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Case Report

Morphological abnormalities of the hip in acetabular fractures

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ABSTRACT

Poor prognosis factors in surgical treatment of acetabular fracture-dislocations have been well established but there is little information about how morphological abnormalities of the hip may affect the surgical outcome. Hip anatomy has a wide range of variations. Morphological abnormalities of the hip can also be observed in patients with acetabular fractures. We present a case of a complication in a patient with a complex acetabular fracture, acetabular retroversion and femoroacetabular impingement. A 31-year old male patient was transferred to our trauma center following a high speed road traffic accident. Trauma series CT revealed cerebral contusion, subdural hematoma, aortic dissection and a left transverse plus posterior wall acetabular fracture. The left hip was reduced and the acetabular fracture was treated with a Kocher Langenbeck approach in prone position. The pelvic X- ray evidenced an anatomic reduction and signs of acetabular retroversion with positive posterior wall sign and crossover sign. CT scan evidenced increased alpha angle in the femoral head neck junction. During the follow up, 2 months after the acetabular fixation, patient suffered a posterior left hip dislocation and a total cementless hip arthroplasty was performed. Patients with acetabular retroversion and femoroacetabular impingement (CAM lesion) may be at risk of posterior dislocation. The influence of acetabular version and impingement may be also closely involved in how challenging the determination of hip stability can be in patients with posterior wall acetabular fractures. Acetabular retroversion and FAI may be related to the dislocation of unstable patterns with small fragments (wall sizes less than 20%). In this case postoperative precautions were not enough. We believe capsular reattachment with anchors and bracing may be useful in these selected cases. As these patients are not candidates for retroPAO (the recommended treatment for acetabular retroversion) maybe arthroscopic anterior wall riming and CAM resection should be performed at an early stage to decrease or avoid fulcrum.

Introduction

Poor prognosis factors in surgical treatment of acetabular fracture-dislocations have been well established [1] but there is little information about how morphological abnormalities of the hip may affect the surgical outcome.

Hip anatomy has a wide range of variations. Some anatomical variations may increase hip instability making it easier to produce a dislocation in a usually highly constrained joint. Several authors have found association between femoroacetabular impingement (FAI) (CAM or Pincer deformities) and patients who have sustained low energy traumatic hip dislocations [2]. Acetabular version

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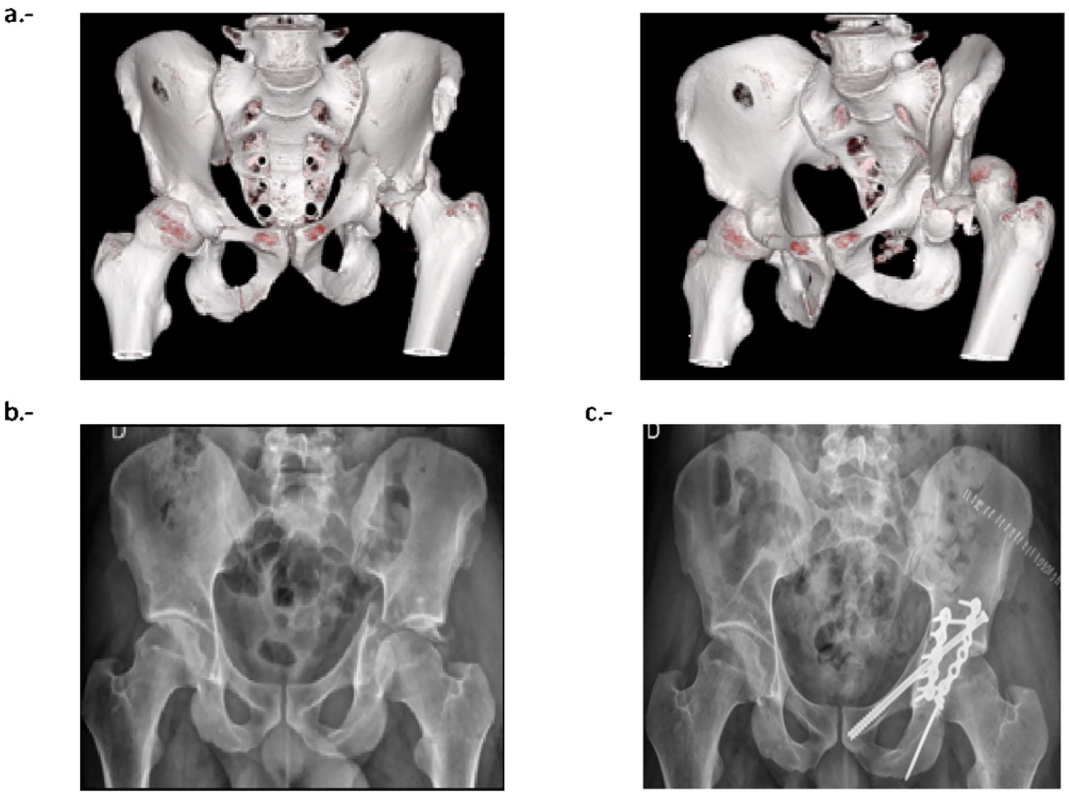

