0008-3194/95/210–216/$2.00/©JCCA 1995

Trauma induced osteonecrosis of the hip: a case report

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A chronic case of lower back pain in a young female is presented. A number of conditions can lead to back pain. This article discusses the sequelae of osteonecrosis of the hip and how it resulted in a leg length discrepancy leading to altered lumbo-pelvic biomechanics and its genesis of lower back pain. Diagnostic imaging and clinical manifestations are discussed in detail. Early diagnosis is important for appropriate treatment and to decrease the severity of deformity.
(JCCA 1995; 39(4):210–216)

KEY WORDS: osteonecrosis, femur, low back pain, chiropractic, manipulation.

On présente une jeune femme souffrant de douleurs lombaires basses chroniques. Un bon nombre de pathologies peuvent êtres reliées aux douleurs lombaires. Cet article examine les séquelles reliées à l'ostéonécrose de la hanche et les causes de l'inégalité de longueur de la jambe entraînant une modification des biomécaniques lombaires et pelviens. Cet article traite aussi de l'étiologie des douleurs lombaires basses et présente une étude détaillée sur la lecture d'une image diagnostique et les symptômes cliniques. Le diagnostic précoce s'avère important afin de déterminer le traitement approprié et de diminuer la gravité de la déformation.
(JCCA 1995; 39(4):210–216)

MOTS-CLÉS : ostéonécrose, fémur, douleurs lombaires basses, chiropratique.

Introduction

Osteonecrosis of bone is defined as death, or necrosis of bone.[1] Many causes are responsible for initiating bone necrosis by precipitating vascular compromise. Some of these are trauma,[2] infection,[3] steroids,[4] sickle cell hemoglobinopathies,[5] Cushing's disease,[6] and others. The condition "spontaneous osteonecrosis" has been given when no underlying cause can be found. Osteonecrosis has a predilection for the hips, shoulder, and knees.

Pain can be the only symptom in the absence of any positive radiographic findings. Hip pain is a very common complaint often seen in chiropractic practice. Correct diagnosis is imperative on initial presentation for successful treatment. Inappropriate treatment can result in severe degenerative joint disease.

The case of a 15-year-old female patient with low back pain is presented.

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In partial fulfillment for requirements for the College of Chiropractic Sciences Field Practitioners Program.

Case report

A 15-year-old female presented to this office complaining of constant pain in her lower back and right hip. The pain was worse with ambulation and relieved with rest. This problem had been progressing over the past four years. Prior to her back pain she had experienced right hip pain which was associated with a known chronic degenerative condition.

Her past history revealed an episode where she was involved in gymnastics. She recalls a somewhat improper and unbalanced landing after a vault and as a result suffered an injury to her right hip. She was examined by her trainer and her family physician and was told she could continue with her gymnastics programme. Her pain did not improve and progressed to the point whereby walking became very difficult and extremely painful. She returned to her physician who had radiographs of her hip taken. A single AP pelvis radiograph demonstrated a sharp step-like defect along the weightbearing superior articular cortex of the right femoral head (Figure 1). From this she was then sent out for magnetic resonance (MR) imaging to further assess her condition.

T1-weighted (Figure 2) and T2-weighted (Figure 3) coronal images of both hips show low signal intensity in the region of the

