

## PŮVODNÁ PRÁCA ORIGINAL PAPER

## RADIOLOGICAL CHANGES OF ISCHIAL TUBEROSITY IN ANKYLOSING SPONDYLITIS (AS)

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## RÖNTGENOLOGICKY ZISTENÉ ZMENY ISCHIÁLNEJ TUBEROZITY PRI ANKYLOZUJÚCEJ SPONDYLITÍDE (AS)

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## Summary

**Objective:** To emphasize the meaning of involvement of ischial tuberosity in ankylosing spondylitis (AS), enriching clinical picture of the disease and pointing at AS, especially when sacro-iliitis is missing or poorly developed.

**Material and methods:** We performed radiological examination of ischial tuberosity in 68 patients with different developmental stages of AS. There were 66 men (97 %) and 2 women (3 %), aged from 25 to 75 years. Anteroposterior radiographs of the pelvis were performed in all patients and independently assessed by two radiologists. The radiological changes on ischial tuberosity were classified into four stages: 1) stage of minimal changes, 2) stage of destructive changes, 3) stage of reconstructive changes, and 4) stage of ossification of tendon fibers in form of the rumpled tufts.

**Results:** The radiological changes of enthesitis were found on ischial tuberosity in 31 patients (45.5 %,  $p < 0.01$ ). The first stage or minimal changes were found in two patients (6.5 %); the second stage or destructive changes in 13 patients (42.0 %); the third stage or reconstructive changes in 11 patients (35.5 %) and the fourth stage or "tufts" phenomenon in five patients (16.0 %).

**Conclusion:** The classification of the changes is useful for the assessment of disease range and progress, as well as in diagnostics when sacro-iliitis is obscurely developed and other radiological signs are not present.

**Key words:** enthesitis of ischial tuberosity, ankylosing spondylitis, radiographs, diagnosis.

## Súhrn

**Cieľ práce:** Zdôrazniť význam postihnutia ischiálnou tuberozitou pri ankylozujúcej spondylitíde (AS), rozšíriť klinický obraz tohto ochorenia a dokázať prítomnosť ankylozujúcej spondylitídy, ak je sakroiliitída nevýrazná.

**Materiál a metódy:** 68 pacientov s AS v rôznom štádiu sme vyšetrili na ischiálnu tuberozitu. V súbore pacientov bolo 66 mužov (97 %) a 2 ženy (3 %) vo veku od 25 do 75 rokov. Všetkým pacientom sme urobili anteroposteriorne röntgenologické vyšetrenie panvy. Rtg snímky posudzovali dvaja nezávislí rádiológovia. Na základe vyšetrenia sa zostavila štvorstupňová škála röntgenologicky zachytených zmien ischiálnej tuberozity: 1. štádium: minimálne zmeny, 2. štádium: deštruktívne zmeny, 3. štádium: rekonštrukčné zmeny, 4. štádium: osifikácia šlachových vlákien do podoby rozstrapatených chumáčov.

**Výsledky:** U 31 pacientov (45,5 %,  $p < 0,01$ ) sa röntgenologicky zistili zmeny entezity ischiálnej tuberozity. 1. štádium ochorenia charakterizované minimálnymi zmenami sa zistilo u 2 pacientov (6,5 %), 2. štádium charakterizované deštruktívnymi zmenami sa zistilo u 13 pacientov (42,0 %), 3. štádium charakterizované rekonštrukčnými zmenami sa zistilo u 11 pacientov (35,5 %) a 4. štádium charakterizované tzv. chumáčmi sa zistilo u 5 pacientov (16 %).

**Záver:** Klasifikácia zmien je dôležitá pre posúdenie rozsahu a progresie ochorenia a pre diagnostiku v prípadoch, ak je sakroiliitída nevýrazná, alebo sa röntgenologicky nezistia iné príznaky ochorenia.

**Kľúčové slová:** entezitída ischiálnej tuberozity, ankylozujúca spondylitída, röntgenologické vyšetrenie, diagnostika.

## INTRODUCTION

Enthesitis is a characteristic of ankylosing spondylitis (AS) (1). It may develop across the whole locomotor system where many tendons and ligaments are inserted

to the bone, but most frequently on ischial tuberosity, calcaneus, ischial tuberosity, symphysis, manubriosternal synchondrosis, greater femoral trochanters, external occipital protuberance, iliac crest, and spinous processes of the spine (2).



Fig. 1. Initial ossification of the tendon insertion on ischial tuberosity.



Fig. 2. Contours of the ischial tuberosity look like "moth-eaten" due to superficial and deep erosions.

Enthesitis was first described in 1966 by Niepel et al. (3). In 1971, Ball minutely described the microscopic finding of enthesitis at many sites (4). According to Androic (5), inflammatory process in AS rapidly causes destructive and resorptive foci as well as reparatory and sclerotic foci that are sometimes simultaneously developed. This results in calcification and ossification of the tendon insertion. The cartilage zone between terminal ends of a tendon and bone is also involved in the ossification. A new bone is forming in the tendon or capsule of the adjacent joint. Radiological signs may appear at every site of enthesitis occurrence, although they more frequently manifest in some insertions of tendons and ligaments. There is no correlation between syndesmophytes and sacro-iliitis occurrence and enthesitis development.

A complete course of the disease could be seen on radiographs.