Fig. 1. a.- Left posterior hip dislocation and complex acetabular fracture. b.- Left hip reduced. c.- Fixation of complex left acetabular fracture.

may have an important role. A retroverted acetabulum may decrease the force needed for a posterior hip dislocation as it provides less posterior wall to contain the femoral head [2,3]. Hip morphological abnormalities may combine. In the study by Dandachli et al. [4], half of the hips with acetabular retroversion also had a cam-type deformity.

Radiological signs of FAI are well known. Alpha angle in the anteroposterior and crosstable views correlate to the presence of a CAM type impingement. Cross over sign (COS) is seen when the anterior rim of the acetabulum "crosses over" its posterior rim [5]. There are several signs of acetabular retroversion that can be recognized in a pelvic X-ray. Posterior wall sign (PWS) is positive when the center of the femoral head is lateral to the posterior wall in the AP pelvis [5]. Ischial spine sign (ISS) [6] is positive when the ischial spine projects into the pelvic cavity. Finally, the acetabular retroversion index (ARI) is a quotient between the length of the overlap of the anterior rim in comparison with the entire length of the lateral acetabular opening [7].

Morphological abnormalities of the hip can also be observed in patients with acetabular fractures. In these cases, attention is usually placed in the fracture pattern and associated injuries, but anatomical variations may be related to some complications or progression to arthritis.

We present a case of a complication in a patient with a complex acetabular fracture, acetabular retroversion and femoroacetabular impingement.

Case

A 31-year old male patient was transferred to our trauma center following a high speed road traffic accident. He was riding a motorcycle and crashed into a car. He was retrieved to our trauma center hours later the accident from a primary hospital.

Primary survey revealed a hemodynamically stable patient, a Glasgow coma score of 15 points and a right pneumothorax with a tube. The left lower extremity was shortened and in internal rotation position. There was damage to the sciatic nerve with motor and sensitive compromise (Fig. 1a).

Trauma series CT revealed cerebral contusion, subdural hematoma, aortic dissection and a left transverse plus posterior wall acetabular fracture.

The patient underwent vascular surgery with an aortic endoprosthesis. After vascular surgery, the left hip was reduced under general anesthesia (Fig. 1b). The pelvic X- ray evidenced signs of acetabular retroversion with positive posterior wall sign and crossover sign (Fig. 2). CT scan evidenced increased alpha angle in the femoral head neck junction (CAM).

Nine days later, the acetabular fracture was treated with a Kocher Langenbeck approach in prone position. The transverse pattern was reduced and fixed with a 7.0 mm cannulated screw and the posterior wall was reduced and fixed with a 5 holes and 7 holes plates. Anatomical reduction was obtained (Fig. 1c).