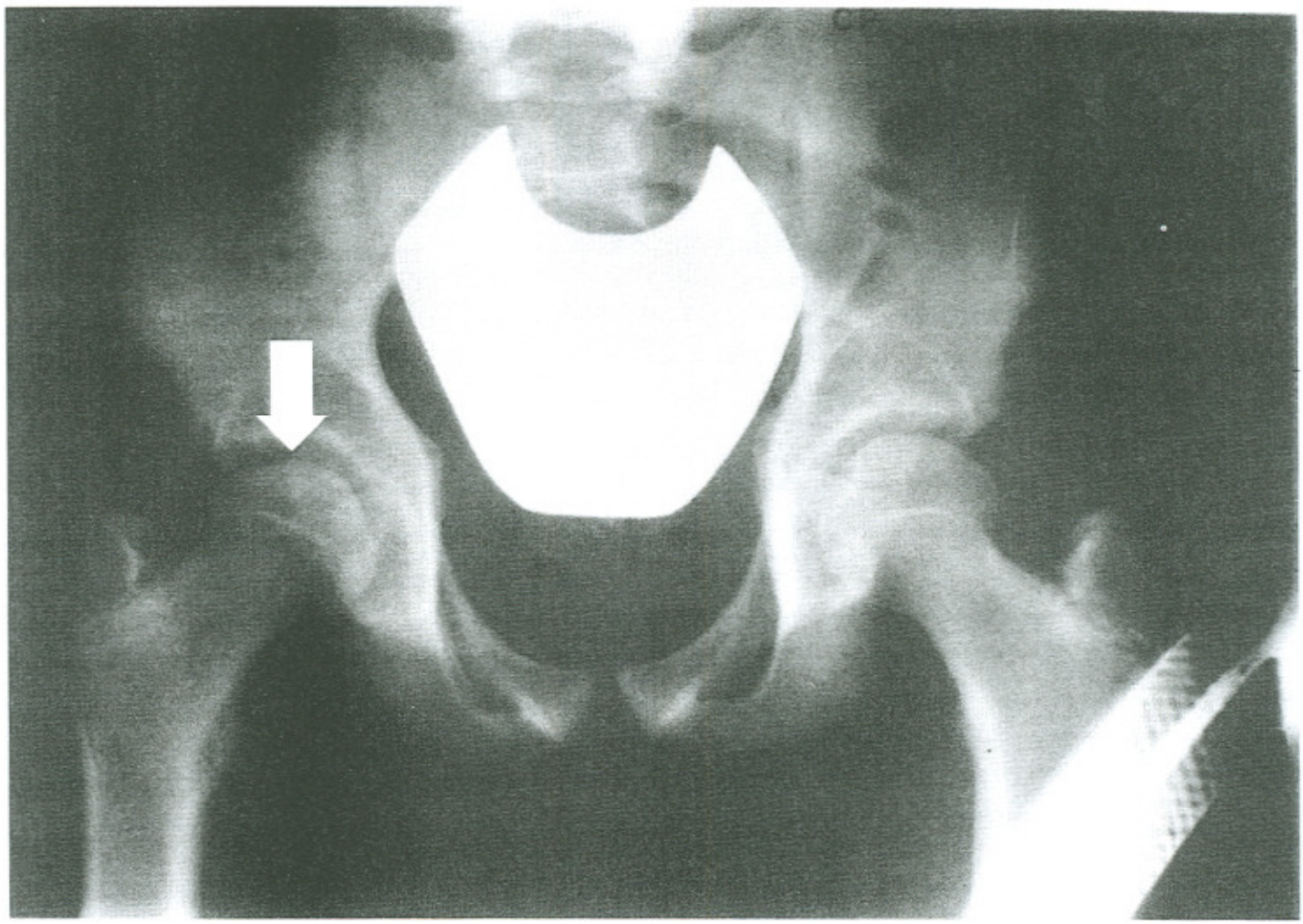

Figure 1 AP pelvis radiograph demonstrates the "step" defect at the superior articular cortex of the right femoral head representing collapse.

epiphysis of the right femoral head. There was high signal intensity fluid surrounding the right femoral head and neck (Figure 3). A T1-weighted axial image gave low signal intensity of the right femoral head epiphysis (Figure 4). The conclusions from the MR imaging were avascular necrosis of the right femoral head epiphysis.

She was instructed by her physician to stop all physical activity especially gymnastics and to use crutches to assist with her weight bearing.

On her initial presentation she limped into the office. She complained of lower back pain which was more right sided. She stood with an antalgia to the right and found it difficult to straighten herself.

Examination revealed right pelvic unleveling with a compensatory spinal scoliosis which was convex to the right. Marked atrophy of the right gluteal musculature was noted as was the right thigh musculature. She could not flex forward due to pain. When standing erect she favored the right hip by weight bearing totally upon the left leg. Straight leg raising and Patrick's FABERE test was painfully restricted to about 50%. Tenderness was noted over the posterior sacroiliac ligaments on palpation. Left lumbar paraspinal hypertonicity was noted. Deep tendon reflexes of the lower extremities were normal. The quadriceps, hamstrings and gluteal muscles were weak on the right. A right leg discrepancy of 3 cm was measured. She also had a fallen metatarsal arch of the right foot which was also accompanied with a hallux valgus deformity of the big toe.

