

# RADIOGRAPHIC ASSESSMENT OF HIPS IN PATIENTS WITH SPINAL CORD INJURY

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## ABSTRACT

**Objective:** The spinal cord-injured patients begin to present a new configuration of forces on the joints. The hip joint is one of the most affected, because these patients generally use a wheelchair as a means of locomotion. Osteoarticular changes, such as heterotopic ossification, can be found in these patients, as evidenced by radiographic studies. This study aims to identify radiographic changes in hips of spinal cord-injured patients. **Methods:** 15 patients (30 hips) were evaluated and followed up at the Laboratory of Biomechanical Rehabilitation of the Musculoskeletal System of HC-Unicamp, through the analysis

of radiographs of the pelvis in anterior-posterior and Lowenstein lateral positions. **Results:** Of the total hips, only seven (23%) had no evidence of articular damage. The prevalence of heterotopic ossification found (16.6%) was similar to the literature. **Conclusion:** The radiographic assessment of these patient's hips is justified by the prevalence of joint changes found. *Level of Evidence II, Development of diagnostic criteria in consecutive patients (with universally applied reference "gold" standard).*

**Keywords:** Spinal cord injuries. Hip. Radiograph. Ossification, heterotopic. Spinal injury

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## INTRODUCTION

Spinal cord trauma brings consequences for all the organs and systems of the human body, causing relevant psychological and social impacts among affected patients. Besides the sensory and motor neurological damage provoked by this injury, these individuals evolve with musculoskeletal impairment in various joints, due to disuse, repetitive lower energy trauma and absence of orthostatism that they begin to experience.

In paraplegic or tetraplegic spinal cord-injured patients, the hip constitutes the main weight-bearing joint, since these patients begin to use the wheelchair as the primary means of accommodation and daily locomotion. Therefore the mechanical stress due to the axial load is immense. At the same time, patients face the immobility inherent to the seated position, which determines accentuated disuse of this joint, accelerating the degenerative process.

All of these factors together, in the course of the natural evolution of these patients, determine osteoarticular alterations, which can mostly be evidenced through radiographic examination. These include: heterotopic ossification, narrowing of coxofemoral joint space, ectopic calcifications and morphological alterations in the femoral head and acetabulum.<sup>1</sup>

Although many patients with spinal cord injury and even health

professionals are unaware of the association of spinal cord injury and heterotopic ossification, it is known that this association affects about 20 to 30% of these patients, in a ratio of two men to every woman, predominating between the ages of 20 to 30 years.<sup>2-4</sup> Moreover, it is known that heterotopic ossification can cause pain, edema and limitation of movement of the impaired joint in approximately 35% of these patients, which can result in delay and difficulty for rehabilitation.<sup>4-6</sup>

Due to the ease of access, low cost and interpretation simplicity of the radiographic examination, this becomes a valid option for the evaluation of osteoarticular abnormalities developed in these hips of these patients. In association with this fact, there is the shortage of publications about this topic in the national and international literature. Thus, this study is aimed at drawing a radiological profile of the hips of spinal cord-injured patients, monitored at the Laboratory of Biomechanical Rehabilitation of the Musculoskeletal System of Hospital das Clínicas da Unicamp.

## MATERIAL AND METHODS

The data collection was carried out through the random selection of 15 spinal cord-injured patients (30 hips) monitored at the Laboratory of Biomechanical Rehabilitation of the Muscu-

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Study conducted at the Laboratory of Biomechanics and Rehabilitation of the Musculoskeletal System of HC-FCM/UNICAMP.

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loskeletal System. We reviewed the medical records from the hospital's archive, as well as the pelvic radiographs from the hospital files on these individuals.

To qualify for inclusion, patients were supposed to present at least one pelvic radiographic examination in two positions (AP and Lowenstein) throughout their period of treatment at the institution, to standardize radiographic incidence among all the patients. For this purpose, these patients could not have any significant functional limitation or fixed deformities of the hips that would prevent them from undergoing the examinations. In these criteria, all the patients selected qualified for inclusion in the survey.

The radiographic findings observed had as a basis for analysis a radiological observation sheet composed of the following items: femoroacetabular congruity, articular surface and joint space, presence of coxofemoral dislocation/subluxation and heterotopic ossification.

## RESULTS

Of the 15 patients assessed, 13 are male and two female. The average age found was 35.6 years (25 to 53 years). The average spinal injury time was 8.8 years (3 to 22 years). Thirteen patients were identified as tetraplegic and two as paraplegic.

