Guide to Clinical Practice for Dynamic Osteopathy of the Pubis (DOP):

Diagnosis, Treatment and Prevention

FCB Medical Department
Version 6.0 (April 2010)

Contents:

1. Introduction
2. Etiopathogenesis
3. Epidemiologic studies
4. Symptoms and Diagnosis
   4.1. Symptoms and physical examination
   4.2. Complementary tests
5. Differential diagnosis
6. Evaluation of lumbo-pelvic stability
7. Treatment
   7.1. Phase I, II and III
   7.2. Phase IV
   7.3. Surgical treatment
8. Criteria for return to competition
9. Preventative protocols
   8.1 Primary
   8.2 Secondary
10. Consulted bibliographic references

1. Introduction

The dynamic osteopathy of the pubis (DOP) has been described as an inflammatory pathology of the symphysis pubis and the osteoarticular and tendon structures that encase it. It was first described in sportspeople by Beer in 1924 and Spinelli in 1932 as a syndrome of the adductor muscles and/or lower rectus abdominis muscle and later in footballers by Bandini in 1949 [1].

In the international bibliography, this clinical picture has generated much controversy and confusion:

- First, because of the name. For many years, reference was made to the concept of the "sports hernia" or "athletic hernia" "[2,3,4,5] as the cause of the pain in the groin was attributed to small and concealed inguinal hernias. Nowadays, the most commonly used names are "osteitis pubis",[2,4,6,7,8,9,10] "athletic hernia" [11,12,13,] "adductor-related groin pain" [14] and the latest expression, coined by Verrall in 2007, is "sports-related chronic groin injury" [,15]
- Second, given the complexity of the etiopathogenesis of the clinical picture, better knowledge of the elements that form part of the anterior pelvis have given us a more profound understanding that has enabled us to design better preventative and therapeutic strategies based on the imbalance of forces that cause considerable stress on the articulation of the pubis[15] .

The name Osteitis Pubis (OP) is the most widely used on an international level, but we believe that Dynamic Osteopathy of the Pubis (DOP) is more appropriate, and is more traditional in our own country, so we shall maintain the use of that name.

DOP is most common in sportspeople that run, and most of all in sports in which the ball is kicked, such as Association, American, Gaelic and Australian Football. The incidence of injuries in the general sporting population is between 0.7 and 7% of all sports injuries and specifically in soccer is between 3 and 5%.[7,8,16,17].

Early diagnosis is not easy, but needs to be made, because DOP evolves chronically and can over-prolong the delay in returning to active sport. The condition usually begins with groin pain at the insertion level of the adductor muscles and evolves into supra-public pain at the insertion level of the anterior rectus abdominis [2,14].

Diagnosis is performed in accordance with analysis of the symptoms, physical examination and complementary X-ray studies, although the 'gold standard' is still clinical examination. DOP is a severe clinical condition, which requires a prolonged period of rehabilitation and complete recovery takes between two months and one year.[2 7,9,13,14,15]

Differential diagnosis is broad, and varies from urological, infectious or degenerative pathology to that which is related to sporting activity itself. Differential diagnosis must be performed with the inherent injuries of the abdominal muscles, the adductor muscles, and inguinal hernia.[,14,18,19]

The effectiveness of many of the protocols for the treatment of DOP have not been supported by a great deal scientific evidence, and many experts recommend conservative treatment, while surgical treatment is only recommended for the most refractory cases. [5,7,14,18,19,20] .

The treatment must be multidisciplinary, i.e. it must involve the participation of a variety of professionals and should be managed well. Rest from sport is also essential, which will evidently depend on the seriousness of the condition and it is often difficult to convince the sportsperson of how important it is for the process to evolve correctly.

The return to sporting activity must be gradual, and progress from one phase to the next should only occur once the pre-established targets have been achieved.

With respect to prevention, the risk factors of each particular sport need to be considered, including the injury-proneness of specific sporting movements, as well as the intrinsic risk factors of each sportsperson, thereby designing personalised preventative strategies for each individual.[21,22]

Finally, we must remember that this topic is still generating confusion and debate, so different scientists and clinicians with an interest in the matter should constantly be on the lookout for the latest developments.

2. Etiopathogenesis

The articulation of the pubis is a complex matter, which involves much more than merely the pubic symphysis, i.e. the space between the two pubic branches and which is of fibrocartilaginous constitution. In the articulation of the pubis or 'pubic joint', different muscular groups are inserted to cause a variety of rotational forces (see figure 1)

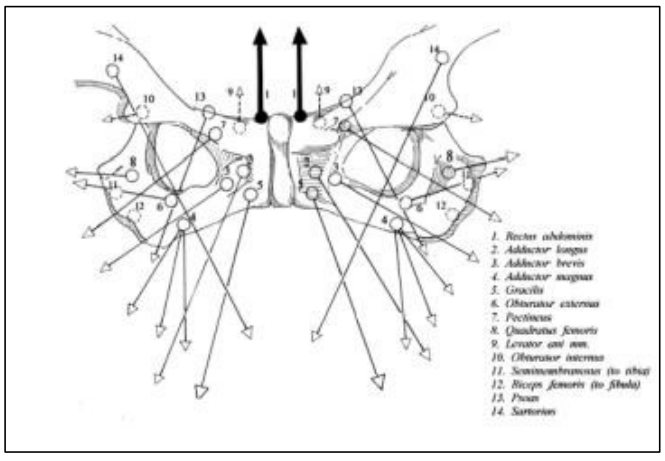


Fig 1 Anatomy of the articulation of the pubis and muscular insertions (from Meyers et al, 2007[13])

Fundamentally, we need to understand that the pubis is inserted in the abdominal muscular group *(rectus abdominis muscle and oblique muscle*) and where the adductor muscular group originates (*adductor longus and adductor medius muscles, adductor magnus muscle, adductor minimus or brevis muscle, pectineus muscle and gracilis muscle).*

The antagonistic action of these two groups has been postulated as the main cause of dynamic osteopathy of the pubis (DOP).

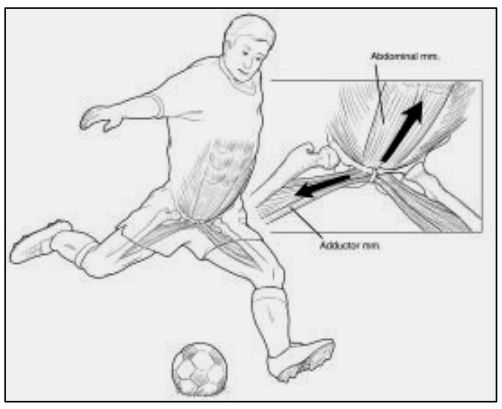


Fig 2. Antagonistic action of the muscles that are inserted in the pubis.

A Mandelbaum et al, 2006

This muscular imbalance mainly between the adductor muscles, which are especially trained, strong and tonic, and the abdominal muscles, which are phasic, and usually weaker and less trained, generates anterior pelvic instability that causes a constant shear defect of the pubic symphysis.[8]

So, through a repetitive and accumulated mechanism, a first disorder is produced on a bone – tendon level, followed by subacute prostatitis and ultimately, when the dynamic system for remodelling the bone reaches its limit, a suffering of the same is produced that causes bone edema on the level of the pubic branches.

