

Etio-pathogenesis and microtraumatism  
(1932, Mathieu-Pierre Weil)

Can the microtraumatic pressures exerted through sport or other means, and the increase in external aggressions engender or accelerate the apparition of premature coxarthrosis of a hip which is morphologically and radiologically proven to be normally constituted?

The mechanical factors of constraint on the tissue elements of the coxofemoral joint can be outlined in three groups:

- the intermittent static pressure exerted during the process of walking. This lever of the second type which is the hip is submitted to a biomechanical constraint four times the actual weight of the body for each step taken,
- the supporting area, whose determining role has been clearly demonstrated by Pauwels, supports, on average, a unit pressure of 16 kilos per square centimetre. This pressure may rise from 200 to 420 kilos per square centimetre if the hip is out of place, deformed or suffering from cotyloidian dysplasia, which is made worse when the body's posture is put off balance (as during the practice of shooting, dancing, judo, jumping, etc...), and depending on the weight of the subject
- the constant muscular pressure exerted due to normal muscle tonus, may be multiplied by ten when contractions occur, during intense muscle-development exercises and repeated and extreme tensions during the dynamics of movement brought about by sport

For the athlete, the hip is constantly put under pressure thus accentuating these phenomenon, and, what is more, the intense and sometimes excessive use of the locomotor apparatus, which is submitted to repeated stretching, running, jumping, hitting and throwing movements, creates repeated and identical multiple micro-traumatism in specific areas of the body. Tangential shocks caused through friction, or perpendicular shocks caused through micro-percussion, submit the capsules, tendons, cartilage, bones and ligaments to overstrain themselves (lesions of the chondrocyte), and progressively create extensive and long-lasting lesions, resulting in intra-articular pulverisation, which may bring about the formation of osteocartilaginous nodules which can be equally damaging.

However, not all normal subjects, nor even all sports people, suffer from coxarthrosis. The quality of the cartilage (matrices, chondrocytes, etc.) no doubt plays a role. A certain margin of security allows the hip cartilage to resist exterior aggressions and, as BURCKARDT (5) states concerning other articulations, are there not possibilities which permit to anatomically adapt to effort exerted on them which would augment their resistance? Therefore micro-traumatism do not explain all pathogens of sport-induced osteoarthritis.

To these micro-traumatism we must add violent traumatism (2 to 3%) caused by contusions or by falling (post-contusional bruising visible on MRI several months after the actual contusion) with or without fracture or dislocation (affecting ligaments, capsules, glenoidian folds...). In these cases, especially when bone or intra-articular lesions involving fractures occur, it is a well known classic to say that the apparition of premature coxarthrosis of a radiologically normal hip is fatal and very often rapid. This classic of traumatology does not however explain all osteoarthritic affectations of the sports person's hip.

The statistical studies of insurance companies (DUFORNIER (16)) show the feeble frequency of these real traumatism of the hip during sport activities, in particular concerning those sports which would seem to be the most affected by coxarthrosis (rugby, soccer...).

The repercussions of sport activities on the hip and regarding certain athletes' osteoarthritis, seem to be mostly of a micro-traumatic origin. However, it is not possible to estimate the percentage as regards the chance of an athlete getting coxarthrosis any more than a normal subject.

#### Data from the literature

Athletes are often victims of osteoarthritis, usually located in parts of the body characteristic of the sport speciality and of the consequent micro-traumatism thereof: soccer player's ankle (JR CABOT), elbow arthritis of the javelin thrower (FOURRE JM), etc. and yet it was an author called de MONTHERLAN, who first described the symptoms of the soccer player's foot in 1922 in his book "The Olympiads" !

The literary backup is relatively meagre.

