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GRADING SCALE OF RADIOGRAPHIC FINDINGS IN THE PUBIC BONE AND SYMPHYSIS IN ATHLETES

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Abstract

Purpose: Radiographic abnormalities in the pubic bone and symphysis are often seen in athletes with groin pain. The aim was to create a grading scale of such radiologic changes.

Material and Methods: Plain radiography of the pelvic ring including the pubic bone and the symphysis was performed in 20 male athletes, age 19–35, with long-standing uni- or bilateral groin pain. We used two control groups: *Control group 1:* 20 healthy age-matched men who had undergone radiologic examination of the pelvis due to trauma. *Control group 2:* 120 adults (66 men and 54 women) in 9 age groups between 15 and 90 years of age. These examinations were also evaluated for interobserver variance.

Results and Conclusion: The grading scale was based on the type and the amount of the different changes, which were classified as follows: No bone changes (grade 0), slight bone changes (grade 1), intermediate changes (grade 2), and advanced changes (grade 3). The grading scale is easy to interpret and an otherwise troublesome communication between the radiologist and the physician was avoided. There was a high interobserver agreement with a high kappa value (0.8707). Male athletes with long-standing groin pain had abnormal bone changes in the symphysis significantly more frequently and more severely ($p > 0.001$) than their age-matched references. In asymptomatic individuals such abnormalities increased in frequency with age both in men and women.

Key words: Pubic bones, symphysis; athletes; radiography, grading.

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Groin pain is a common condition in athletes particularly in football players (4, 7, 9, 13, 14). A sudden onset is often associated with a few well-defined musculoskeletal traumatic injuries like avulsion fractures or muscle or tendon ruptures (8, 10, 14, 15). However, groin pain often presents itself with an insidious onset and a protracted course. Such longstanding groin pain in athletes has a varying and complex pathogenesis. The differential diagnosis includes conditions such as overuse or strain injuries to the tendons, adductor tenoperiostitis, apophysitis, stress fractures, inguinal hernia, neuralgia, prostatitis or symphysitis (1, 2, 4, 13).

The primary clinical investigation always includes plain radiography of the pelvis, hips, pubic bone and symphysis in order to detect (stress) fractures and other conditions including abnormalities due to symphysitis. The radiological findings in the pubic bone around the symphysis are often difficult to describe and consequently the report may be difficult to interpret.

The aim of the present investigation was therefore to study and create a grading scale for the radiographic abnormalities in the pubic bone and symphysis in a group of male athletes with long-standing groin pain and to compare the findings

with the bone changes in the same area in two control groups of individuals.

Material and Methods

Patients: Twenty male athletes with a mean age of 26 years (19–35 years) who were referred to The Section of Sports Medicine because of uni- or bilateral groin pain for 3 months or more were included. Seventeen were football players, 2 handball players and 1 an ice-hockey player. All athletes underwent radiologic examination with plain films of the pelvic girdle including the pubic symphysis. Films were obtained with the patients in the supine position and including additional projections if necessary.

Control group 1: As a control we used 20 age-matched men, obtained from the central film and referral archives of the city, in whom there was no history of sports injury, urologic complaint or other pelvic condition. The level of physical activity in this reference group could not be estimated. They had undergone radiologic examination of the pelvis due to trauma with films obtained with the patient in the supine position and including additional positions if necessary. A condition was that the pubic symphysis was fully visualized on the films.

Control group 2: As a second control group we used 120 patients who had undergone radiological examination of the pelvis after trauma. These patients were divided according to sex and in nine age-groups from 15 to 90 years. Films were obtained with the patient in the supine position and including additional positions if necessary. A condition was that the pubic symphysis was fully visualized on the films. The level of physical activity in the reference group could not be estimated.

Based on our prior experience the radiographs were classified into four groups with regard to the degree of visible changes in the pubic bone and the symphysis. The findings were categorized in four groups according to a grading scale (Table 1, Figs 1–4).

In order to calculate the interobserver variability the radiograms in Control group 2 were independently classified according to the grading scale by two independent radiologists (J.B. and C.S.). Cohen's kappa value was calculated using StatXact.

Results

The results are summarized in Tables 2 and 3. Neither in the group of male athletes nor in the group of references could any radiographic abnormalities be seen in the sacroiliac joints and there was no widening of the symphysis.