The family history was negative for any hemoglobinopathy or any collagen disease. She had not been on corticosteroid therapy and she did not use alcohol. Social history was unremarkable.

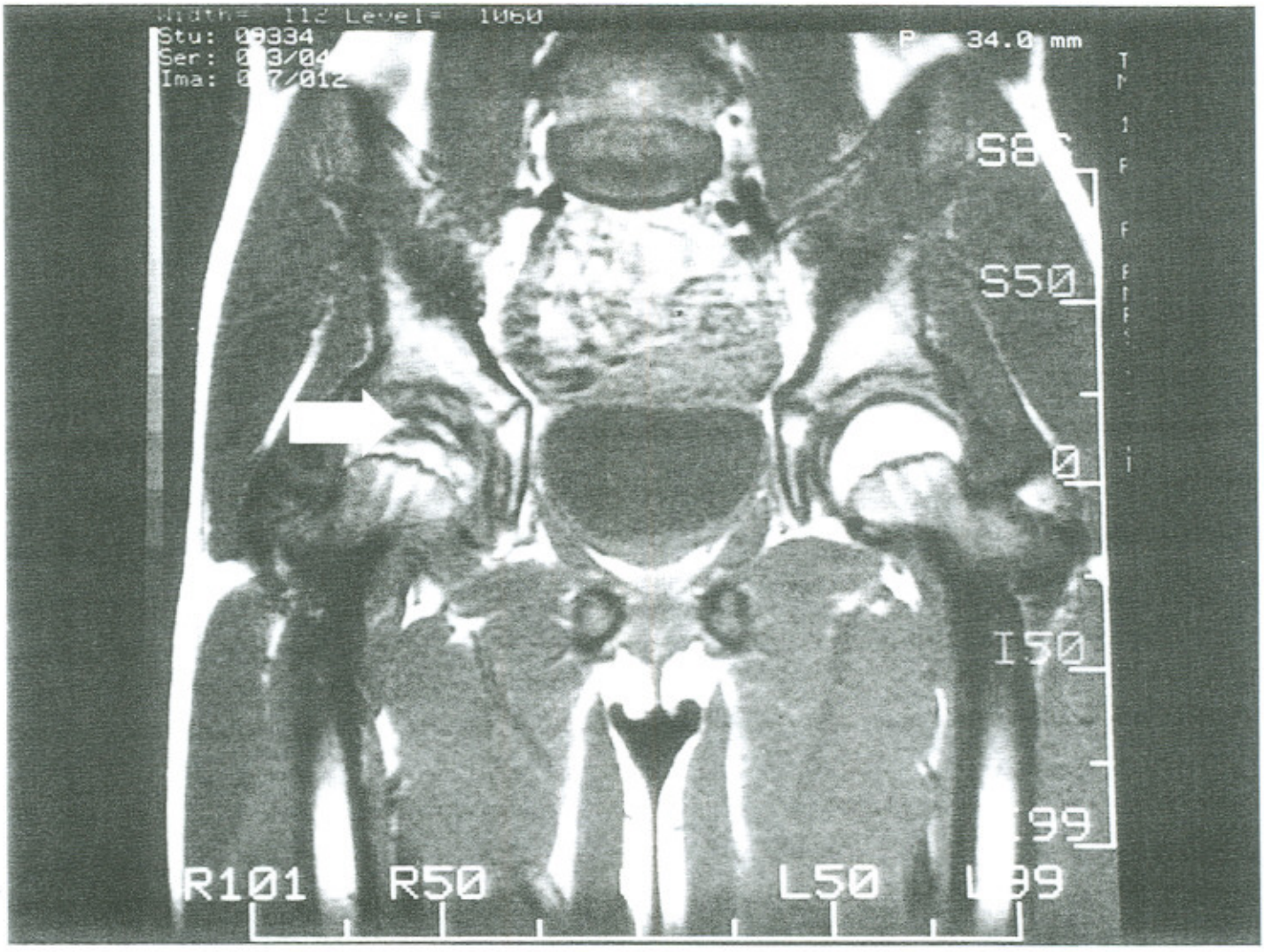

Figure 2 T1-weighted coronal image shows low signal intensity in the epiphysis of the right femoral head. Note the "double line" sign in the epiphysis which is highly specific for avascular necrosis (arrow).

