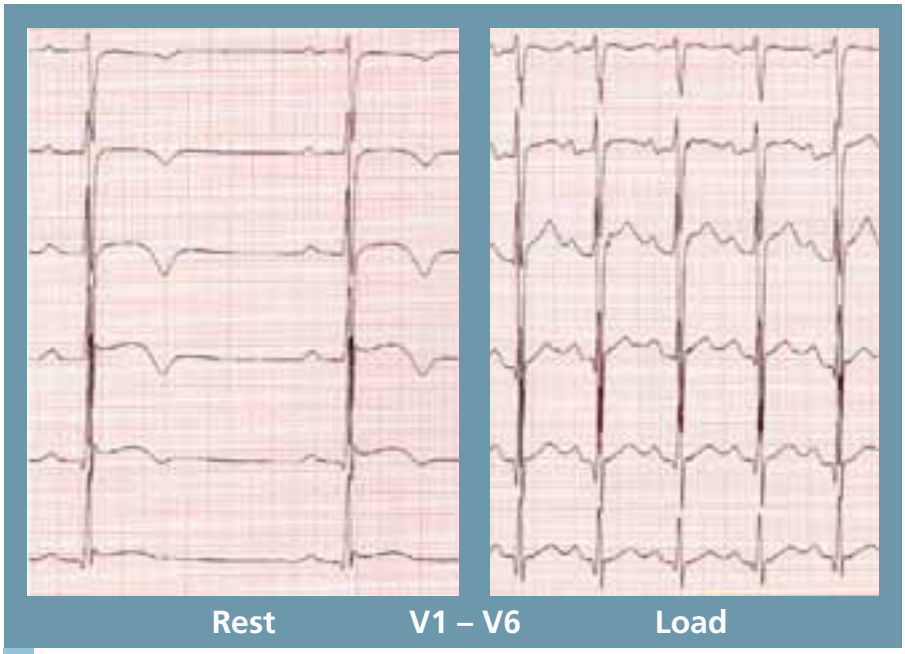


Diagram 3: Clearly abnormal rest ECG (left) and normal stress ECG (right) of a healthy 26-year old footballer. Colour Doppler echocardiography and a heart muscle biopsy failed to detect any disease.

CHRONIC SOFT TISSUE INJURIES OR A SPINAL PROBLEM?

By Prof. David Sutherland Muckle

Frozen shoulder, tennis elbow, golfer's elbow, groin strain, adductor tendonitis, hamstring tears and Achilles tendon problems… are a series of chronic soft tissue injuries that affect sportspeople. Some, as we all know, can be very troublesome in footballers.

We look to the soft tissues for pathology - micro-tears, scarring, haematoma formation, calcification; but often no obvious defect is found. Still the footballer struggles on with an array of therapies including steroid injections, ultrasonics, massage etc. Surgical intervention may even be used, such as tendon lengthening. However, there may be a spontaneous resolution in time even without any form of intervention.

In 1977 I was struck by the frequency of tennis elbow in an age group, which mirrored the onset of cervical disc degeneration and prolapse. The use of CT and later MRI scanning regularly indicated degeneration and prolapse of the discs in the cervical spine in 42 cases of refractory tennis elbow (lateral epicondylitis) (Muckle 1991).

Not all chronic injuries are a reflection of spinal disorders, but one must keep such disorders in mind, especially in troublesome cases. Common examples of a dual pathology are given below.

Frozen Shoulder
Classically a frozen shoulder limits abduction to below 70 degrees and tenderness is found over the anterior capsule with a subachromial bursitis. Our department's early arthroscopic studies (in 1979) showed a band of inflamed synovium across the anterior aspect of the capsule, in the distribution of the C5/6 nerve beneath the subscapularis muscle. Scanning indicated problems in the neck at this level in 40% of sportspeople investigated (70 patients). So how does the restriction of abduction occur? Quite simply due to scarring, pain and tightness of the anterior capsule. For abduction beyond 90 degrees requires external rotation of the humerus. A simple test is to abduct the shoulder with the palm facing downwards. External rotation of the hand becomes obvious as 110 degrees is reached. Therapy to restore full external rotation is mandatory and sometimes release of the anterior capsule by an arthroscopic technique is required.