Likewise, this muscular imbalance can also cause suffering in the adjacent articulations, especially of the sacroiliac joints and can reach other articulations such as the hip joints or lumbosacral region.

Various risk factors have been proposed to explain the propensity of certain sportspeople to suffer DOP. Orchard et al[21] in general and Arnason et al [22] in footballers highlight as the main intrinsic factors (i.e. that are inherent to the characteristics of sportspeople), the type of morphology of the pelvis (specifically the android pelvis), the dissymmetry of the lower limbs, the anteversion of the pelvis, as well as having a short hamstring. As extrinsic risk factors (i.e. those factors that are not directly associated to the sportsperson's physique), we could mainly consider the characteristics, such as type and amount, of training, as well as the characteristics of the playing surface, such as how slippery it might or might not be.

Of similar importance is the frequency with which certain sports movements and gestures are repeated, such as bending of the hips and adduction of limbs. Knowledge of these risk factors is very important when it comes to evaluating preventative strategies and treatment once the first symptoms have become apparent.

3. Epidemiologic studies

As we commented at the start of this guide, the incidence of injuries among the sporting population in general is around 0.5 -7% of all sports injuries. [7,8,16,17]

There have been few rigorous studies performed using an agreed and prospective methodology. Moreover, DOP is still a condition that is often not diagnosed correctly and is confused with its most frequent differential diagnoses, such as injuries of the adductor or abdominal muscle or groin hernias.

From a prospective study that has been conducted by the UEFA medical committee over the last six seasons in collaboration with the medical services of more than 17 clubs that play in the Champions League (Ekstrand, 2005)[17] we can summarise that the incidence of injuries involving the hip and groin area is 14% of the total. Of these, 62% correspond to problems related with the adductor muscle, 5% to inguinal hernia problems and 6% to groin pain, which includes DOP.

4. Symptoms and Diagnosis

4. 1 Symptoms:

The primary symptom of this pathology is pain in the groin area when doing sport. The pain is initially located in the insertion region of the adductor muscles, or otherwise in the supra-pubic area where the abdominal muscles are inserted. These initial manifestations are those of a traction enthesopathy, whereby the sportsperson will feel gradually increasing pain every time they do sport. The pain will gradually cause limitations on movements that combine bending and rotating of the hips and the adduction of the limb, as tends to happen when shooting, pivoting, jumping or changing direction while sprinting.

Even though the pain might disappear during the first few days of rest, or after warming up prior to doing sport, the condition evolves quickly and the sportsperson starts feeling pain during everyday physical activity, such as getting in and out of a car, until this is before, during and after physical activity. The pain definitively appears in the pubic symphysis and can irradiate towards the adductor area, the deep groin area, the testicles, and even the buttocks and lumbar regions.

4.2 Physical examination:

It is necessary to conduct a thorough examination of the lower limbs and of all of the passive and active elements of posterior and anterior lumbo-pelvic stability, which we will be looking at in more detail later in this guide.

During physical examination, the pubic symphysis is found to be painful, swollen and soft to the touch, which is what we call ‘tenderness’.

The diagnostic text proposed by most authors is what is known as the ‘Gap Test’ or ‘Squeeze Test’, in which the patient lies down with both legs and hips bent at 90º, whereupon the

examiner places his fist between the two legs and asks the patient to perform an isometric contraction. If the patient feels pain, the test is considered positive. [23]

Figure 3. The gap or squeeze test.
Isometric contraction test of the adductor muscles.
A Rodriguez et al, 2001[9]

An evaluation should also be made of the muscle and tendon masses of the abdominal and adductor muscles and of the inguinal rings, which could be dilated.
In 2001, Rodríguez et al[9] presented a clinical classification of DOP in 4 phases and several authors have made reference to this in naming the stages of the evolution of this condition:

Phase I: the symptoms are unilateral, mainly in the dominant limb, and are presented as groin pain and in reference to the adductor muscles. The pain is characteristically mechanic, and disappears after warming-up before training and reappears afterwards.
Phase II: the symptoms are bilateral, the pain is localised in the inguinal region and along the adductor muscles. The pain can also be focalised on the suprapubic region if treatment has commenced and therefore the symptoms relating to the adductor muscles improved. The pain increases after each training session.
Phase III: the symptoms are bilateral; the pain spreads to the suprapubic and abdominal region. There is pain during training, especially when shooting, sprinting, pivoting or jumping, and the objectives of the training session commonly cannot be achieved and the athlete withdraws.
Phase IV: the pain is generalised and tends to spread to the lumbar region. It increases when walking and/or defecating. The patient describes limitations on performing minor everyday tasks.

4.3 Complementary tests

The most commonly used image tests, and those that enable an accurate diagnosis and evaluation of the stage of the disorder at the moment of examination, include:

- Simple x-rays, which consist of,
    - an anteroposterior (AP) of the pelvis. In this projection, irregularities and sclerotic margins are found in the pubic branches and symphysis in the insertion area of the abdominal and adductor muscles.
    - an AP of each of the limbs in one-footed load (flamingo position). It is considered that a vertical displacement of > 2 mm between the pubic branches is pathological. Likewise, a horizontal separation of more than 7 mm is also considered positive[8]
- Bone gammagraphy with Tc 99: Shows early images captured at the pubic symphysis level and is therefore more appropriate for performing a quick diagnosis. The presence of asymmetric hypercaptation in each pubic branch is appraised and most valued of all is the bone phase, which tends to display an increase in bone metabolism or 'turn over'. Three degrees are described, which depend on the tracer's captation: light, moderate or intense.(1)
- Muscle-tendon echography: Something very important to do because this study completes the other tests and makes it possible to evaluate the implied muscles, especially their periostic insertions. We can discard purely muscle-tendon pathology. Likewise, echography enables a study of the inguinal canals whereby we can discard inguinal hernia pathology as the so-called sports hernia[1]
- MR (Magnetic Resonance): Seems to be the most appropriate test to confirm the diagnosis. Clear signs of DOP are the presence of bone edema in one or both pubic branches, liquid in the pubic symphysis and periarticular edema. There is unanimous agreement on this among several different authors: Albers, 2001 [24], Holmich, 2004 [18], Verrall, 2005 [25] and Cunningham, 2007 [26].

Zoga et al, in 2008, calculated major sensitivity of 98%, and specificity between 90-100%, when making a differential diagnosis mostly to differentiate between the enthesopathy of the adductor muscles and the rectus abdominis muscle; Cunningham [26] proposes an MR observation (see fig 4) of the presence of a second 'cleft' at the insertion level of the common tendon of the adductor longus and gracilis, which enable differential diagnosis with insertional enthesopathy.