- H VASEY (29), following the systematic examination of 1500 hips of athletes from various disciplines and of ages varying from 6 to 78, remarked 33 functional affectations of the hip, 31 of which were confirmed by radiology; but no conclusions were drawn from this study. In fact, if soccer players seem to be the most affected (43% of the subjects) this seems to be linked to the way the subjects were recruited. Only the Swiss soccer clubs submitted themselves to the examinations, and what is more they were all veterans.
- M BOUREL and al. (4) put forward various hypothesis and conclude, after an explanation of the coxofemoral function, that "the tendency to coxarthrosis is not exceptional in professional soccer players over the age of 50", thus concurring with F COSTE and al.'s study carried out on dancers.
- H BAGNERES and al. (3), note that on the 52 observations of ex-soccer players, there are only two cases of external polar coxarthrosis, one of which is bilateral. P DUFORNIER and al.(16) make similar observations in rugby players.
- Y DEMARAIS (11) (14), in his thesis, observes 9 cases of coxarthrosis amongst soccer players, 9 amongst rugby players, one judoka, one dancer, etc., and several amongst those who practice jumping, bringing the total to 29 out of 300 study cases. This study, involving a cross-examination and the medical examination of former P.U.C players, reveals that coarthrosis is more frequent in the sports environment than within the general population (0.1 % MURRAY & DUNCAN) (27) and that some sports specialities are more affected (soccer, rugby, judo, dance, jumping ...)
  - J ALFONSI and JP BOCHOT (7,8), as well as M GUGLIELMI's thesis (20), reveal 16 cases of coxarthrosis, 10 of which are bilateral, amongst professional soccer players.
- MURRAY & DUNCAN (27) study the adolescent athletes hip problems (epiphysary migration of the femoral head).

### **Radiological and Clinical characteristics**

#### **1 – To begin with, certain points must be made:**

- the least favourable sports seem to be soccer, rugby, dance and judo. There is therefore a certain pathological specialisation of sport (the effect of jumping, asymmetrical pressure points, sudden changes of direction...).
- Skiers suffering from coxarthrosis find it easier to ski than to walk (F FORESTIER), cyclists and swimmers re-educate their muscles, which is beneficial for the hip. Walking in warm thermal waters or in the sea helps re-education.
- Sex: a relative increase in frequency is observed in men. This is linked to the fact that a majority of men practice the more violent sports (soccer, rugby, judo...). It is worth carrying out comparative studies on the intense physical efforts exerted if sexual parity is not available, as with the US Marine Corps (cf. fractures due to fatigue).

#### **2 – Clinical cases**

Coxarthrosis :

Comparative clinical studies of coxarthrosis in the general population (0.1%) and in veteran sports people, allow for certain characteristic traits:

- in mild clinical cases, we may observe:
  - a prolonged period of rest and a good tolerance to pain (several discoveries during the systematic X-ray check-ups – the pursuing of intense physical activities) (F COMMANDRE (9)).
  - However, when the coxarthrosis is more painful, a less intense physical activity or a careful orientation thereof seems to lessen the pain (Y DEMARAIS,(12,14)).
  - A slow and progressive development and a stiffening of the hip. « The athlete learns to live with his/her coxarthrosis ».
  - Bilateral coxarthrosis predominates (16 out of 25 soccer players, F COMMANDRE, (8,9)). According to Y DEMARAIS (14), bilateral with a tendency to start and dominate on the left hip (4 out of 6), not found in certain statistics of M GUGLIELMI (20). This bilateral tendency can be explained by the constraints and the overstraining of the articulations in cases of dysplasia, which cannot always be detected.
  - The apparition of arthritis in the athlete is premature both for the primary and the secondary cases. The effects seem to appear around the age of 45 in the primary cases, and more remarkably around the age of 30 for the secondary cases.
  - No radio-clinical correlation has been observed between a specific sports activity and the apparition of coxarthrosis. However, coxarthrosis may strike athletes who have radiologically normal hips and no classic cause of coxarthrosis observed.
  - Finally, the notion of physical hyperactivity and sport is very important.

### **Simple osteophytic hip of the athlete:**

Coxarthrosis is not limited to the influence that sport may have on the hip. In fact, several studies allow us to observe the following:

- The fact that the hip is sometimes limited in its movements, without any functional evidence. VASEY (29) observes over 3% of these cases in male subjects practising diverse sports. DEMARAIS (13,14) observes the same small anomaly. C MANSAT (26) observes the debilitating stiffness due to the internal posterior affectation of the interlinear articulations leading to an internal posterior coxarthrosis due to the feeble backward and forward movement of the femoral neck.
- The progress is slow, the stiffness eventually predominates the pain.
- The objective radiological studies of the particular characteristics show a prevailing constructive factor (osteophytosis, condensation, osteosclerosis) over destructive phenomenon (articular pinching, geode), let's however note the following:
  - A perifoveal osteophytosis with superior and inferior cross-sections (between 40 and 50% of cases)
  - Modifications in the supporting bone structures, which become denser in 7 to 10% of cases. The one case of pagetic coxopathy observed is a pure coincidence.
  - A marked accentuation of the acetabular bones that receives the head of the cotyloid (15 to 30%) is characteristic of soccer.
  - Geodes of the femoral neck (11%) with or without associated osteophytosis. A pinching of the interlinear articulation is much more uncommon.
  - Thus athletes do not present any clinical or functional symptoms, but the X-rays reveal isolated osteophytosis of the hip. Dysplastic anomalies are rare.

