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# Minimal invasive para-rectus approach for limited open reduction and percutaneous fixation of displaced acetabular fractures

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ABSTRACT

*Introduction:* Minimal invasive fixation has been reported as an alternative option for treatment of acetabular fractures to avoid blood loss and complications of extensive approaches. Closed reduction and percutaneous lag screw fixation can be done in minimally displaced acetabular fractures. Open reduction is indicated, if there is wide displacement. In this study, we report the use of a mini-open anterior approach to manipulate and reduce anteriorly displaced transverse acetabular fractures combined with percutaneous lag screw fixation.

*Methods:* This report included eight patients. All had anterior displaced simple transverse acetabular fractures. An oblique mini-incision was made above and medial to the mid-inguinal point, and lateral to the lateral border of rectus abdominis muscle. The external abdominal oblique aponeurosis was incised along its fibres. The arched fibres of internal abdominal oblique were displaced medially above the inguinal ligament to expose and incise the fascia transversalis. Care was taken to avoid injury of ilioinguinal nerve, inferior epigastric vessels, and spermatic cord. The external iliac vessels were palpated and protected laterally. A blunt long bone impactor was introduced through this small incision to manipulate and reduce the fracture under fluoroscopic control. Fluoroscopic guided percutaneous lag screw fixation was done in all patients.

*Results:* The average time to operation was 4 days. Average blood loss was 110 mL. Operative time averaged 95 min. Maximum fracture displacement averaged 10 mm preoperatively and 1.3 mm postoperatively. According to Matta score, anatomical reduction of the fracture was achieved in five patients and imperfect in three. Follow up averaged 27 months. Wound healing occurred without complications and fracture union was achieved without secondary displacement in all patients. Average time to fracture healing was 14 weeks. According to the modified Merle d'Aubigné score, functional outcome was good to excellent in all patients.

*Discussion and conclusion:* Limited open reduction can solve the problem of fracture reduction, which is the main concern in minimal invasive fixation of acetabular fractures. It may help the inclusion of displaced acetabular fractures for percutaneous lag screw fixation. This mini-para-rectus approach has the advantages of minimal soft tissue dissection with the possible anatomical reduction of simple transverse displaced acetabular fractures.

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## Introduction

Management of acetabular fractures remains a challenge for orthopaedic surgeons [1]. The treatment options for acetabular fractures range from non-operative treatment for un-displaced fractures to operative fixation with extensile approaches [2,3]. As any articular fracture, the gold standard for the treatment of displaced acetabular fractures is the anatomical restoration of the articular surface and stable internal fixation [4]. Minimal invasive fixation has been reported as an alternative option for treatment of acetabular fractures to avoid blood loss, infection and complications of extensive wounds. Closed reduction and percutaneous lag screw fixation under fluoroscopic guidance was described in minimally displaced acetabular fractures [5–9]. CT guided fixation of acetabular fractures with percutaneous placed lag screws has been used successfully. However, this technique is limited by fracture pattern, questionable sterility of

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the CT suite, radiation exposure and prolonged surgical time [10]. Failure of closed reduction of the fracture is the main concern in minimal invasive fixation of acetabular fractures. The need for direct manipulation of the fracture to achieve anatomical reduction was the basis of this preliminary report of minimal invasive para-rectus approach for mini-open reduction of displaced acetabular fractures. This work has been approved by the ethical committee of our institution.

## Patients and methods

In this preliminary study, we report the use of a mini-open anterior approach to manipulate and reduce acetabular fractures. From January 2009 to June 2012, 32 patients with simple transverse acetabular fractures (AO type 62B1) were treated with percutaneous columnar lag screw fixation. In all patients, closed reduction was done by fracture manipulation under fluoroscopy, longitudinal traction of the limb and side traction with a pin inserted in the trochanteric region, if needed. Failure of achieving adequate closed reduction of the fracture was an indication of using mini-incision to manipulate and reduce the fracture. We report the use of mini-para-rectus approach for limited open reduction in eight out of the thirty two patients, after failed closed reduction techniques. All were simple transverse anteriorly displaced acetabular fractures. Gap displacements were excluded from this study. Age ranged from 22 to 49 years (average 33 years). Seven patients were males and one was a female. Anteroposterior and Judet oblique views of the acetabulum together with multi-detector CT scan were done for all patients. Timing of surgery ranged from 3 to 7 days after injury.

Instruments and implants for possible classic open reduction using standard approaches, and plate fixation were standby in all cases.