Previous radiographic studies that she secured and brought with her were reviewed. The initial anteroposterior (AP) lumbopelvic study (Figure 1) shows a distinct difference in the contour of the right femoral head with a slight deformity ("step" defect). A follow-up study (Figure 5) of the AP lumbopelvic region four months later shows greater collapse of the femoral head articular cortex. Increased bony sclerosis is also evident. Osteoporosis of the femoral neck and trochanters is also seen on the right. Remodelling of the acetabulum was also noted.

A further follow up study (Figure 6) eight months after the initial study (Figure 1) demonstrated even further collapse with varying sclerosis and radiolucency within the femoral head. There is considerable lateral displacement of the femur as well. Periosteal buttressing of the femoral neck along the medial cortex was evident.

All of the radiographic changes were consistent with moderate degenerative joint disease secondary to osteonecrosis of the right hip. It was felt that this condition had led to a delay in skeletal maturation of the right lower extremity resulting in an altered gait which developed a right sacroiliac joint dysfunction syndrome.

Discussion

The above case described a cause of osteonecrosis which was believed to be due to trauma. Whatever the cause, it is the loss or reduction of blood that leads to osteonecrosis. Intra-articular epiphyses are predisposed to necrosis due to the majority of the

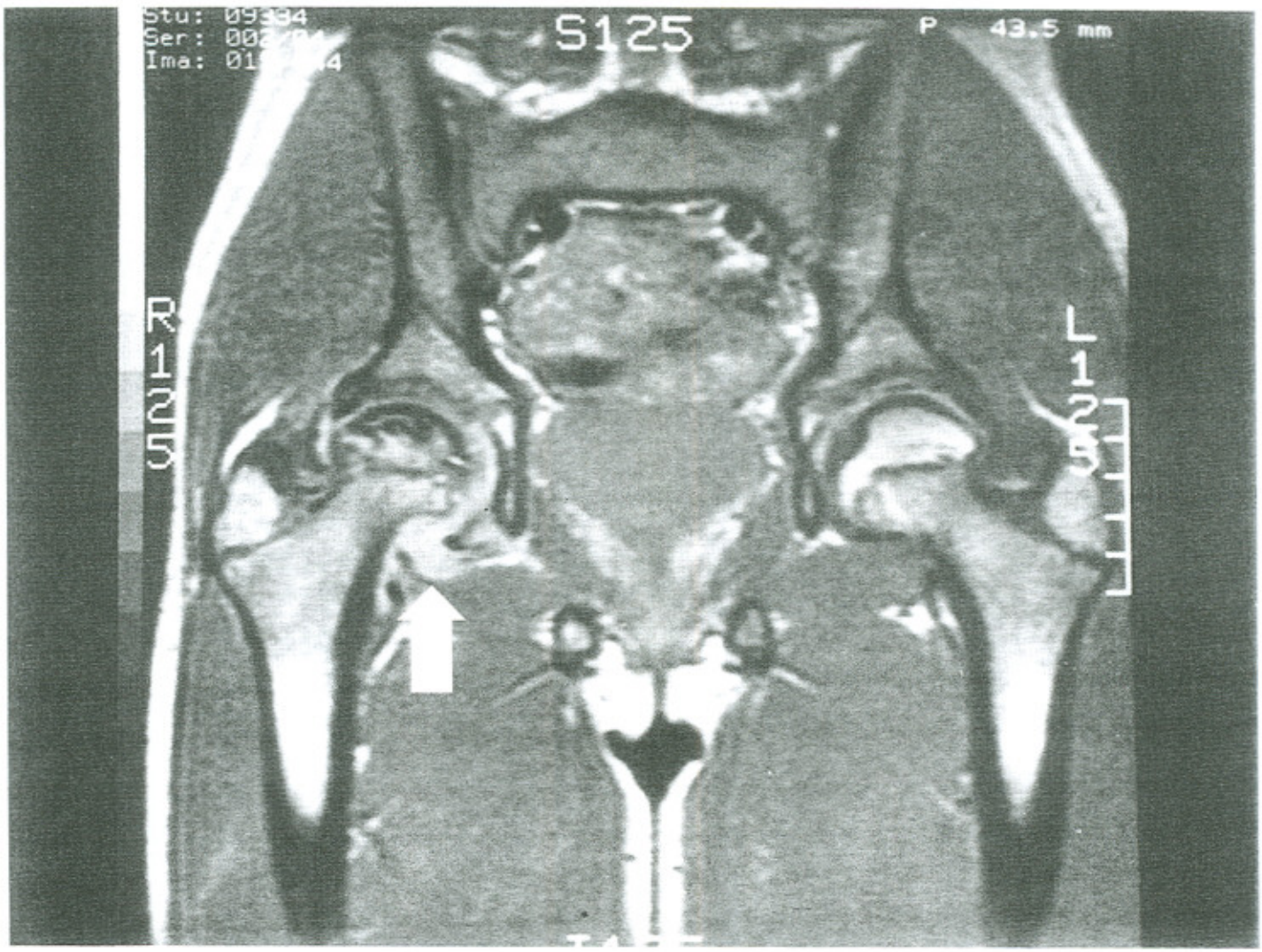

Figure 3 T2-weighted coronal image of the pelvis shows high signal intensity fluid surrounding the right femoral head and neck (arrow).

blood supply being derived from vessels which penetrate through the joint capsule and lie in a subsynovial position on the external surface of the bone. Therefore, these vessels are very vulnerable.

Pathologically the first feature of osteonecrosis is the avascular phase where loss of blood supply leads to the death of osteocytes and marrow cells. The surrounding articular cartilage continues to grow. Radiographically the femoral head has normal bone density, however, the joint space may be increased. Routine radiographs are insensitive to changes in the soft tissues and bone in this phase. The high contrast resolution of MR imaging makes it an ideal method for imaging the hip to detect any subtle abnormalities if osteonecrosis is present.[7]

The next phase of osteonecrosis involves the revascularization phase. New blood vessels form with new bone being deposited onto dead bone. This accounts for the sclerosis seen on plain film radiographs ("snowcap"). Resorption of bone also occurs in this phase which leads to weakening of the articular cortex with a resultant collapse ("step" defect). A subchondral fracture can also occur with a resultant "'crescent" sign being seen on radiographs. This is seen under the articular cortex at the point of maximum stress.

The third phase is the repair phase where remodeling occurs. New bone is deposited and is easily modeled. Deformity may occur depending on the stresses applied to the new bone.

The final phase is dependent upon the previous two phases of revascularization and repair. If compressive forces are kept to a