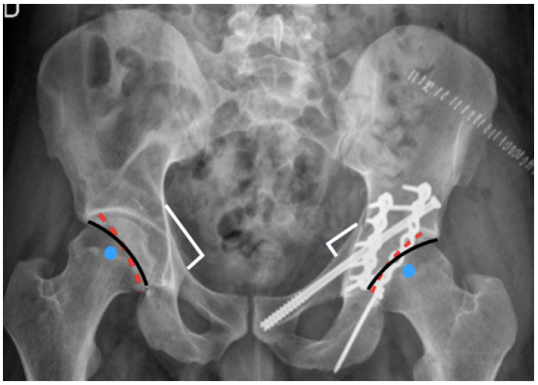

Fig. 2. Acetabular retroversion in both hips. Posterior wall sign, crossover sign and ischial spine sign. (Anterior wall in red dotted line, posterior wall in black straight line, ischial spine in white straight line, center of femoral head in blue oval). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Postoperatively, physiotherapy was with passive exercises and progression to transfer to a wheelchair. Weight bearing was restricted. The patient was instructed to avoid hip flexion and internal rotation because of his poor acetabular posterior wall coverage.

During the follow up, 2 months after the acetabular fixation, during sleeping, patient suffered a posterior left hip dislocation (Fig. 3). Six days later a total cementless hip arthroplasty was performed (Fig. 4).

He was allowed to partial weight bearing on his left side with two crutches for 6 weeks progressing to full weight bearing at eight weeks without crutches.

Discussion

Hip dislocation after open reduction and internal fixation of an acetabular fracture is often considered to be caused by poor reduction, specially of the posterior wall or by soft tissue damage during trauma or surgery. Although a lot of attention is given to the fracture pattern, marginal impaction and comminution, many orthopedic trauma surgeons usually do not consider patient's anatomy before the injury as a relevant factor.

Patients with acetabular retroversion and femoroacetabular impingement (CAM lesion) may be at risk of posterior dislocation.

According to Hansen et al. [8] after using 3D models in retroverted acetabula they observed less total coverage of the femoral head, slightly anterior over-coverage and substantial posterior under-coverage (40%). Mayer [2] compared 12 male patients who had a posterior hip dislocation during sports to control hips and found a higher proportion of cam deformity in the dislocated group as well as lower values of acetabular anteversion at the center of the femoral head. Steppacher et al. [3] found that hips with posterior traumatic dislocation more often present an increased alpha angle and retroverted acetabulum. They speculate that the observed morphologic features of FAI may mechanically predispose these hips to dislocation. With increasing flexion and internal rotation, the femoral head-neck junction contacts the prominent acetabular rim, which acts as a fulcrum. The increasing force pushes the femoral head posteriorly. Hips with a fulcrum need less impact and may dislocate, specially when the posterior border is less prominent (acetabular retroversion) and patients have torn the capsule and external rotators muscles. Novais [9] found that patients with posterior hip dislocation had lower acetabular version and decreased posterior acetabular coverage in the dislocated hips and in the

Fig. 3. Left hip dislocation after acetabular fixation.

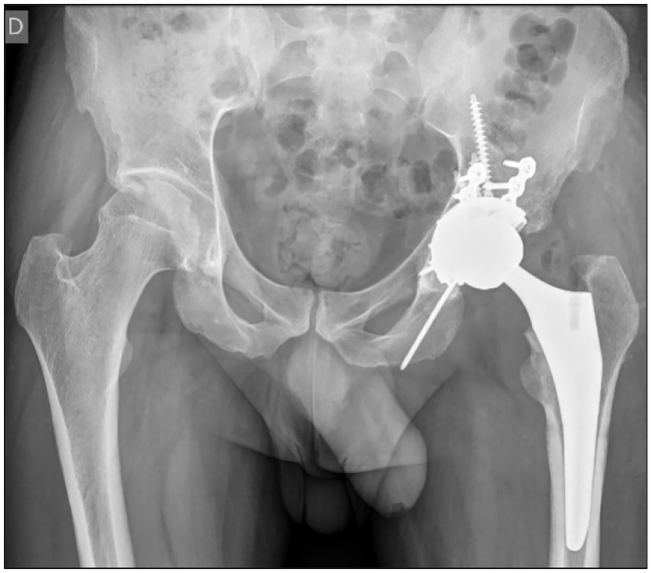

Fig. 4. Left total hip replacement.

contralateral uninvolved hips when compared with control patients. The mean acetabular anteversion angle (± SD) was lower in the study group at 10 mm from the acetabular dome (−0.4° ± 9° versus 4° ± 4°; mean difference − 5°; 95% confidence interval [CI], −9 to −0.3; $p = 0.015$) and at the center of the femoral heads (10° ± 5° versus 14° ± 4°; mean difference − 3°; 95% CI, −6 to −0.9; $p = 0.003$). A higher proportion of acetabula was severely retroverted in the study group (14 of 27 [52%]; 95% CI, 33%–71% versus four of 27 [15%]; 95% CI, 1%–28%; $p = .006$).