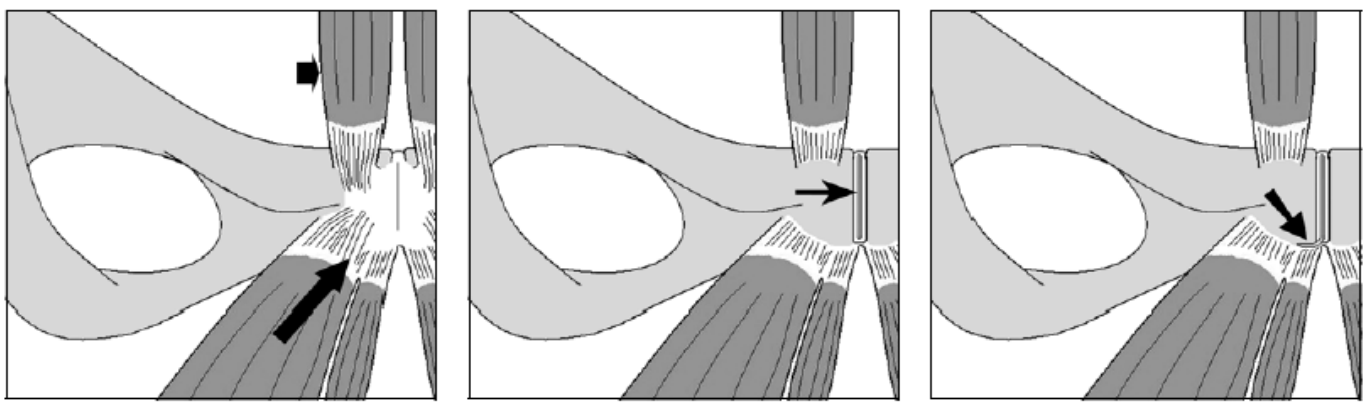


Figure 4. Of the pubic symphysis with (A) insertion of the abdominal muscle and adductor longus and gracilis, (B) normal 'fissure' of the pubic symphysis and (C) second 'fissure' or cleft of the injury through traction of the common tendon of the adductor longus and gracilis. A Cunningham et al 2007

In very developed cases, subchondral sclerosis, irregularity of the bone margins and osteophytes are also observed[10]

In short, to perform a diagnosis of DOP we should comply with certain clinical and x-ray criteria, along the lines proposed by Verrall et al in 2007, and which are those shown in table 1:

History	·	*Symptoms: uni or bilateral*
	·	Localization: anterior groin pain, adductor region, lower central abdominal region
	·	Duration: at least 6 weeks
Physical examination	·	'Soft' palpation of the pubic symphysis
	·	Painful palpation of the pubic branches until the insertion of the adductor (not the tendon)
	·	Positive gap or squeeze test
MR	·	Extensive bone edema, also presence of a hyperintense line in the pubic symphysis.

Table 1. Summary of the criteria for the diagnosis of dynamic osteopathy of the pubis

5- Most important differential diagnoses

Swan, in 2006 [3] and in a broad review of the issue of the 'sports hernia', proposed the differential diagnoses that are summarised below:

1. The first is to differentiate initial DOP from that which is an injury to the actual adductor or abdominal muscles, whether a tendon injury or torn muscle fibre.
2. Pathology of the iliopsoas (bursitis, tendon injury, torn fibre). Thus is normally an acute condition due to a brusque bending of the hip with profound groin pain and the functional tests are positive.
3. Unspecific groin pain, what is known as a 'sports hernia', or 'footballer's hernia', and has been described as an incipient inguinal hernia typified by pain below the pubic tubercle and discomfort in the pectineus area, which sometimes coincides with a 'weakening' of the external inguinal ring.
4. Abdominal or groin hernias in the truest sense
5. Sacroiliac dysfunction
6. Pelvic stress fractures, rare on a pubic branch level and, in adolescents, avulsion fractures.
7. Intra or extra capsular hip problems
8. Trapped nerve syndromes (obturator nerve (L_2-L_3) or femoral nerve (L_3-L_4))
9. Discogenic pain from T_{12} to L_5
10. Hip pathology such as acetabular impingement, osteochondritis etc.

Zoga et al, in 2008[(27)], in a revision of 141 patients diagnosed with 'athletic hernia' or 'groin pain', noted that 102 patients received surgical intervention after MR. The diagnoses were, in order of frequency, 64 insertional disorders of the rectus abdominis muscle, 48 with insertional affectation both of the rectus abdominis muscle and the adductor muscle, 15 with an adductor pathology, 8 with osteitis pubis, and two hernias in the truest sense, but 55% of all cases presented bone edema around the pubic symphysis.

Given the above, we can say that the diagnosis of DOP is still a complex matter and in many cases it is essential for MR to be performed in order to confirm the diagnosis.

6. Valuation of Lumbo - Pelvic Stability

Lumbo-pelvic stability (LPS), which is known in the bibliography as 'core stability', is what Kibler et al defined in 2006 [28] as the basis of the dynamic control of the torso that permits transfer and control of the forces of movement towards the lower segments of the kinetic chain.
We have already commented that the lumbo-pelvic region is the converging point of different opposing forces that act on the pelvis, such that we call them ascending and descending kinetic chains. While these chains, formed by ligaments, muscles and fascias, transmit the forces and tensions that end up converging in the pelvic girdle and its passive structures (sacro, iliacs, pubic symphysis, lumbar, etc), any deficit in neuromuscular control of the torsi and pelvis can be the cause of sports injuries, such as a lack of abdominal strength, which could lead to further hamstring injuries. [29]

LPS depends on good synchronization between the different lumbo-pelvic stabilising elements, and which are divided into the local and global. The local are made up of the pelvic floor, the transversus abdominis, the diaphragm and the deep fibres of the multifidus.

They play the role of increasing intra-abdominal pressure, increasing the tension of the thoracodorsal fascia and increasing articular rigidness. The global stabilisers are the oblique posterior chain (formed by the latissimus dorsi, thoracolumbar fascia and gluteus maximus), the oblique anterior chain (formed by the external oblique abdominus, abdominal fascia, oblique muscles and adductors), the longitudinal chain (formed by the biceps femoris, thoracodorsal fascia and spinalis thoracis) and the lateral chain formed by the gluteus medius, and the thoraco-pelvics) [30].

Comentario [M1]: Es

That said, we propose that the initial evaluation of the LPS of a player is very simple and consists of performing an ASLR (Active Straight Leg Raise) from the supine position as shown in Figure 5. What we evaluate is whether the leg can be raised or whether there is a reduction in strength or small compensatory pelvic movements.