The supraspinatus, often torn, is also supplied by the C5/6 nerve. Goalkeepers may also detach part of the glenoid labrum, especially the anterior aspect when abducting the arm while throwing the ball, as well as damaging the subscapularis and supraspinatus muscles.

Tennis elbow and golfer's elbow
These are not really a problem in football but once again reflect pathology at C5/6. The recurrent branch of the radial nerve and a major division (posterior interosseous nerve as it emerges from the supinator muscle) can give rise to a double crush (neck/peripheral compression) situation. A small branch of the

The hamstrings, when tight, may be torn as the player attempts to collect a waist high ball.

The mechanism of heading a ball requires arching (hyperextension) of the lumbar spine with a sudden flexion to give distance.

ulnar nerve as it passes behind the medial humeral epicondyle is often implicated in golfer's elbow. Therapy should be directed to the neck, if involved, as well as the limb.

Groin Strain
In almost forty years of treating elite footballers, two conditions now occur more frequently than previously; these are groin strain and stress fractures of the lumbar spine. Could they be related in any way? Stretching or tearing of the lower abdominal musculature around the inguinal rings in footballers can lead to a fatty hernia or even a small bowel hernia. The mechanism cited is the repeated internal and external rotation of the lower limb, which occurs in football. However, this explanation ignores the simple fact that rotation is at the hip alone and all muscles that rotate arise from the pelvic wall below the inguinal rings, apart from the psoas major, which originates from the lumbar vertebrae.

The mechanism of shooting demands extension of the back and hip, with psoas major pulled taught to powerfully flex the lower limb and, as a secondary feature, internal rotation of the limb occurs. The short external rotators must counterbalance this internal rotation and keep the foot pointing forwards. Thus the psoas tendon, external rotators and back are all at risk.

Weightlifting and an excessive strenuous training schedule can, by their repetitive nature, cause both back and lower abdominal muscle overloading, the latter leading to weakness around the inguinal rings.

The repair of all groin strains as an indicator of a hernia formation or fascial tear can lead to a failure in a small percentage of cases where the back or the muscles arising from the pelvic arch are damaged. On occasions, our department has identified and removed L3/4 or L4/5 discs as the cause of the groin pain. This level of disc therapy has led to the oft-repeated remark that the groin area is only supplied by L1 and L2 nerves, i.e. over the inguinal ring and inner upper thigh. However, the obturator nerve (anterior division) arises from L3/4, and when compressed by a disc bulge, can produce pain in the groin and also over the adductor longus tendon where it forms a plexus of nerves with the femoral nerve.

Hamstring injuries
Football is ballet with a ball. As the lower limb reaches towards a right angle with the trunk to collect a waist high ball the hamstrings are pulled taught at the ischial tuberosity. Anyone dealing with chronic back problems notes that the patient cannot carry out a straight-leg-raising test (often beyond 40 degrees) or touch the toes.

With lower lumbar problems the hamstrings tighten both reflexly and through a lack of active stretching due to pain. Thus when the footballer is asked to trap or collect a high ball or produce the sudden propulsive force of a sprint, the tight hamstring muscle fibres tear - usually at the tendon/muscle interface. The lateral hamstring (biceps femoris) has the common peroneal (lateral popliteal) almost adherent to its lower third and pain can be severe.

In 1984 our department showed that one common cause of hamstring problems in footballers is a stress lesion affecting either L5/S1 or L4/5, sometimes with a forward slipping of one vertebral body on another. With a forward slip, the disc between the vertebrae may be disrupted and adds to the nerve root irritation usually of L5, S1 and S2. Lumbar discs can on their own, of course, produce nerve irritation and muscle spasm. The back needs investigation by isotope or MRI scanning in all cases of recurrent hamstring injury (Muckle 1990).

Achilles tendonitis
The Achilles area and calf is supplied by L4/5, and disc or facet joint changes at this level can result in repeated micro-tears, leading to eventual rupture. As with tennis elbow the prevalence of Achilles tearing mirrors the onset of disc problems usually in persons in the late thirties. Once again, it may be wise to investigate the lower lumbar spine.

This brief article is intended to stimulate interest and aid a reappraisal of chronic soft tissue injuries in footballers, when the associated spinal problem can be easily overlooked.

IMPRESSUM

PRODUCTION
UEFA Publications Unit
Atema Communication SA – CH-Gland
Printed by Cavin SA – CH-Grandson

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