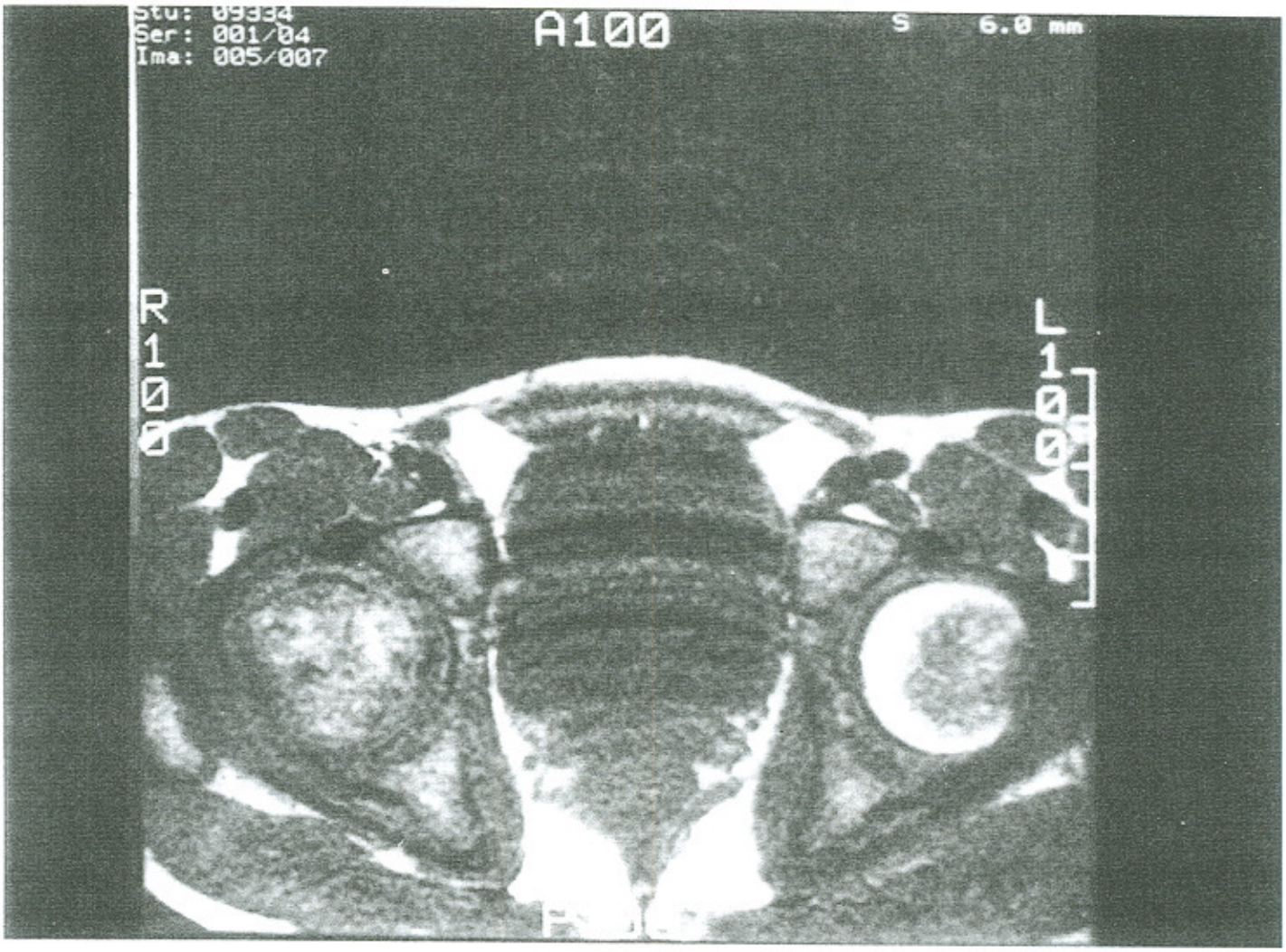

Figure 4 T1-weighted axial image shows low signal intensity of the right femoral head.

minimum then restitution of the epiphysis to it's normal configuration occurs. The closer the deformed shape to the normal the better the long-term prognosis and the less likelihood of DJD.[8]

MR imaging is considered the imaging modality of choice for detection of osteonecrosis of the hip. Surrounding the ischemic area is a zone of repair which is seen as a band of decreased signal intensity on both T1- and T2-weighted images. Adjacent to this band on the T1- and T2-weighted images is another band of increased signal intensity. This appearance is called the "double line" sign and is believed to be highly specific for avascular necrosis.[9] As more fluid and inflammation accumulate in the area a low signal intensity on T1-weighting and high signal intensity on T2-weighting becomes evident.[10]

Treatment for osteonecrosis of the hip is varied. Muscle-pedicle bone grafting,[11] core decompression,[12] bone graft and total hip replacement[13] are all controversial. Core decompression produced better results than conservative treatment which consisted of strict nonweight bearing with a walker or axillary crutches.[14]

It is imperative that femoral head deformity be minimized in patients with osteonecrosis. Joint deformity will ultimately lead to degenerative joint disease which will itself lead to pain and disability and require total hip replacement to alleviate the suffering.

Conclusion

A case of lower back pain, primarily a right sacroiliac joint dysfunction syndrome was presented. Osteonecrosis of the hip was the initiating factor which lead to pelvic unleveling causing an abnormal gait creating this patient's symptomatology.

