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FEMOROACETABULAR IMPINGEMENT AFTER THE FEMORAL NECK FRACTURE HEALED IN A NONANATOMICAL POSITION

Case presentation

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ABSTRACT

Introduction: Femoroacetabular impingement is the result of the pathological conditions in the osseous acetabulum and/or the proximal femur, one of its causes is a non-anatomically healed femoral neck fracture.

Case report: Male, age 51, with a subcapital left femoral neck fracture, treated conservatively. The fracture healed, but even 9 months later, the patient was walking on crutches and suffered from pain in the left groin. The X-ray images showed the valgus and the retroposition of the left femoral head. The patient was operated on and intraoperatively the thickness and a bone prominence in the anterosuperior femoral neck area in the line of the previous fracture were found, which was pressing and spreading beneath the acetabular labrum, thus squeezing the acetabular cartilage. The labrum lesion which was found was the result of the mechanical pressure of the existing femoral neck deformity during the hip movements. Irretrievably damaged part of the labrum has been resected as well as the
anterosuperior femoral head-neck osteochondroplasty has been done. One year after the surgery, the patient suffered from no pain, he walked without limping, the impingement test was negative, the radiological parameters were adjusted, with no signs of the avascular necrosis of the femoral head.

**Conclusion:** The femoral neck fracture should be treated adequately with the full anatomical position and the proper internal fixation. If the deformity occurs as the result of a treatment, it should be removed as soon as possible to prevent the osteoarthritis of the hip.

**Key words:** femoral neck fracture; femoroacetabular impingement; hip pain; surgery.

**INTRODUCTION**

Femoroacetabular impingement (FAI) is the cause of the hip pain in young adults and is a potential cause of a hip arthrosis development\[1,2,3,4,5,6,7,8,9\]. The minimal bone changes of the proximal femur and/or acetabulum combined with FAI as a pathophysiological mechanism, lead to an early labrum lesion and adjacent cartilage. FAI represents a marginal conflict of the altered bone morphology between the rim of the acetabulum and the proximal femur of the hips\[10,11\]. Flexion, internal rotation and the adduction of the hip provokes the unnatural contact between the femoral head-neck junction in the aspect of the asphericity with the anterosuperior upper rim of the acetabulum.

Two basic mechanisms of FAI have been described: cam impingement and pincer impingement, with a mixed type which combines the previous two. The cam impingement appears in younger, more often male adults and is the result of morphological, bone changes at the proximal femur, at the femoral head-neck junction in the form of a bone thickening or a cam, with the aspherical configuration of this junction. These changes, depending on the author who described it, were called ‘’pistol grip’’ \[12\] or ‘’tilt’’ deformity of the proximal femur\[5\]. Such changes can be seen in, slipped capital femoral epiphysis\[13,14,15\], Legg-Calve-Perthes disease\[16,17\], avascular necrosis of the femoral head\[18\] and non-anatomically healed femoral neck fractures \[19,20\].
During the flexion, the adduction and the internal rotation in the hip, anterosuperior, pathologically altered part of the femoral head-neck junction, spreads beneath the acetabular labrum, thus squeezing the labrum adjacent articular cartilage, while the labrum itself, initially, remains intact. Consequently separation of the acetabular cartilage from the labrum and subchondral bone occurs. Acetabular cartilage is irretrievably damaged, separating from the subchondral bone and the adjacent labrum, which leads to the degenerative changes of the hip[1,21,22]. Due to the fact that the labrum lesion occurs last, and the labrum is richly innervated, the groin pain intensifies in the developed stages of the disease appears[23] which is the reason why the cam FAI is malignant morbotipe of the disease.

Aim of this presentation: We are presenting a relatively rare form of cam FAI, which is the result of a non-anatomically healed femoral neck fracture and also the results of the surgical treatment of the hip changes induced by trauma.