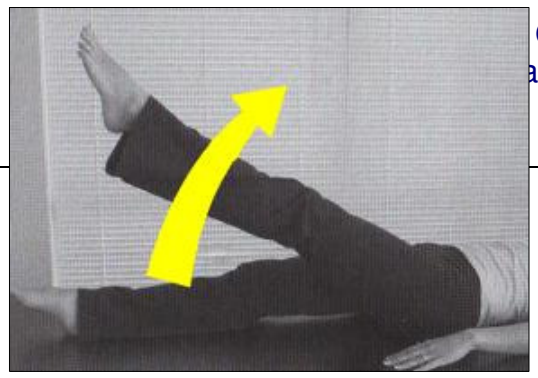


Fig 5. Active Straight Leg Raise test (ASLR)

To evaluate lumbo-pelvic stability

If this is positive, we can move on to a much more analytic second level, which normally requires some training for the therapist or examiner, and consists of the evaluation of the following elements:

- Balance of the pelvic floor, abdominal, adductor, abductor, gluteus, multifidus, pyramidal, lumbar, iliopsoas, rotator and hamstring muscles.
- Structural and/or articular balance of pubic, hip, sacroiliac and lumbosacral articulation.
- Balance of stability and integral flexibility, which consists of evaluating all of the described elements by means of complex exercises, as we shall see.

By doing all of this, we can make a very accurate diagnosis of the extent of the condition, and a more personalised recovery schedule can be programmed. [31]

7- Treatment

The treatment should be conservative at first, evaluating the characteristics of the bones and the actual sportsperson, as this could indicate early surgical treatment.

As always, the treatment should be individualised but in general terms the most important thing is that, when the first clear symptoms of DOP appear, rest from sport should be recommended,

along with a basic rehabilitation programme and some good guidelines to improve lumbo-pelvic stabilisation.

The period of rest from sport is a controversial issue and according to different authors can be anything from 3-4 weeks to 5-6 months, though this will obviously depend on such factors as age, the sport in question, the time of the season, etc. [5, 6, 7, 14, 15, 20]

As tends to happen in these cases, we have not found any studies that provide any clear scientific evidence for the different rehabilitation protocols. The most widely used treatment is basically a personalised combination for each patient involving NSAIDS, ultrasonography and electrostimulation. It has also been described that we can improve the symptoms with cryotherapy, massage and lumbo-pelvic stabilization through exercises. Corticosteroid infiltration has been used with good results, especially in sportspeople that cannot stop competing, but this is not a definitive treatment, it is merely palliative.[32]

Another proposal has been the use of neoprene 'hose' to alleviate the discomfort in the groin[33]. Low-intensity pulsed ultrasound (< 0.1 wcm^2) has also been proposed, which is applied for 20 minutes to the area of the pubic symphysis and branches. [34]

The rehabilitation protocol that we are proposing in this guide to the treatment of DOP is the one described in Wollin 2006 [2] and Verrall 2007 [15], which is subdivided into a programme for the phases I, II and III in Rodriguez et al [9] and another for phase IV:

7.1 DOP rehabilitation programme in phases I, II and III

1st module: Pain reduction phase

- RICE (rest, immobilization, compression and elevation)
- Low intensity pulsed therapeutic ultrasound on the pubic symphysis.
- Magnetotherapy (frequency 20-25 Hz, 10-15 degrees of intensity and 4-pole interferentials around the pubic area (50-100 Hz/ 80-100 Hz) has been proposed but not verified.
- Static isometric strength work on the muscles of the pelvic floor and transversus that can be guided using a musculo-skeletal diagnostic ultrasound apparatus.
- Isometric adductor muscle exercises, with specific control of the abdominal muscles.
- Prolonged and gentle stretching, controlled without causing pain. This phase only lasts 3 to 6 weeks depending on the case.

2nd module: Early dynamic phase

- Resistance is increased to the exercises to strengthen the pelvic floor and transversus muscles.
- Work commences on the gluteus.
- Using elastic bands, work commences on flexion, extension, abduction and adduction of the hips (the latter with much caution).
- Work may commence on the exercise bike, starting with 10 minutes a day and increasing gradually.
- Work commences on lumbo-pelvic stabilization, which are more demanding exercises as shown in figure 6. The repetitions and periods of rest must be progressive. The postures should be maintained for between 6 and 12 seconds.

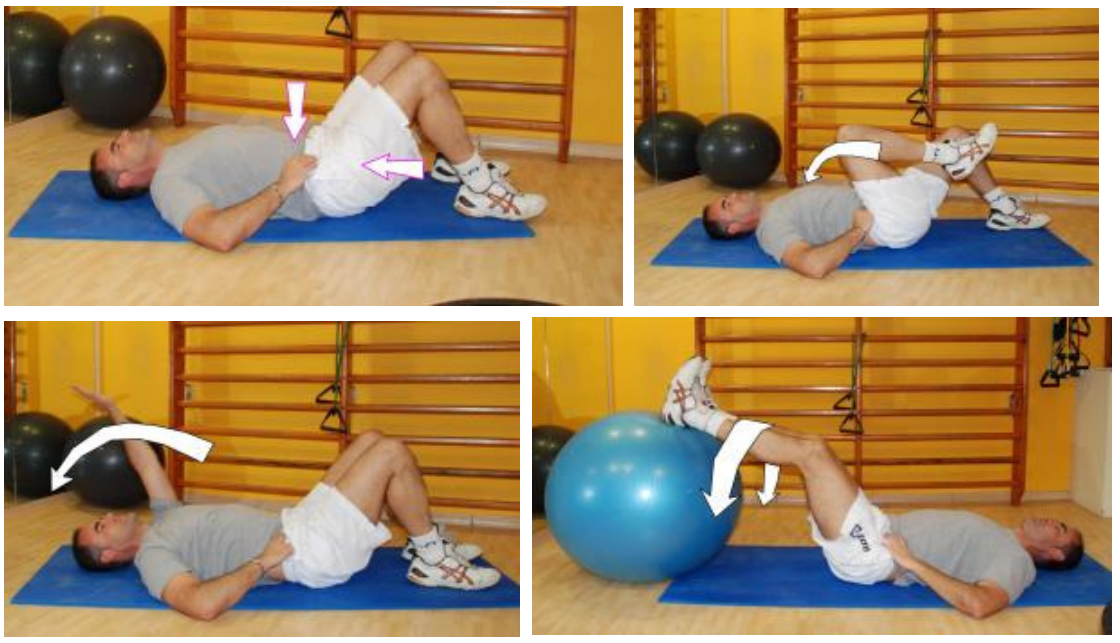


Figure 6. Four basic exercises for improving lumbo-pelvic stability

<u>3rd phase: Dynamic in the truest sense</u>

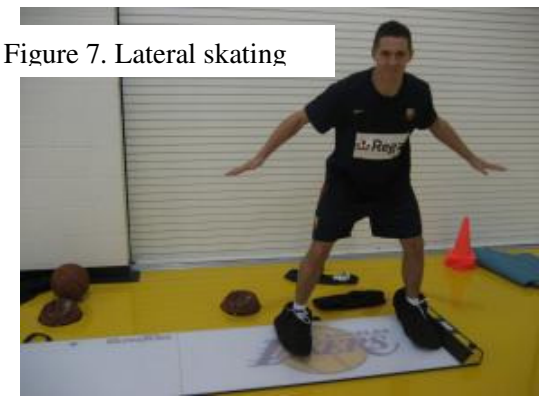


Figure 7. Lateral skating

- Work commences on lateral ‘skating’ exercises (see Figure 7), first with a distance of 1m and gradually increasing to 3 series of 10 repetitions of 30 seconds each.
- Manual exercises are done with the entire eccentric-concentric range of motion (ROM) of the adductor muscles with the help of the physiotherapist or fitness coach.