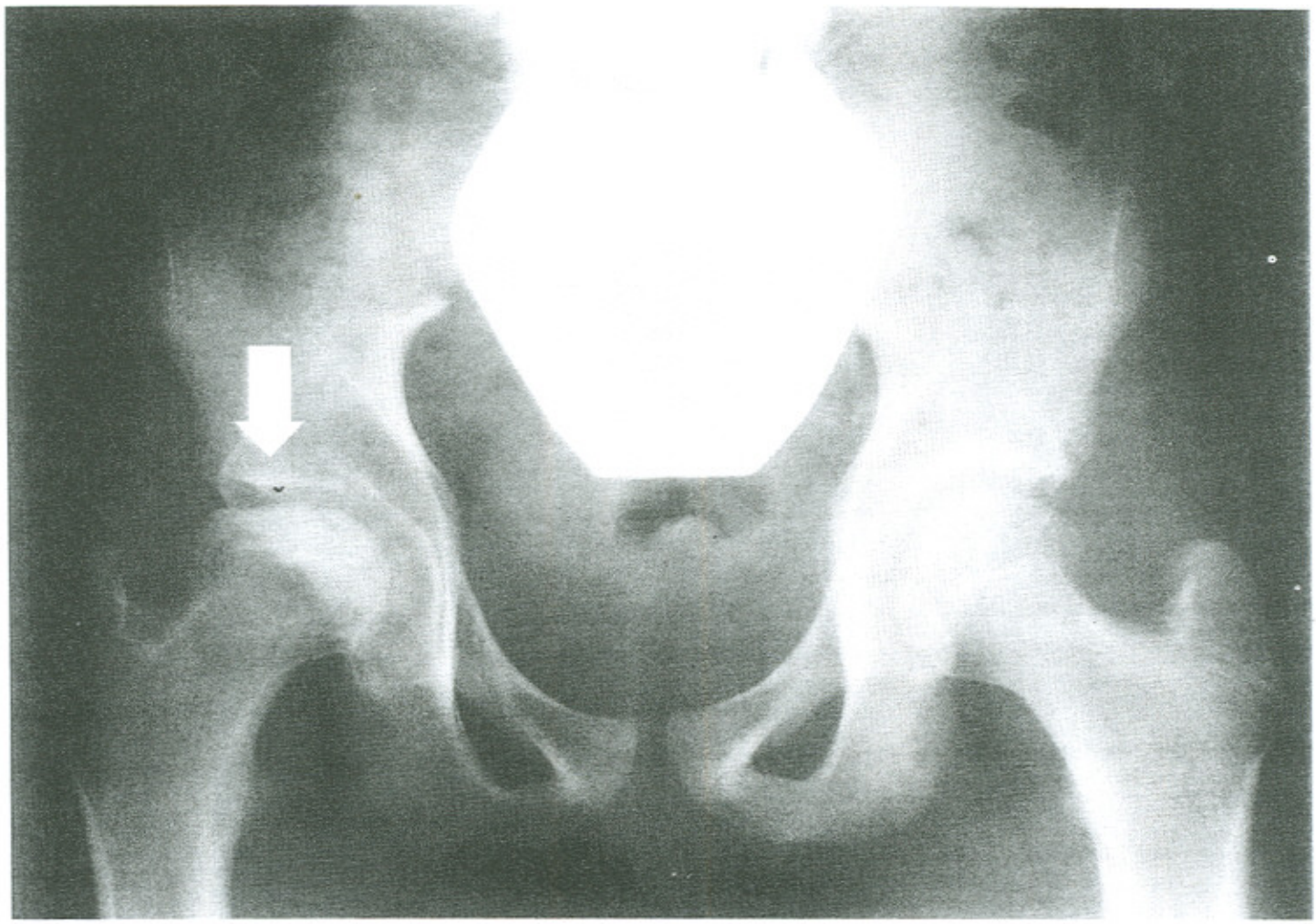

Figure 5 AP pelvis radiograph four months later after Figure 1 showing a more pronounced "step" defect and increased sclerosis subchondrally (snowcap). Note the osteoporotic femoral neck and trochanters compared to the normal left side. Also note the "crescent" sign which represents a subchondral fracture (arrow).

A painful hip in a child or adolescent should lead the chiropractor to consider osteonecrosis in the gamut of differential diagnoses. Plain film findings can be totally inconclusive in the early stages of this condition. MR imaging is the imaging modality of choice since it is more sensitive to the early changes of osteonecrosis than any other imaging procedure.