#### PATIENTS AND METHODS

We performed radiological examination of ischial tuberosity in 68 patients with primary AS. Selection of the patients was according to their arrivals in outpatient department. There were 66 men (97 %) and two women (3 %) included in the study. The patients' age ranged from 25 to 75 years. However, most of the patients were between 26 and 45 years of age (55.8 %). The mean age of men was 40 years. The mean age of men at the onset of the disease was 23.4 years. Duration of the disease before the radiological examination was from 5 to 50 years. The mean duration of symptoms was 22 years. In two patients, the disease started with the enthesitis on heels and ischial tuberosity. All patients had positive HLA-B27 antigen.

All changes could be seen and properly assessed in real size 'cause' they were not enlarged in imaging (close to the

film). Survey to AS included existence of difficulties in the region of ischial tuberosity, grade of sacro-iliitis and technique of radiological imaging.

Anteroposterior radiographs of the pelvis were performed in all patients. The radiographs were independently assessed by two radiologists. The changes on ischial tuberosity were classified into 4 stages: 1) minimal changes — subcortical demineralization and depletion of the cortex (Fig. 1); 2) destructive changes — erosions of different depths (Fig. 2); 3) reconstructive changes, consisted of perilesional condensation of the osseous substance and initial ossification of tendon fibers (Fig. 3); and 4) "tufts phenomenon", characterized by a more intensive ossification of the bundle of tendon fibers in form of protracted, thinner or thicker, tufts presenting as shadows on the radiographs, which gave impression that the bone and ossified fibers were rumpled as tufts (Fig. 4). If the fibers were more ossified, the shadow of bone density appeared.

Diagnosis of the disease was established on basis of the New York criteria (6). Certain diagnosis was established on basis of grade 2 or 3 sacro-iliitis (6).

The obtained data were statistically analyzed by  $\chi^2$  test.

#### RESULTS

It was noticed that enthesitis frequently occurred in the patients with longer duration of the disease, so it was found in 39 patients (57.3 %,  $p < 0.01$ ) who had been ill 5—10 years. The radiological changes of enthesitis were found on ischial tuberosity in 31 patients (45.5 %,  $p < 0.01$ ). In other patients, there were no radiological changes on ischial tuberosity but they had full-developed clinical picture. Dominant clinical sign was a pain, stronger while sitting or



**Fig. 3.** Single ossifications of the tendon fibers with initial forming of calcifications in the shape of bone mass.

even caused by sitting on a hard chair. While palpation of the ischial tuberosity the pain always appeared.

There were no significant disagreements in the assessment of radiological changes between two radiologists, engaging in radiological diagnostics of rheumatic diseases. The first stage or minimal changes were found in two patients (6.5 %); the second stage or destructive changes in 13 patients (42.0 %); the third stage or reconstructive changes in 11 patients (35.5 %) and the fourth stage or “tufts” phenomenon in five patients (16.0 %).

## DISCUSSION

Many muscles are inserted with their tendon fibers to the ischial tuberosity (7, 8). Clinically, enthesitis in AS often occurs at different locations (70—80 %), but radiological changes have been noticed rarely (30—40 %), except on calcaneus (8). The domination of plastic and reconstructive changes over the destructive ones is an important sign of AS (9).



**Fig. 4.** “Tufts” phenomenon with intensive ossification of the tendon fibers and connective tissue in the terminal part of the muscle.

“Softening” of the osseous structures with terminal osteopenia, as well as other developmental stages of enthesitis was found by radiological examination (9). In 1934, Krebs described periosteal changes on ischial tuberosity (10). These changes were also described later (11, 12, 13), but were not classified or used for the assessment of the disease progress.

In our study, the second or destructive stage and the third or reconstructive stage were present most often, developing in 24 patients. That fact corresponds with disease duration and activity. “Tufts” phenomenon as a final changes was found in only five patients.

Typical ankylosing spondylitis has been described in the absence of radiological evidence of sacro-iliitis (14). On the contrary, patients with bilateral, grade 4 sacro-iliitis and no extrapelvic disease are frequently seen (15).

Enthesopathy in diffuse idiopathic skeletal hyperostosis (DISH) may be considered in differential diagnosis, but demineralization and erosions of ischial tuberosity in that case do not appear (16). Extraspinal manifestations include irregular new bone formation, large bone spurs, seen particularly on olecranon and calcaneus, as well as severe ligaments calcification, seen mainly in sacrotuberous, iliolumbar and patellar ligaments (16).

Seronegative spondyloarthropathies (Reiter’s syndrome, involvement of the axial skeleton in psoriatic arthritis) rarely have radiological manifestations on ischial tuberosity. If an enthesitis still develops, there is no demineralization but osteosclerosis (17, 18).

Sacro-iliitis develops considerably faster (for 1—2 grades) than enthesitis of ischial tuberosity (19), what we have been found too in all patients.

Enthesitis on ischial tuberosity is common characteristic of AS and appears in 80 % patients. In our study, it has been noticed in 39 patients.

Enthesitis in AS has specific radiological and morphological signs for which we have not found so many data in the literature (14, 15). We neither have found classification of these changes (17, 19), so we fully present it in this paper. It is so characteristic that it may be useful in diagnostics, especially in patients with poorly developed sacro-iliitis or without it.

## CONCLUSION

Enthesitis may develop at many sites, particularly on ischial tuberosity, where tendons are inserted to several muscles.

The classification of radiological changes on ischial tuberosity is useful for the assessment of disease range and progress, as well as diagnostics, especially when sacro-iliitis is obscurely developed and other radiological signs are not present.

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