- The exercises are intensified with the gluteus and on lumbo-pelvic stability, namely the exercises proposed in figure 8.

Figure 8. Advanced lumbo-pelvic stabilization exercises

- More resistance on exercise bike
- Jogging commences

This phase can last between 4 and 6 weeks

<u>4th module: Advanced phase</u>

- Exercise bike with intervallic protocols
- Continue increasing jogging with changes of direction and speed
- Increase the number and length of skating exercises.
- Work intensely on the full ROM with eccentric-concentric exercising of the adductor muscles
- More complex lumbo-pelvic stability exercises are incorporated that are normally more specific for each sports movement.

This phase can take between 4 and 6 weeks.

The advance from one phase to the next is determined by the optimum adaptation for each patient. If there is no pain, the gap test is negative and the lumbo-pelvic stabilization exercises can be done without any loss of balance, then the patient may progress to the next stage.

7.2 Treatment phase IV

The treatment of a phase IV patient/player can be controversial. Normally in elite sportspeople that have reached this stage by whatever means, it is necessary to directly indicate the option of surgery, as it will not have any major effect on the term for returning to competition and we may avoid relapse. However, in sportspeople that are unwilling to take the surgery option, the conservative protocol is the following:

Initially

- Rest for 12 weeks, where it is important not to apply any kind of load, to walk very little and obviously not run.
- Likewise, we start work with all of the antianalgesic instruments we have, along with those described previously for phases I, II and III.
- Initially, only swimming with a float between the legs and the exercise bike are permitted. And these activities are only allowed when they do not cause pain!!!!!
- After a month, the patient may start gym-work using weights to work on the upper body.

After 6 weeks of rest

- Start step exercises, 5 minutes a day, increasing by 1 minute every day as long as the sportsperson does not feel any pain.

After three months:

- The patient may start running, starting with 5 minutes of jogging a day and increasing by 1 minute each day as long as no pain is felt. This strategy should be followed until reaching 30 minutes.
- At this moment, the early dynamic phase proposed for phases I, II and III can be incorporated.
- Then we can gradually increase the speed by means of an interval-based training session involving changes of speed and direction.
- Gradually introduce specific exercises to readapt the sports movement and comply with all of modules of the advanced phase.

7. 3 Surgical treatment

Remember that as we said earlier, surgical treatment is only performed in the case of the conservative treatment failing. Although the indications for surgical treatment will depend on many factors: age, sport, level of competition, etc, we can offer as the main indications:

- Severe pain that does not go away with medical treatment or physiotherapy.
- Persistence of the symptoms after 4-6 months of conservative treatment.

Also, it does not seem that image tests such as MR can be used to indicate the need for surgery[35]

There is no consensus based on scientific evidence regarding the most adequate moment or procedure for surgery. The main procedures used have been the following:

- Tenotomy of the adductor longus.
- Curettage of the pubic symphysis.
- Arthrodesis of the pubic symphysis.

Tenotomy of the adductor longus is the most used technique in our field, especially in patients with a large degree of ‘adductor’ symptomatology, and although the bibliography on the subject is very limited, it does seem to achieve good long term results. [36,37, 38]

Curettage of the pubic symphysis is a relatively simple technique and can be significantly beneficial for athletes with 'pubic symphysis' symptomatology and that wish to take up sport again quickly. [20, 38]

Placing a retro-pubic mesh is an effective technique for the treatment of patients with a large degree of 'abdominal' symptomatology[35]. Therefore, repair by open or laparoscopic surgery gives good results but the latter permits an earlier return to sporting activity. Arthrodesis of the pubic symphysis in cases of osteitis pubis with vertical instability of the symphysis has in some cases been described with somewhat inconclusive results. [6]

8. Criteria for return to sporting activity

Wollin et al in 2006[2] proposed various tests to evaluate when a player can return to sporting activity with full guarantees after suffering DOP. But it depends on many factors: the type of player, the sport, the level of sport, etc. What we are proposing in this guide are common and generic criteria for all sports and players.

Clinical criteria:

- Asymptomatic for at least one month
- Negative isometric gap test
- Painless palpation of the pubic symphysis and pubic branches.
- Perfectly tolerates the different strengthening exercises proposed.
- Perfectly tolerates both the skating rehabilitation exercises (3 series of 10 repetitions in 5 minutes) and the eccentric – concentric exercises (3 series of 12 repetitions with 6Kg)
-

Criteria for physical test:

- Achieve a similar time and intensity in different tests to the values prior to the injury, and also in the Multi-Stage Fitness Test.

By passing this test, we understand that the player can gradually start rejoining training sessions with the rest of the team, but this does not mean that he/she will be in peak physical condition for competition. But the athlete can be declared fit, and allowed to return to competition as long as he/she is able to tolerate at least one week of normal training with the rest of the team without suffering any bother.

The bibliography contains various approximate forecasts, depending on the stage of progress, for the return to activity. As a rough guide and based on different authors [9, 31, 8, 2], Table 2 gives an indication of these expected periods.

Clinical stage	Forecast for 'return to play'
I	4-6 weeks
II	6- 8 weeks
III	9- 12 weeks
IV	4- 5 months

Table 2. Predicted period for return to competition by stage of DOP recovery process

9. Prevention

Prevention continues to be the major pending matter among coaches and managers, who find it difficult to incorporate prevention programmes in their daily training schedules, and it is also a troublesome issue among clinicians and scientists, as there have been very few studies that have shown using scientific evidence that any specific programme can guarantee any reduction in the risk of suffering DOP.

Prevention work is a stimulus that must be performed all year round, from the start of the season, and not just during periods of pain.

It generally consists of correct toning and balance of all of the muscle groups, meaning the abdominals, which should be toned, the adductors, which need to gain flexibility, and the

external rotator muscles of the hip and hamstring, where possible disorders between the agonists and antagonists must be evaluated and compensated.

In this section, we shall be showing what primary prevention protocol should be observed by all players in the team. Secondary prevention is what we understand to mean activities that should be performed by all players that have suffered from DOP and who should therefore follow a more specific and individually-adapted programme. The protocol we describe here is based on the experiences of the group working at FC Barcelona.

9. 1 Protocol for primary prevention of DOP in teams

This should be done every day in training as part of the warm-up. All of the exercises are done and by the entire group, while the number of series and repetitions must be adapted to the category, time of day, week and season.

1st exercise

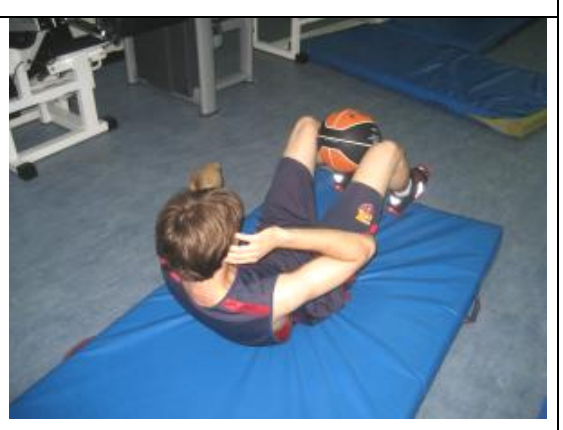
Objective: isometric tonification of the flexor muscles of the trunk and abdominal oblique, through the muscular diagonals and decoaptation of the posterior chain.