Conservative treatment is very important, however, an orthopedic consultation for further evaluation should always be suggested.

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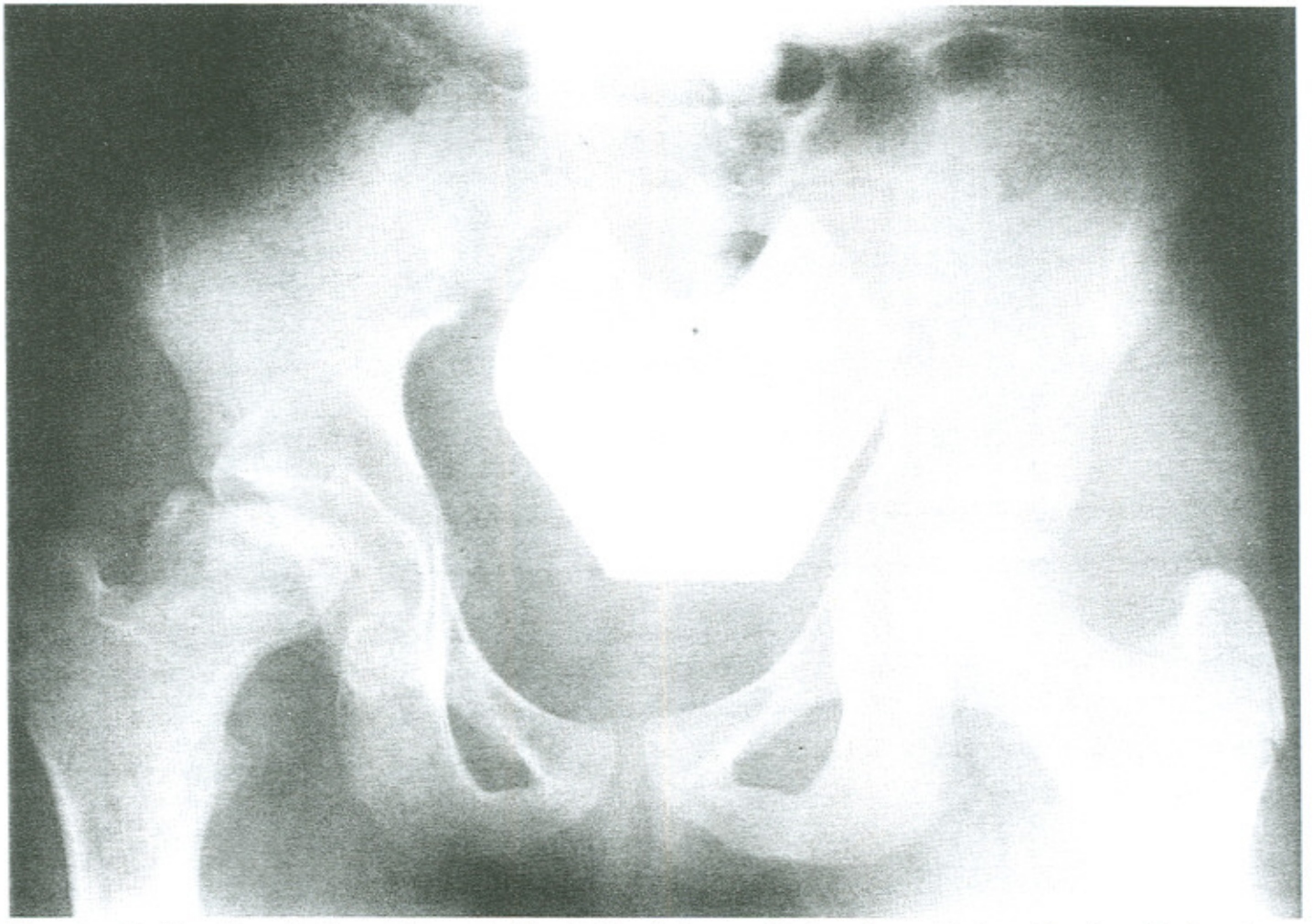

Figure 6 AP pelvis radiograph eight months later after Figure 1. Note the changes of further collapse of the femoral head as well as lateral displacement of the femur. Periosteal buttressing of the femoral neck is seen along the medial cortex.

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