Among the male athletes with groin pain (study group) 9 patients had slight radiographic changes

Table 1

Classification and grading of the abnormalities in the pubic bone and the symphysis

Grade 0 No bone changes

Grade 1 Slight changes

Criteria:

- a. Cortical irregularity with erosions <1 mm
- b. Absence of cysts or cysts <1 mm
- c. Bony proliferation, beaking <1 mm (cancellous sclerosis and hyperostosis may also occur)

Grade 2 Intermediate changes

Criteria:

- a. Increased subchondral irregularity. Erosions from 1 to 3 mm:
- b. Cysts <5 mm.
- c. Beaking <2 mm (moderately increased cancellous sclerosis may also occur)

Grade 3 Advanced changes

Criteria:

- a. Erosions >5 mm
- b. Increased appearance of cysts
- c. Increased beaking

according to the classification presented in Table 1. An additional 9 patients had intermediate changes, and 2 had advanced changes. In Control group 1 (aged-matched athletes without groin pain) there were 17 with radiological changes, all slight (Table 2). In Control group 2 (non-athletes in

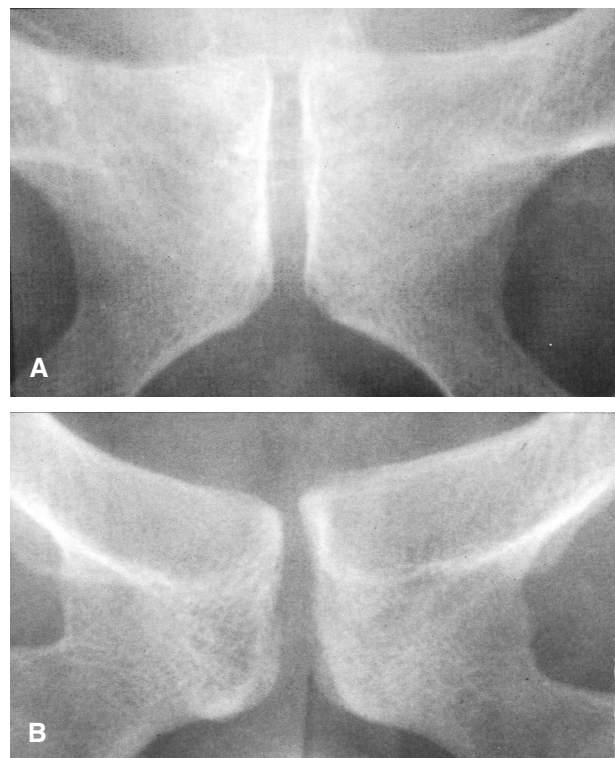


Fig. 1. A) and B) Two examples of normal symphysis. Normal width and shape of the symphysis. Well-demarcated corticalis. No erosions or cysts. No sclerosis.

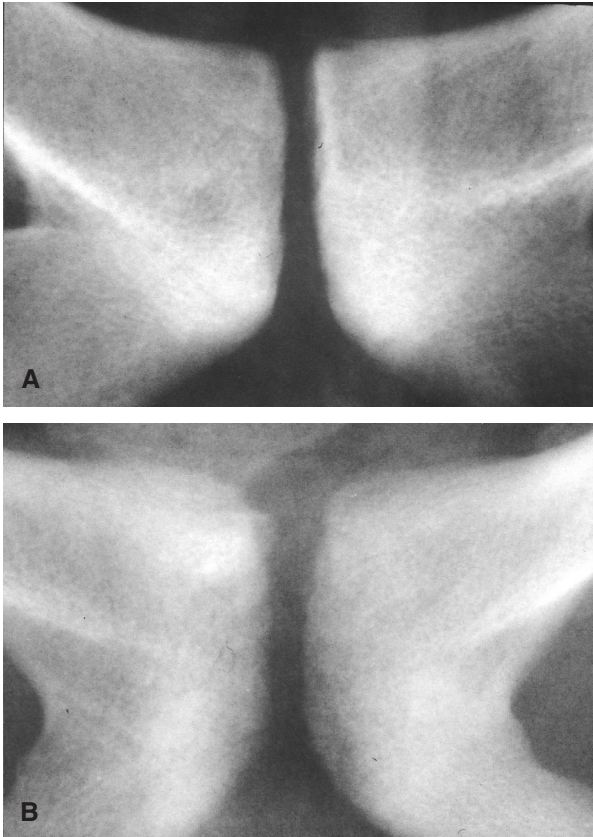


Fig.2. A) and B) Two examples of symphysitis grade 1 (slight changes). There are cortical irregularities with erosions <1 mm. No cysts. Some sclerosis in the inferior aspect of the symphysis.