Initial position: Patient in Supine Position on a floor mat, with the hips bent at 90º and the feet crossed, without touching the floor. Perform a counterweight with one hand on the Ant-Int face of the opposite knee. The other hand behind the head to relax the neck muscles.	
Execution: Perform a concentric contraction of the trunk flexor muscles, trying to move the knees to the chest, being neutralised by an equal intensity force in the opposite direction to the crossed-over hand. Hold the contraction for 10” and then alternatively change the diagonal. Perform (10 rep./leg x 10”) x 2	

series	

2nd Exercise

Objective: Isometric tonification of the adductors and transversus, and concentric/isometric tonification of the abdominals.

Initial Position: Patient in Supine Position on a floor mat, bending the hips and knees 90º (holding a ball between the knees), and with the feet rested on the floor. Hands behind the ears with elbows bent and open, but making sure that the neck muscles are not overworked.	
Execution: Breathe air in and out from the abdomen and then perform an apnoea, along with isometric contraction of the transversus muscles. Then perform an isometric contraction of the adductor muscles against the ball and finally perform a concentric contraction of the abdominals, holding the isometric contraction of the abdominals for 10". Perform (20 rep. x 10") x 2 series.	

Third exercise

Objective: Isometric tonification of the transversus and concentric tonification of the anterior rectus abdominis

Initial position and Execution: Patient in Supine Position on a floor mat, knees bent 90º and feet supported on the floor. Perform an isometric contraction of the transversus and immediately after a concentric contraction of the abdominals (anterior rectus). At the same time stretch the arms towards the knees, which will perform an external rotation of the hips, holding the position for 10". Perform (15 rep. x 10") x 2 series.	

Fourth exercise

Objective: Eccentric/concentric tonification of the latissimus dorsi, in closed, bilateral kinetic chain.

Initial position: Patient in lateral supine position with two points of support, one in the arm with the elbow bent 90º and the other in the outer face of the foot. Counter-lateral hand on the iliacus in 'war position'. The whole body in a straight line: head, upper limbs, trunk and lower limbs aligned.	
Execution: Starting from an isometric contraction, slowly perform an eccentric contraction of the latissimus dorsi and before touching the floor once again perform a concentric contraction of the latissimus dorsi until the body is back in line, then hold this position by isometric contraction for 5" and then repeat. Perform (20 rep x 5") x 2 series.	

Fifth exercise:

Objective: Isometric tonification of one half of the body and concentric tonification of the other.

Initial position and Execution: Patient in supine / lateral position supported on arm with elbow bent at 90º and on the external face of the foot. Counter-lateral hand on the iliacus in 'war' position. Holding the whole body with the upper limbs, trunk and lower limbs in line. From this position, make upward abduction movements with the free lower limb. Perform (10 rep. x 2 series), bilateral	

Sixth exercise:

Objective: Isometric tonification of the complete anterior muscle chain in closed kinetic chain.

Initial position and Execution : Patient in Prone Supine Position on the floor, with two support points, on both arms and on the tips of the toes, holding an isometric contraction of all of the implied structures for 1'. Perform (3 rep. x 1') x 2 series.	

Seventh exercise:

Objective: Tonification of the dorsi and oblique muscles in concentric/eccentric contraction in closed kinetic chain.

Initial position: Patient in lateral supine position and two points of support, arm with elbow bent to 90º and both feet, one in front of the other to stabilise and line the head, the trunk, elbow and lower limbs, Counterlateral arm in line with the body and bent 90º at the elbow to facilitate rotation of the trunk.	
Execution: From an isometric contraction we perform a slow eccentric contraction of the latissimus dorsi and at the same time rotate the trunk by contraction of the oblique. Without touching the floor, we end in the supine/prone position and again rotate the trunk until the body is in line, and start the exercise again. Perform (20 rep x 2 series), bilateral	

Eighth exercise:

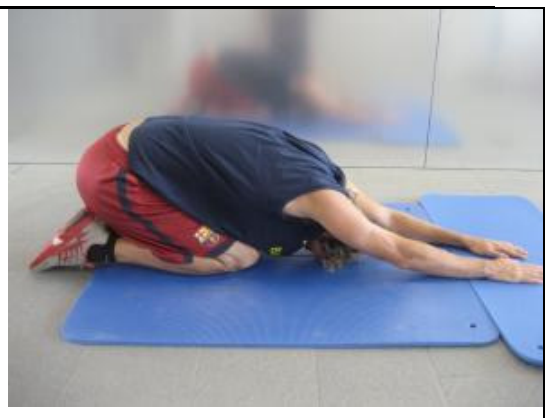
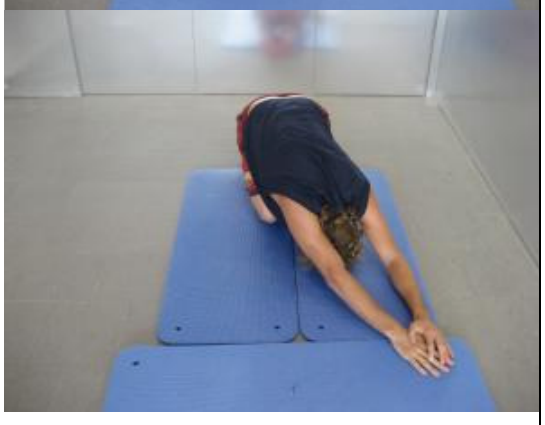
Objective: Isometric/concentric tonification of the multifidus, gluteus and hamstring in closed kinetic chain.

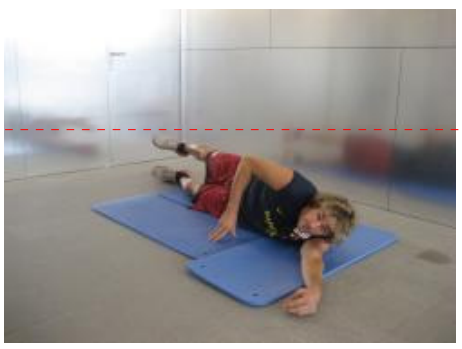
Initial position: Patient in Supine Position on the floor with three points of top support on the occipital, back and arms, and the lower body supported with both feet on the floor and with the knees bent. Align the head, trunk, hips and lower limbs by means of an isometric contraction. Once aligned, lift a lower limb with the knee semi-bent.	

Execution: Once we have full control of the starting position, perform a concentric and eccentric contraction of the gluteus and hamstring of the supported limb in such a way that we raise and lower the limb that is in the air, without it making any contact with the floor. Perform (10 rep. x 2 series), bilateral.	

