Injury, Int. J. Care Injured 45S (2014) S9–S15

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Anterior Combined Endopelvic (ACE) approach for the treatment of acetabular and pelvic ring fractures: A new proposal

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ARTICLE INFO

Keywords:
Acetabular fracture
Pelvic fractures
Anterior approach
New approach
Osteosynthesis
Iliac vessels
Corona mortis

ABSTRACT

Purpose: We present our experience of using the Anterior Combined Endopelvic (ACE) approach, which consists of a combination of a newly modified Stoppa approach with the lateral approach to the iliac crest. This approach is discussed in terms of fracture reduction and fixation, technical aspects, and the incidence of complications, and as an alternative to the ilioinguinal approach for the treatment of acetabular fractures.

Methods: A consecutive group of 34 adult patients with acetabular fractures treated surgically with the ACE approach was compared with a group of 42 adult patients treated with the ilioinguinal approach between 2010 and 2013. Both approaches were performed by a single surgeon to fix the acetabular fractures with main anterior displacement and the anterior and lateral parts of the pelvis. All the patients were analysed with typical X-ray projections for acetabular fractures and CT-scan. Charts and radiographs were reviewed for fracture pattern. Operative time, blood loss, quality of reduction, functional outcomes and perioperative complications were compared between the two groups of patients.

Results: The mean follow-up of patients was 26 months (range 6–49 months), with a median of 24.5 months. The types of acetabular fraction in the study were as follows: 32 anterior and posterior columns, 18 anterior columns, 10 anterior columns with posterior hemitransverse, 10 transverse associated with posterior walls, two transverse; two T-Type transverse and two anterior walls. Average blood loss was 1090 mL in the ACE group and 1200 mL in the ilioinguinal group. Anatomic or satisfactory reduction was achieved in 94% of the acetabular fractures. Two patients (one in each group) had mild symptoms of the lateral femoral cutaneous nerve and improved within 4–6 months; one patient in the ilioinguinal group developed ossification Brooks grade III.

Conclusion: The ACE approach for the treatment of acetabular fractures is highly recommended when the fracture involves the quadrilateral surface and anterior column. This approach provides a direct good-to-excellent visualisation and access to the entire fracture, which makes reduction and fixation easier. The clinical outcomes were slightly better with ACE compared with the ilioinguinal approach. Complication rate was similar in the two groups. The ACE technique is a viable alternative to the ilioinguinal approach when exposure of the anterior acetabulum is required.

Introduction

The overall incidence of pelvic and acetabular fractures has not changed significantly in the last 20 years, according to epidemiology data. Pelvic ring fractures (PRFs) were 23% per 100,000 persons [1] and acetabular fractures (AFs) were 3 patients/100,000/year [2]. Most of the reported fractures were caused by a fall from a height or a motor vehicle accident [3]. The median Injury Severity Score, however, has been considerably reduced because of the introduction in most industrialised countries of improvements in automobile safety, like stringent legislation on the use of seatbelts, speed limiting and alcohol consumption of drivers [2]. Improvements in surgical treatments and resuscitation techniques after Judet-Letournel's early work [4,5] significantly decreased mortality rate, length of hospital stay and incidence of osteoarthritis [6,7]. Letournel et al. [8] described anterior, posterior, combined and extensile approaches for the treatment of pelvic fractures.

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http://dx.doi.org/10.1016/j.injury.2014.10.016
0020–1383/

Any decisions about surgical treatment depend on the classification of the fracture [9], displacement of the bone fragment, condition of the skin at the site of surgical incision and timing of surgery (early versus delayed).

The extended ilioinguinal approach provides an excellent direct visualisation, which simplifies reduction and fixation of the fracture [10]; however, these extended approaches are associated with serious complications, such as Morel-Lavallèe haematoma [11], which limits their use.

Combined approaches are necessary when the fracture pattern involves the pelvis anteriorly and posteriorly, but close attention is required when positioning and assessing the length of the screws to fix the fragments on one side, so that it does not negatively affect the reduction and fixation on the other side. Conversely, approaches that are too limited may not provide adequate visualisation, which makes it difficult to reduce and fix complex fractures [12].

Pfannenstiel and ilioinguinal approaches are the most commonly used procedures anteriorly to the pelvis. They are often indicated in an anterior pelvic ring disruption and in dislocation of the pubis symphysis, rather than in an anterior column fracture, and in combination with posterior approaches in complex fractures. The Pfannenstiel approach limits direct visualisation to the posterior pubis surface. The ilioinguinal approach enables direct visualisation of a large part of the iliac crest and surface, and of the restricted surface of the iliopubic bulge (Fig. 1).