So what lies in wait for the “simple osteophytic hip of the athlete”? (De SEZE, Y DEMARAIS and al. (13). The following of certain cases over several years has not given any precise answers, but some cases did develop into ascertained coxarthrosis.

### **Epiphyseal migration of the femoral head in the adolescent athlete**

Precocious physical activity in the adolescent may favour the epiphyseal migration of the femoral head. Systematic X-ray examinations, carried out by MURRAY and DUNCAN (27) on three separate groups of students belonging to schools where sport activities were practised with equal intensity, confirm this fact. The groups of students coming from schools where sport is obligatory showed more frequent radiological signs of epiphysiodesis (significant statistical differences). Jumping in particular is damaging.

These facts were not observed by Y DEMARAIS (13), nor by MURRAY & DUNCAN (27) in their studies on confirmed athletes.

### **Dysplasia and sports activities:**

The possible epiphyseal migration of the femoral head during sporting activities poses the problem of acquired dystrophy, or "congenital" dysplasia.

Might the premature overstraining during the period of growth, as well as certain specific exercises, favour the appearance of malformations? The discovery, during systematic studies (23,32), of a number of problems or dysplastic hips in dancers and judo players, seems to confirm this hypothesis. Can one not compare it to the external torsion of the tibia in the young soccer players? But on the other hand, is it not the fact of having a dysplastic hip which facilitates, by the suppleness it confers, the subject's ability to perform specific exercises? And finally, does not the athlete's coxarthrosis develop because the articulation already presents architectural or morphological faults linked to dysplasia, or a problem hip?? This last observation has resulted in the Medical Commission of the F.F.F. (French Soccer Federation) (AG BOEDA & A DUREY (17)) rendering obligatory an X-ray examination of the pelvis for all young soccer players in training during their medical visit for aptitude.

Not all the authors agree: on a group of 16 soccer players with coxarthrosis, 11 were already carriers of definite dysplasia or of a clearly pathological coxometric angle. Finally, one of the subjects presented the symptoms of a minor form of chondrodystrophy (M GUGLIELMI (20)). This would explain the bilateral tendency of coxarthrosis in athletes (9,11). DEMARAIS (13) observed that 5 out of 7 soccer players had a problem hip or a minor dysplasia. COSTE and al. (11) observed the same in dancers.

Finally, lesions of the cotyloid fold are often suspected, and sometimes discovered with the mechanical dimensional bone densometry with athletes complaining of pain associated with stiffness or disability. Are these lesions an etiological factor for seemingly primitive hip osteopathies but which are, no doubt, dysplasias...or are they linked to an articular degenerescence? What to think??

Athlete's coxarthrosis seems likely to be secondary, all the more rapidly appearing when the biomechanical constraints are precocious, frequent and intense. HUSSON and all. (21) observe lesions of the cartilage after the 12<sup>th</sup> hour of hyper-solicitation consequent to flexing and extending, with vibrations at a frequency of 70 hertz. The absence of rest inhibits all regeneration of the chondrocyte. A critical limit of overstraining exists, and reparatory rest is necessary.

### **Conclusion**

If athletes often suffer from femoral articulation disorders, the affectations are not all identical and certain problems occur.

The manifestation of coxarthrosis, revealing a dysplasia or an anterior architectural fault, is detected earlier compared to a sedentary individual. The microtraumatism and the excessive constraints a sport imposes work as a catalyst. The Ecole Toulousaine together with FICAT, ARLET, GEDEON & MAZIERES oppose the mechanical osteoarthritis on initially sane cartilage (bruising, instability) to structural cartilage chondrogenesis which is naturally of an inferior quality. According to orthopaedists, this precocious apparition is beneficial in that a corrective therapy of the architecture of the hip can be carried out, thus limiting the articular deterioration.

Coxarthrosis, often constructive and bilateral, imposes prolonged rest, thus favouring the maintaining of a good muscle tone of the thighs and of the pelvic girdle of the athlete.

Besides this major manifestation, the “athlete’s hip” also reveals a radiological detection of osteophytosis, bone osteocondensation, which is particularly destructive and for which clinics have only limited solutions.

Finally, precocious overstraining of the hip articulation poses the problem of the consequences of physical activities as favouring acquired dystrophies and dysplasias said to be “congenital”. As for all human activity, we must keep in mind that “one must keep reason” (F RABELAIS)