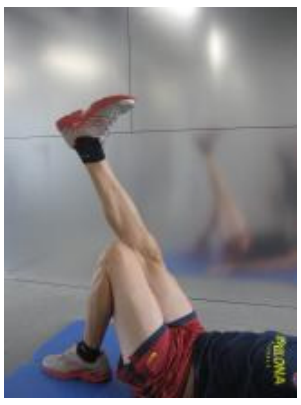
9. 2 Protocol for secondary prevention of DOP

We understand a secondary prevention protocol to be all that athletes that have suffered a hernia in the past do in addition to the exercises that they perform with the group. These can be done after every training session and normally involve 3 series of 8/10 repetitions with 3 minutes rest between series.

Exercise 1 *Objective:* Delordosing stretching of the back *Initial position:* Patient sat on their heels with the arms outstretched, placing the hands as far away as possible from oneself, with the head facing the belly and trying to stretch the back as much as possible. *Execution*: Hold the maximum stretch position, relax and once again seek the longest stretch possible.	
Exercise 2 *Objective:* Delordosing stretching and lateral flexibilization. *Initial position:* Patient kneeling and sat on the heels with the arms outstretched, placing the hands as far away as possible from oneself, with the head between the knees and facing the belly and trying to arch the back as much as possible. *Execution:* Once this stretching position has been reached, gradually shift the trunk sideways, trying to place the hands as far ahead and to the side as possible. Once the maximum stretch is reached, hold the position. Then gradually move to the other side and once again seek the maximum stretch.	 
Exercise 3 *Objective:* Mobilization and flexibilisation of the back *Initial position:* Patient on all fours with the knees apart and arms stretched. Start with global lordosis, with the head outstretched looking forwards. *Execution:* From the starting hyperlordosis position, mobilise each vertebra in turn (by segments), from the sacral, then lumbar until the cervicals until reaching the maximum delordosing effect, finishing with the head looking inwards. Use little tension to achieve this.	

	
Exercise 4 *Objective:* Strengthening of the gluteus and diagonal stabilization *Initial position:* Patient on all fours with the knees apart and the arms stretched, keeping the sacral, back and head inwardly aligned on the same plane. *Execution:* From this starting position, stretch a leg backwards, without forcing the final degrees and stretching the opposite arm forward as much as possible, again without forcing the final degrees. Hold this position for 20" and then immediately so the same with the opposite diagonal.	 
Exercise 5: *Objective:* Strengthening of the hip adductors *Initial position:* Patient in lateral supine position on the floor, with the lower leg slightly bent to stabilise the body and with the upper leg's knee stretched. *Execution:* Once nicely stable, perform a contraction of the tensor of the fascia lata of the upper leg, lowering the limb, but without touching the other leg...	 

Comentario [M2]: Po
según la foto es 'bajar', n

Exercise 6 *Objective:* Reinforcement of the hamstring, gluteus and multifidus in closed kinetic chain. *Initial position:* Patient in Supine Position with three points of support on an occipital, shoulder and feet level, with the knees bent. Keep the body aligned with the knees, hips and back in isometric contraction for 10". *Execution:* From this position, relax the muscles by letting the gluteus drop and then perform the concentric contraction of the hamstring and gluteus again. Perform another concentric contraction of the hamstring and gluteus to align the body once again. Hold this position for 10".	 
Exercise 7 *Objective*: Reinforcement and stabilization of the pelvis, single-foot. *Initial position:* Patient in supine position with three points of support: occipital, shoulders and one foot. Keep the knee, hips and shoulders aligned on the same plane hold the other lower limb with the knee outstretched and the hips bent. *Execution:* From this position relax the muscles and lower the gluteus without it reaching the floor and then raise again by means of a contraction of the hamstring, gluteus and multifidus of the supported lower limb.	 
Exercise 8 *Objective:* Reinforcement of the abdominals and flexors of the hip. *Initial position:* Patient in Supine Position on the floor. With the knees bent and feet on the floor, cross the arms over the chest. *Execution:* Perform a concentric contraction of the abdominals and bend the trunk, holding this position for 10" and then lower	

again by slowly relaxing the muscles. Repeat the movement as soon as the floor is touched.	
Exercise 9: *Objective:* Reinforcement of the abdominal and adductor muscles with pelvic control of the lower limbs. *Initial position:* Patient on all fours with the arms stretched and knees bent and apart. *Execution:* Stretch a lower limb and keep the other one bent, and from there perform movements of the adductor muscles of the lower limb that is in the air. Then repeat with the other limb.	
Exercise 10: *Objective:* Reinforce the external rotators of the hip. *Initial position:* Patient on all fours with the arms stretched and knees bent and apart on the floor. *Execution:* From this position perform a concentric contraction of the external rotators on one side of the body to achieve an abduction of the hip. Repeat this movement 10 times, and then repeat with the other lower limb. When complete, repeat with the first lower limb.	 

10. Bibliographic references

At the end of each citation the level of recommendation is given in parenthesis, and which is given in accordance with the level of scientific evidence. The criteria are established in the following table.

Grading systems for recommendations of guides to scientific evidence (ⁱ)

Level of scientific evidence		**Level of recommendation**
1 ++	Systematic RCT* meta-analysis or revisions of high quality, or RCT with a very low risk of subjectivity	**A**
1 +	Systematic RCT meta-analysis or revisions of a good level, or RCT with a low risk of subjectivity	
1 -	Systematic RCT meta-analysis or revisions, or RCT with a high risk of subjectivity	None
2 ++	High quality systematic revisions of cohort studies or controlled cases, or studies of cohorts or controlled cases with a very low risk of subjectivity or possibility of the relation being coincidental.	**B**
2 +	Studies of cohorts or controlled cases with a low risk of subjectivity and moderate of the relation being coincidental	**C**
2 -	Studies of cohorts or controlled cases with a high risk of subjectivity or possibility of the relation not being coincidental	None
3	Non analytical studies (descriptive clinical cases that are non experimental, comparative, correlated, series, etc.)	**D**
4	Expert opinions, or opinions of prestigious committees or authorities	

RCT: randomised and controlled trial. The evidence that can be extrapolated from studies is categorized with a level of scientific evidence, which can mean that the level of recommendation of some categories is classified lower. Thus, 1+ can be **B**, 2++ can be **C** and 2+ can be **D.**