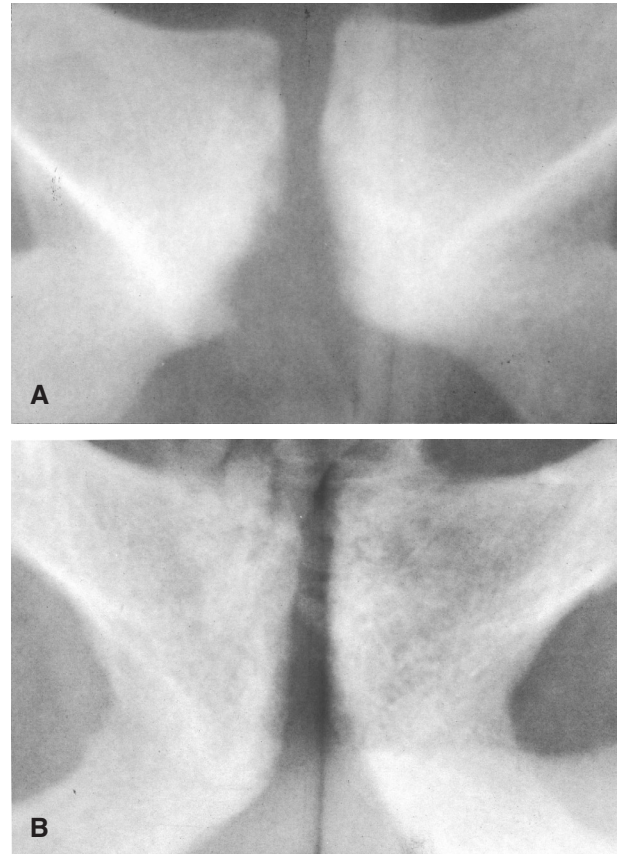


Fig.3. A) and B) Two examples of intermediate changes in symphysitis. There is an increased subchondral irregularity with erosions up to 3 mm. Cysts and subchondral sclerosis are <5 mm. There is some beaking as well as sclerosis in the inferior aspect of the symphysis.

different age groups) mostly slight or (in a few individuals) intermediate abnormalities were observed. There were very minor interobserver variations (Table 3). Cohen's kappa coefficient for observers A and B regarding the assessment of symphysitis was 0.8707 (SE 0.04192).

In Control group 2 (non-athletes) there was an increase in abnormalities with age. Spearman's correlation coefficient was calculated to 0.345 with a *p*-value of less than 0.05.

Discussion

After clinical investigation of a patient with groin pain, the plain radiography of the pelvis, hips, pubic bone and symphysis gives the most important information in the diagnostic procedure. The radiograph reveals most skeletal disorders. The films of the pelvic girdle including the symphysis, obtained with the patient in supine position, and additional positions are necessary when the abnormalities in the pubic bone and symphysis are described and graded. A following scintigraphy and/or MR may give further information about the activity in

the pubic bone. There is a good correlation between radiographic and scintigraphic findings (11) and also a good correlation between the radiographic and the MR findings (5, 12), which is of importance in future diagnostic and therapeutic studies in athletes with groin pain. We here introduce a grading scale useful in the presentation and description of abnormalities in the region of the pubic bone and symphysis (Table 1).

In a prior study we examined 21 male football players with long-standing unclear groin pain. They were examined by a surgeon in order to reveal groin hernia and neuralgia. An orthopedic surgeon focused on tenoperiostitis and symphysitis. A urologist focused on prostatitis. Herniography was performed to reveal groin hernia pain. Plain films and nuclear studies were performed to visualize skeletal abnormalities. In 19 of 21 patients we found two or more diagnoses. Ten patients had two diseases, 6 patients had three and 3 patients had four. Our conclusion was that the cause of groin pain in athletes is complex and the differential diagnostics is difficult (4).