CASE OUTLINE

Male, age 51, was hurt in July, 2009. Radiological finding: subcapital left femoral neck fracture with the dislocation of the femoral head in abduction. The patient was treated conservatively. The patient complained of a severe and constant pain in the left groin, after conservative treatment has been compleated, he could not walk without crutches and he was limping when walking. Nine months after the injury, physical examination of the patient confirmed: limping on the left leg, slightly positive Trendelenburg's sign on the left leg and the limited motion in the hip joint: flexion up to 80 °, internal rotation 20 °, external rotation 45 °, abduction is 40 ° and adduction up to 10°. The impingement test[1] was positive in the range of 40-80 ° of the flexion. The clinical findings were graded according to the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [24], and it was 76.

Radiological findings showed the healed subcapital femoral neck fracture without necrosis of the femoral head. The anteroposterior(AP) X-ray images of the hips (Figure1) show the value of collo-capital diaphyseal angles (CCD) at the healthy right hip it was 135 ° and at the injured, left hip 149 ° that goes in favour of the healing of the femoral neck in abduction, ie.valgus position of 19° [25]. Tonnis angle [26], had the value of 0 ° on both sides, the value of Wiberg angle[27], on the right hip was 43 °, and on the injured, left hip 38 °. The value of the alpha angle, as the parameter of the femoral head convexity, as seen
on the AP X-ray images of the hips, measured by the Nötzly method[28], on the right hip was 47 °, and on the left hip was 57 °. On the Dunn-Rippstein Müller lateral X-ray images, on the right hip, the alfa angle was 40° and on the left hip 73°, with the evident retroposition of the femoral head on the injured hip in relation to the healthy hip, with the disparity of 33° (Figure 2). The head of the femoral bone is not located centrally on the femoral neck, but it is located back and upwards. We have measured the angle between the head of the femoral bone and its neck – the gama angle or collo-capital angle (25). Its normal value is $-1° < \text{gama} < 2°$, in our patient the gama angle is 5° (scheme 1,2).

The open surgical procedure, so called trochanteric major flip osteotomy approach[29,30], was performed, under spinal anesthesia, in May 2010, nine months after the hip injury. After the anterior "Z" capsulotomy, the controlled anterior surgical dislocation of the hip was performed.

Intraoperatively, in the anterosuperior femoral neck region, the femoral neck bone prominence was noticed (Figure 3), in the shape of a cam. This prominence, i.e. cam, was osteotomized, taking into consideration that the size of the resection of the neck does not exceed 30% of its thickness[31,32,33], (Figure 4). A resection osteoplasty of the impinging site on the neck-head junction was performed to improve femoroacetabular offset. In the upper anterosuperior part of the acetabulum, ranging from 12-17 hours (4,34), the separation and serious damage of the labrum from its ledge was noticed, with no possibility of its refixation, the partial resection of the labrum has been conducted. The reposition of the hip was performed, the joint capsule reconstructed, a major trochanter was fixed.

The first postoperative day active exercises in bed started and the walking on the crutches was allowed from the second day with a touch down on the tip toes of the operated leg for six weeks after the surgery.

One year after the surgery, we have found: the absence of the hip pain, walking without crutches and no limping, Trendelenburg sign negative, the impingement test also negative, the hip flexion was 90°, the internal rotation 15° and the other movements of the hip were within the normal range, and WOMAC score was 94.

Postoperative Dunn-Rippstein-Müller profile X-rays images of the hip showed the reduction of the alfa angle values of the injured hip, from 73° to 50°, while on the AP X-rays, the value of alpha angle was reduced from 57° to 52°, and valu of gama angle was reduced from 5° to 1° (figure 5). Trochanter osteotomy of the femur, was healed, the
femoral head was clearly contoured, without bone cysts and with no signs of the avascular necrosis development et heterotopic ossification.

**DISCUSSION**

There are few papers in the literature dealing with surgical correction of the deformity at the femoral head-neck junction after femoral neck fractures healed in a non-anatomical position [16,17]. Thus Eijer et all.in his paper, published in 2001, presented the treatment of 9 patients using the open surgical method, whereas all the other authors in their papers presented the surgical treatment of the non traumatic cam FAI form in patients with the pathological substrate at the femoral head-neck junction[3,8,13,25,27].