The endopelvic fracture line is often fragmented and displaced and is not directly visible with the ilioinguinal approach; it is often only tested by the "endopelvic finger" (touching the fracture by sinking the flexed index finger into the pelvic ring). This considerable limitation is associated with difficulty in reducing the fragments of the quadrilateral surface, and the space to introduce and move the reduction instrumentation is very tight.

The lack of direct endopelvic visualisation can considerably extend the duration of surgery and is associated with poor reductions, increased postoperative infection rates and poor outcome. Moreover, the ilioinguinal approach requires isolation of the femoral nerve and iliac vessels, which increases iatrogenic injury rate [13,14]. This approach therefore requires a long learning curve and generates a lot of anxiety in young surgeons.

The modified Stoppa approach, as described by Cole and Bolhofner [15], provides direct exposure of the quadrilateral surface up to the sacroiliac joint, which enables the introduction of plates and screws to stabilise fractures in the pelvic ring, although posteriorly to the acetabulum. However, as this is a midline approach, it does not expose the iliac wing (Fig. 2). Another important limitation is the remarkable soft tissue tension when a Hohmann lever is positioned above and then lateral to the iliopubic eminence. A hard pull of the lever may strangle the iliac vessels and lead to a high risk of injury and thrombotic lesion.

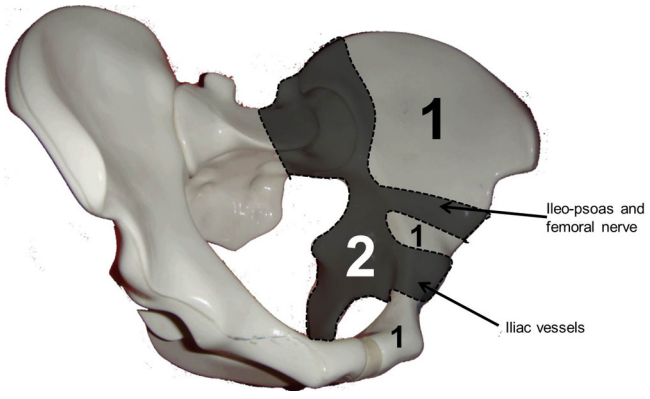

Fig. 1. Ilioinguinal approach direct visualisation.

Fig. 2. Modified Stoppa approach direct visualisation.

To overcome the respective limitations of the ilioinguinal and modified Stoppa approaches, for about three years we have performed a new procedure that combines the modified Stoppa approach with the proximal, lateral window of the ilioinguinal approach. We have called it the Anterior Combined Endopelvic (ACE) approach.

This approach enables the direct visualisation of the entire anterior column fracture line, both inside and outside the pelvic ring, over the entire surface of the iliac wing (Fig. 3), which provides easier reduction and internal fixation of both pelvic ring and acetabular fractures. Lateral skin incision drastically reduces the soft tissue tension and avoids damage to the iliac vessels, particularly in obese patients.

As iliac vessels do not need to be isolated, even young or inexperienced surgeons can improve their experience as a result of a complete direct visualisation and easier reductions and fixation, thus they can perform this surgery calmly and confidently.

Materials and method

Materials

From January 2010 to December 2013, 76 cases of acetabular fracture were treated surgically at our institution, which is a second level Trauma Centre. All 76 patients were enrolled in the study: 64 were male and 12 female, with a mean age of 53.1 years (range 18–85 years). The initial injury was caused by a variety of reasons: falls from a height (28 cases), car accidents (13 cases), motorbike collisions (12 cases), falls off a bicycle (seven cases), crushing trauma (seven cases), pedestrian accidents (five cases) and skiing accidents (four cases).

All patients were studied with anteroposterior (AP) and Judet oblique view X-ray projections for acetabular fractures [4] and high resolution CT-scan with 3D reconstruction. In each case, the fracture pattern was classified pre-operatively and was confirmed by the senior author during the operation according to the classification of Judet et al. [8].

The types of acetabular fracture in the study were as follows: 32 anterior and posterior columns, 18 anterior columns, 10 anterior columns with posterior hemitransverse, 10 transverse associated with posterior walls, two transverse; two T-Type transverse and two anterior walls (Table 1).

The ACE approach was used in a group of 34 patients, and the ilioinguinal approach was used in a group of 42 patients. The