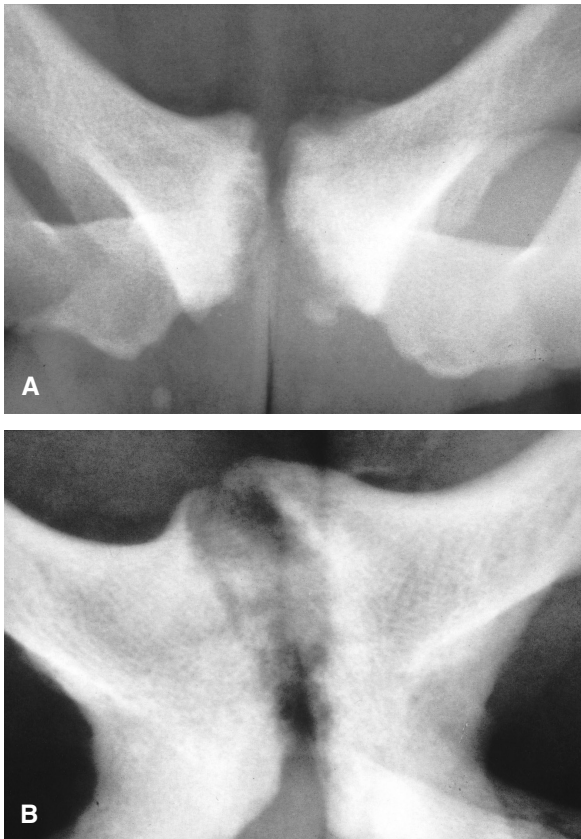


Fig. 4. A) and B) Two examples of advanced changes in symphysitis. Erosions are >5mm. There are also subchondral sclerosis and cysts. There is a pronounced beaking at the superior aspect of the symphysis.

Infections in the urinary tract, surgical procedures in the pubis region, pregnancy, sepsis, and rheumatoid diseases may rarely cause abnormalities in the pubic bone and symphysis. This has earlier been described and named osteitis pubis (3).

In this study of athletes with groin pain compared with non-symptomatic non-athletes there was an

Table 2

Radiologic abnormalities of the pubic bone and the symphysis: (1) in athletes with groin pain: (2), Control group 1 (men matched for age with the athletes): (3), Control group 2 (120 patients examined due to trauma, in different age groups). Assessed by two radiologists (J.B. and C.S.). These groups were also used for calculation of interobserver agreement

	Radiologic abnormalities			
	None	Slight	Intermediate	Advanced
Athletes (n = 20)	0	9	9	2
Control group 1 (n = 20)	3	17	0	0
Control group 2 (J.B.)	42	64	14	0
Control group 2 (C.S.)	40	65	15	0

Table 3

Interobserver variation in the assessment of symphysitis according to the classification in Table 1. Two observers (C.S. and J.B.). Cohen's kappa coefficient was calculated to 0.8707 (SE 0.04192)

	Grade (C.S.)		
	0	1	2
Grade (J.B.)			
0	37	5	0
1	3	60	1
2	0	0	14

increase of abnormal changes in the pubic bone and symphysis seen on plain films. This may be a normal reaction to an increased load on the bone and the other tissues in the groin region. The increased load on the os pubis and symphysis in football players may result in an increased stress-induced bone formation, an inflammatory reaction – periostitis – and pain. There was also, however, an increase over age in the frequency of such abnormalities in both men and women. This again may support the hypothesis that it is a consequence of wear and tear. A positive scintigraphy with an increased uptake of technetium may also support the theory of an increased bone formation in the os pubis (11). Patients with radiological changes in the os pubis and the symphysis also have an abnormal edema on MR examination visible on T2-weighted signals (5, 6).

Our *conclusion* is that overload and stress-induced increased bone formation in the pubic bone and symphysis and the following inflammatory reaction are some of the main causes of groin pain in athletes. The abnormalities seen on plain radiographs in the bone and symphysis are valuable signs in the diagnostic procedure. However, when there are no abnormalities seen on plain radiography films in athletes with longstanding groin pain, a diagnosis other than stress-induced bone formation has to be suspected and further investigations to exclude hernia, tendinosis, tendon or muscle injury, nerve entrapment, urinary tract infection, sacroiliac inflammation or disc hernia have to be performed.

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