The influence of acetabular version and impingement may be also closely involved in how challenging the determination of hip stability can be in patients with posterior wall acetabular fractures [9]. Acetabular retroversion and FAI may be related to the dislocation of unstable patterns with small fragments (wall sizes less than 20%) [10].

In our knowledge this is the first case report to relate retroversion and femoroacetabular impingement with dislocation after open reduction and internal fixation of a complex acetabular fracture. Even though his retroversion and CAM deformity were recognized before surgery and the patient was warned to avoid flexion, adduction and internal rotation he dislocated requiring a total hip replacement. Although other factors could have been involved in this outcome, we believe that posterior wall undercoverage is closely related to dislocation.

In this case postoperative precautions were not enough. We believe capsular reattachment with anchors and bracing may be useful in these selected cases. As these patients are not candidates for retroPAO (the recommended treatment for acetabular retroversion) maybe arthroscopic anterior wall riming and CAM resection should be performed at an early stage to decrease or avoid fulcrum.

References

[1] M.M. Tannast, S.S. Najibi, J.M. Matta, Two to twenty-year survivorship of the hip in 810 patients with operatively treated acetabular fractures, J. Bone Joint Surg. Am. 94 (17) (2012) 1559–1567.
[2] S.W. Mayer, J.C. Abdo, M.K. Hill, L.A. Kestel, Z. Pan, E.N. Novais, Femoroacetabular impingement is associated with sports-related posterior hip instability in adolescents: a matched-cohort study, Am. J. Sports Med. 44 (9) (2016) 2299–2303.
[3] S.D. Steppacher, C.E. Albers, K.A. Siebenrock, M. Tannast, R. Ganz, Femoroacetabular impingement predisposes to traumatic posterior hip dislocation, Clin. Orthop. Relat. Res. 471 (6) (2013) 1937–1943.
[4] W. Dandachli, S.U. Islam, M. Liu, et al., Three-dimensional CT analysis to determine acetabular retroversion and the implications for the management of femoro-acetabular impingement, J. Bone Joint Surg. (Br.) 91 (8) (2009) 1031–1036.
[5] D. Reynolds, J. Lucas, K. Klaue, Retroversion of the acetabulum. A cause of hip pain, J. Bone Joint Surg. 81-B (1999) 281–288.
[6] F. Kalberer, R.J. Sierra, S.S. Madan, et al., Ischial spine projection into the pelvis: a new sign for acetabular retroversion, Clin. Orthop. Relat. Res. 466 (2008) 677–683.
[7] C. Diaz-Ledezma, T. Novack, O. Marin-Peña, J. Parvizi, The relevance of the radiological signs of acetabular retroversion among patients with femoroacetabular impingement, Bone Joint J 95-B (7) (2013) 893–899 Jul.
[8] B.J. Hansen, M.D. Harris, L.A. Anderson, C.L. Peters, J.A. Weiss, A.E. Anderson, Correlation between radiographic measures of acetabular morphology with 3D femoral head coverage in patients with acetabular retroversion, Acta Orthop. 83 (3) (2012) 233–239 Jun.
[9] E. Novais, M. Ferrer, K. Williams, S. Bixby, Acetabular retroversion and decreased posterior coverage are associated with sports-related posterior hip dislocation in adolescents, Clin. Orthop. Relat. Res. 477 (5) (2019) 1101–1108 May.
[10] R. Firoozabadi, C. Spitler, C. Schlepp, B. Hamilton, J. Agel, M.C. Routt, P. Tornetta, Determining stability in posterior wall acetabular fractures, J. Orthop. Trauma 29 (10) (2015 Oct) 465–469.