Dislocated fractures of the femoral neck, as a routine, are treated by the partial or the total hip replacement, and, in younger adults, the open reduction and internal fixation of the neck fracture is recommended. Only a few patients, with non dislocated femoral neck fractures are treated conservatively. In this, presented case, has not been noticed dislocation of the femoral head in relation to the femoral neck, and the treatment was completed conservatively. Patient's persistent symptoms and subsequent clinical and radiographic examination showed the presence of the bone prominence i.e. cam in the anterosuperior region of the femoral neck in the area of the former fracture, which led to the conclusion that it was very rare, trauma provoked form of the femoroacetabular impingement. Cam deformity is a consequence of osteogenesis on the place of femoral neck fracture. The dislocation of the femoral head has caused an irritation and made place for excessive callus formation in the shape of cam deformity, which has damaged the cartilage and hip joint labrum with its presence, causing pain and limping. In this manner the femoral head has kept the dislocated position.

In these malposition, the head-neck junction comes in contact with the acetabular rim of flexing the hip within normal range, especially when the leg is rotated internally. The resulting sensation of pain may be caused by shear or compression of the acetabular labrum, which is known to carry proprioceptive and nociceptive nerve fibres, similar to the knee meniscus [23].

Preoperative, subjective and objective symptoms of the patient were reduced and radiographic parameters showed, postoperatively, that the values of the injured hip were brought at a level that approximated the values of the healthy hip. The reduction of alpha
and gama angles to normal values confirms the success of the surgical procedure, ie. it
confirms the sufficient extent of osteochondroplastica. Intraoperatively, these angles can be
radiologically measured and adequately corrected, without relying on uncontrolled
resection that can sometimes be insufficient. The values of these angles confirm the correct
anatomical relation between femoral head and neck and the absence of cam deformity,
causing the femoral neck axes p and l to overlap. Thereby, the factors of pain and further
hip joint labrum and cartilage damage are removed.

Using this procedure we have created almost normal hip anatomy. Therefore, we believe
that applied surgical technique and the approach to treatment, are of the great importance in
the treatment of the trauma-induced femoroacetabular impingement in symptomatic
patients with the femoral neck fractures healed in a non-anatomical position.

CONCLUSION

The best prevention of this form of the impingement is based on the proper and
immediate surgical treatment of the femoral neck fracture. Early surgical treatment of this
form of the impingement is essential to prevent further degeneration and osteoarthritis of
the hip.

LITERATURE

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head cartilage subsequent to femoro-acetabular impingement. Osteoarthritis cartilage
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Image 1: Standardized anteroposterior radiographic image of the hips. Left: femoral bone neck fracture healed in abduction.


Image 5: postoperative Dunn-Rippstein- Müller radiographic image of the hip.
Scheme 1. Femoral head axis (1) – AB, the line that connects upper and lower edge of the femoral bone neck on AP radiographic images of the hip, and front and rear edge of the neck on Dunn90°. M, the central point of the AB line. O, the center of femoral head rotation. OM is a line that represents the axis of femoral bone neck (axis 1) – it depends on the position of the femoral bone head center.
Scheme 2. Femoral head axis represented by two parallel lines (p) – AB, the line drawn on the narrowest part of the femoral bone neck. CD, the line drawn 3-4mm medially from the line AB. M, the central point of the AB line. N, the central point of the CD line. MN, the line that represents the axis of the medial third of the femoral bone neck, the position of which does not depend on the center of femoral head rotation. Axes l and p overlap, (l=p) when the head of the femur is located centrally on the neck. Gama angle is collo-capital angle of the femoral head created by l and p axes, the basic value in the pilot study of healthy hips is $-1^\circ < \gamma < 2^\circ$. In the case of our patient the angle gama is 5°.