1. Balius R. Patologia muscular en el deporte, Ed: Masson, Barcelona, 2004 (D)

2. Wollin M., Lovell G. Osteitis pubis in four young football players: a case demonstrating successful rehabilitation. Phys therapy in sport. 2006; 7: 153-160 (C)
3. Swan KG, Wolcott M, The athletic Hernia Clin Orth and related research, 2006: 455:78-87 (D)
4. Fanton SF. Osteitis pubis etiology and treatment. Sports Medicine 1997: An NFL perspective. May 9-11. San Francisco CA. (D)
5. Gilmore J. Groin pain in the soccer athlete: fact, fiction and treatment. Clin Sports Med 1998: 17; 787-793. (D)
6. Williams P, Thomas D, Downes E. Osteitis Pubis and Instability of the pubic symphysis: when no operative measures fail. Am J Sports Med, 2000, 28:350-355 (D)
7. Pauli S., et al. Osteomyelitis pubis versus osteitis pubis: a case presentation and review of the literature. British J Sports Med. 2002; 36 (1): 71-73. (C)
8. Mandelbaum B I Mora. E. Osteitis Pubis... Oper Tech Sport Med 2005 13:62-67 (D)
9. Rodríguez C., Miguel A. et al. Osteitis pubis syndrome in the professional soccer athlete: a case report. Journal of athletic training. 2001. 36 (4); 437-440. (D)
10. Kunduracioglu B., Yilmaz C, Yorubulut M, Et al. Magnetic resonance findings of osteitis pubis. J Magn Reson Imaging. 2007; 25:535-539. (D)
11. Verrall GM Slavotinek JP,Font GT. Incidence of pubic bone marrow oedema in Australian Rules football players: relation to groin pain. Br J Sports Med 2001;35:28-33 (D)
12. Bouvard M, Dorochenko P, Lanusse P, Duraffour H, La publagie du sportif stratégie thérapeutique. J traumatol sport, 2004, 21, 146-163 (D)
13. Meyers WC, Yoo E, Devon O, et al Understanding “Sports Hernia” (Athletic Hernia): The anatomic and pathphysiologic basis for abdominal and groin pain in athletes. Oper Tech Sports Med, 2007: 15:165-177 (D)
14. Holmich P, Exercise rehabilitation for chronic groin pain in athletes. Int Sports Med J, 2000:1:1-5 (D)
15. Verrall G, Slavotinek J, Fon, G et al. Outcome of conservative management of athletic chronic groin injury diagnosed as pubic bone stress injury. Am J Sports Med, 2007;35:466-474 (D)
16. Walden, M., M. Hagglund, and J. Ekstrand, UEFA Champions League study: a prospective study of injuries in professional football during the 2001-2002 season. Br J Sports Med, 2005. **39**(8): p. 542-6. (C)

17. Ekstrand J, Ringborg S. Surgery versus conservative treatment in soccer players with chronic groin pain: a prospective randomised study in soccer players. Eur J Sports Traumatol Rel Res: 2001 ;23 :141-145 (B)
18. Lovell G. The diagnosis of chronic groin pain in athletes: a review of 189 cases. Aust J Sci Med Sport. 1995; 1: 76-79 (C)
19. Holmich P, Holmich L I Bjerg A. Clinical examination of athletes with groin pain: an intraobserver reliability study. Br J Sports Med, 2004;38:446-451 (B)
20. Radic Ross, Annear P, use of pubic symphysis curettage for treatment resistant osteitis pubis in athletes. Am J sports med 2008:36;122-128 (D)
21. Orchard JW. Intrinsic and extrinsic risk factors for muscle strains in Australian football**.** *Am J Sports Med* 2001, 29(3)**:**300-3 (D)
22. Arnason A, Sigurdsson S, Gudmundsson A, Et al. Risk factors for injuries in soccer. Am J Sports Med 2004:32:5-16 (D)
23. P Malliaras, A. Hogan, A. Nawrocki et al. Hip flexibility and strength measures: reliability and association with athletic groin pain. Br J Sports Med 2009;43:739-744.
24. Albers SA., et al. MR findings in athletes with hernia. Skeletal radiology. 2001; 30: 270-277.(D)
25. Verrall G, Slavotinnek J, Barnes P I Fon. Description of pain provocation test used for diagnosis of sports-related chronic groin pain: Relationship of tests to defined clinical and MRI criteria. Scan J Sports Med, 2005:28-33 (D)
26. Cunningham P, Brennan D, O'Connell et al. Patterns of bone and soft-tissue injury at the symphysis pubis in soccer players: observations at MRI. AJR, 2007: 188:291296 (D)
27. Zoga A, Kavanagh, E, Omar et al. Athletic hernia and "sports hernia": MRI imaging findings. Radiology, 2008; 247:797-807 (D)
28. Kibler WB, Press J, Sciasia A. The role stability in athletic function. Sports Med 2006:36:189-198 (D)
29. Devlin L. Recurrent posterior thigh symptoms detrimental to performance in rugby union: predisposing factors. Sports Med 2000:29:273-287 (D).
30. Moseley, G.L., M.K. Nicholas, and P.W. Hodges, Pain differs from non-painful attention-demanding or stressful tasks in its effect on postural control patterns of trunk muscles. Exp Brain Res, 2004. 156(1): p. 64-71. (D)
31. Hogan A, I Lovell G. Pubic stress tests and rehabilitation of osteitis pubis. In W. Spinks, T Reilly, I A Murphy (eds) Science and football IV. London:Routledge (D)

32. Holt MA, Keene JS, Graf BK. Treatment of osteitis pubis in athletes: results of corticosteroid injections. Am J Sports Med, 1995;23:601-606 (D)
33. Mckim Ktauton J. The effectiveness of compression shorts in the treatment of athletes with osteitis pubis. New Zealand J Sport Med, 2001:29:70-73 (D)
34. Warden S. A new direction for ultrasound therapy in sports medicine. Sports Med, 2003:33:95-107(D)
35. Paajanen H, Hermunen H, Karonen J. Pubic magnetic resonance imaging findings in surgically and conservatively treated athletes with osteitis pubis compared to asymptomatic athletes during heavy training. Am J Sports Med. 2008 Jan; 36(1):117-21.
36. Akermark C, Johansson C. Tenotomy of the adductor longus tendon in the treatment of chronic groin pain in athletes. Am J Sports Med. 1992 Nov-Dec; 20(6):640-3.
37. Van Der Donckt K, Steenbrugge F, Van Den Abbeele K, Verdonk R, Verhelst M. Bassini's hernial repair and adductor longus tenotomy in the treatment of chronic groin pain in athletes. Acta Orthop Belg. 2003; 69(1):35-41.
38. Mulhall KJ, McKenna J, Walsh A, McCormack D. Osteitis pubis in professional soccer players: a report of outcome with symphyseal curettage in cases refractory to conservative management. Clin J Sport Med. 2002 May; 12(3):179-81.

[i] Harbour R, Miller J. A new system for grading recommendations in evidence based guidelines. BMJ. 2001 Aug 11; 323:334-6. **A**

Authors (April 12, 2010)

Coordinators:

Gil Rodas, doctor of medicine and sports doctor
Lluis Til, sports doctor and traumatologist
Ricard Pruna, sports doctor.
Jaume Jardí, physiotherapist and certified osteopath

Collaborators with the FC Barcelona Medical Service

Dani Florit, sports doctor
Ferran Arnedo, physiotherapist and nurse
Toni Caparros, graduate in physical education
Jordi Pares , physiotherapist
Gabriel Layunta, physiotherapist
Toni Bove, physiotherapist and nurse
Albert Andreu , physiotherapist

Collaborators in FC Barcelona environment

Carles Pedret, sports doctor (Unidad Asistencial del Consorcio Sanitario de Terrasa)
Manuel Cusí , sports doctor (Sydney School of Medicine, University of Notre Dame, Australia)