As regards the mechanism of injury, 12 were due to trauma-related causes, including: six automobile accidents, three caused by diving into the surface of shallow water, one fall from a height, one patient run over by a vehicle and one firearm injury. The only cause of nontraumatic spinal cord injury was a consequence of syringomyelia. Two patients did not have the mechanism of injury elucidated due to lack of information in the medical records. The radiographic examinations were evaluated by a single radiologist and always compared with the contralateral hip. As regards the findings, we encountered the following data according to the items presented below:

Femoroacetabular congruity: of the 30 hips analyzed, 24 appeared congruent, four presented congruent incongruity and two appeared incongruous.

Articular surface: no articular surface abnormalities were found in seven of the hips. Twelve hips presented osteophytes only on the acetabular surface (nine with superolateral and three with anteromedial osteophytes). Alterations restricted to the femoral head were identified in 6 patients. All of them corresponded to the rarefaction of the femoral head bone trabeculae. The remaining five hips had alterations associated with the femoral and acetabular surfaces (all with superolateral acetabular osteophytes and alterations of the femoral head bone trabeculae). (Figure 1) Joint space: 17 hips did not appear with impairment of the joint space. Two hips showed an increase of joint space, one of which was inferomedial and the other superolateral. The remaining 11 had globally decreased joint space.

Presence of coxofemoral dislocation: only one hip presented lateral subluxation. The others appeared reduced.

Heterotopic ossification: of the 30 hips analyzed, in five we identified heterotopic ossification - classified by Brooker *et al.*<sup>7</sup> as degree II and III, while four hips presented increase of coxofemoral periarticular density and one was in topography lateral to the ilium. (Figures 2 and 3)

Other findings: increase of anterior acetabular coverage and shepherd's crook deformity of the femur were identified in one hip, while radiolucent image was observed in the femoral head in another hip, compatible with a probable diagnosis of osteoid osteoma.



**Figure 1.** Degenerative alterations can be observed in both hips. Special emphasis on the presence of anterolateral cysts on both sides and increase of acetabular coverage in the left hip.



**Figure 2.** Heterotopic ossification (degree II) present in the enhanced periarticular region.



**Figure 3.** Note the exuberant periarticular heterotopic ossification in the right hip (degree III) and degenerative alterations in the left hip.

## DISCUSSION

Most of the time, spinal cord-injured patients cannot rely on proprioception to assist in joint protection, due to their neurological impairment. These individuals only have anatomical mechanisms as protective factors. Possible trauma, caused even by minimal manipulation, leads to potential risks of neuropathic arthropathy due to chondrolysis and erosion of the articular cartilage.<sup>8,9</sup> As a consequence of this process, other abnormalities may arise, such as bone fissures, formation of subchondral cysts, osteophytes, decrease and impairment of the joint space and articular incongruity, suggesting the early onset of osteoarthritis in these patients.

The radiographic findings of these patients with spinal cord injury in this study indicate a high rate of articular impairment of the hip after a few years of clinical evolution of the neuromotor deficit. Only seven (23%) of the hips evaluated had no evidence of damage to the articular surface. However, as there is a multidisciplinary follow-up of these patients at the Laboratory of Biomechanical Rehabilitation of the Musculoskeletal System, the expected total incidence of degenerative alterations was lower. The prevalence of heterotopic ossification found in the patients studied (5 of the 30 hips: 16.6%) was close to the parameters described in the literature.<sup>2-4</sup> This comorbidity is associated

with joint pain and limitation of range of motion, which implies difficulty in the handling of these individuals, both for hygiene care and for rehabilitation, producing a deterioration in the quality of life.

The radiograph, besides being a highly accessible, low-cost examination, enables a good evaluation of bone structures, favoring the identification of a great deal of degenerative and morphologic joint alterations. It is also the examination of choice for the detection of heterotopic ossification, which is a frequent condition in spinal cord injury patients.<sup>10</sup> Therefore, it should be used routinely in the assessment of these patients.

## CONCLUSION

Over the course of time, spinal cord-injured patients present some abnormality in the conformation of their hips, such as decrease of joint space, osteophytosis, heterotopic ossification and articular incongruity, which can be clearly visualized in the radiographic examination.

Therefore, the radiological follow-up of the hips of such individuals is justified by the high prevalence of the articular abnormalities that they develop. Early detection can assist in their handling, targeting an improvement in activities of daily living, as well as an intensification of rehabilitation programs.

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