### *Surgical technique*

All patients were supine on a radiolucent fracture table. The surgeon stood on the contralateral side of the affected hip. An oblique mini-incision (3–4 cm) parallel to the fibres of external abdominal oblique muscle was made lateral to the lateral border of rectus abdominis muscle, just above and medial to the mid-inguinal point (Fig. 1A). The incision lies within Hesselbach's triangle; bounded by the lateral border of rectus abdominis muscle medially, the inferior epigastric vessels laterally and the inguinal ligament inferiorly [11]. Pointing to the fracture under fluoroscopy served precise localisation of incision (Fig. 1B). The external abdominal oblique aponeurosis was incised along its fibres (Fig. 2). Identification and retraction of the ilioinguinal nerve was done to avoid its injury. The arched fibres of internal abdominal oblique muscle were displaced medially with spermatic cord in male patients (Fig. 3), or round ligament in the female patient, to expose the posterior wall of inguinal canal; the fascia transversalis. The external iliac vessels were palpated laterally to localise their position and prevent their injury. The inferior epigastric vessels were identified (Fig. 4). They were mobilised and protected in four patients and ligated in the other four. The fascia transversalis was incised to open the extraperitoneal space. Two Deaver retractors were used to protect and retract the external iliac vessels laterally and protect the urinary bladder and parietal peritoneum medially. The fracture site was palpated and a long blunt bone impactor was inserted (Fig. 5A), guided by finger palpation, to manipulate the fracture. Using this bone impactor, it was possible to manipulate the fracture through this portal from anterior and medial sides. This manipulation aimed to push the displaced anterior column posteriorly and to derotate and push the medial surface of the posterior column with the quadrilateral plate laterally to reduce

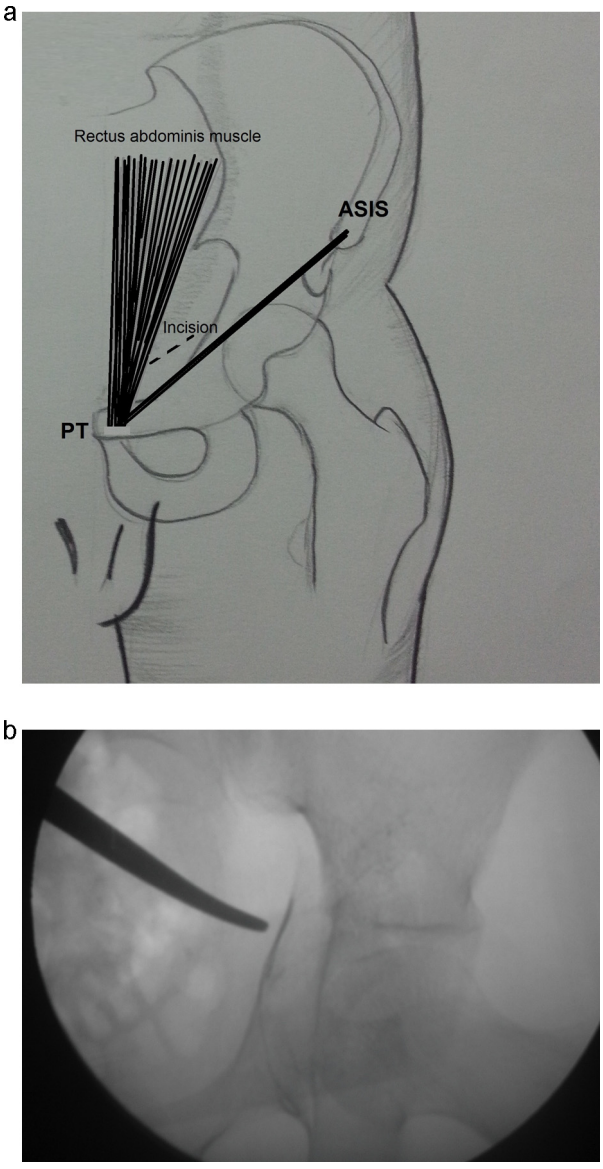


**Fig. 1.** (A) A diagram showing the mini-para-rectus approach as a small oblique incision (3–4 cm) lateral to the lateral border of the rectus abdominis muscle, and above and medial to the mid-inguinal point. (B) Pointing to the fracture site under fluoroscopy served precise localisation of skin incision. (ASIS: Anterior superior iliac spine, PT: Pubic tubercle).

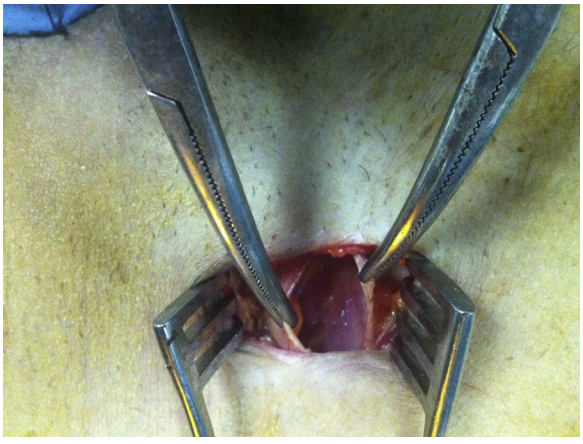

**Fig. 2.** The external abdominal oblique aponeurosis was incised along its fibres.

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