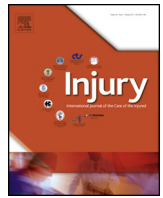




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## Fixation of quadrilateral plate fractures of the acetabulum using the buttress screw: A novel technique

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### ABSTRACT

**Introduction:** Quadrilateral plate fractures constitute one of the most challenging components of acetabular fractures. The objective of this study is to describe and evaluate the novel technique of buttress screw fixation of the quadrilateral plate component of the acetabular fractures.

**Patients & methods:** Forty cases of acetabular fracture with associated quadrilateral plate component were included in the study. Mean age was 35 years (range, 16 – 68 years), with a mean follow-up 16.4 months (range, 9 – 36 months). Fixation of the quadrilateral plate was achieved by one or more buttress screws. The screws were inserted through the reconstruction plate, and placed close to the edge of the pelvic brim. To effectively achieve the 3-point fixation principle, the screw was inserted through the plate hole then outside the bone rubbing on the pelvic surface of the quadrilateral plate.

**Results:** Anatomical reduction of the quadrilateral plate component of the fractures was achieved in all but one patient. The modified Merle D'Aubigné and Postel score was excellent in 13 cases, good in 23 cases, fair in three cases, and poor in one case. No screw displacement or failures were observed during follow-up evaluation. No major complications related to this technique were observed in this series.

**Conclusion:** Buttress screw fixation of the quadrilateral plate fracture component in associated acetabular fractures is a safe and effective technique for reduction and fixation of these challenging fractures with no major complications related to this novel technique.

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### Introduction

The principles of acetabular surgery were first described by Letournel in 1964 [1], and acetabular surgeons have since strived to achieve anatomical reduction and rigid internal fixation of acetabular fractures with quadrilateral plate involvement. As most studies emphasize the importance of achieving anatomical reduction, and link it directly to the final outcome [2–4], surgeons have been trying to implement new techniques and approaches, which all aim to achieve this ultimate goal. Quadrilateral plate fractures of the acetabulum are a challenging group of acetabular fractures to manage. The main difficulties include the position of

the fracture inside the true pelvis, the degree of comminution that is usually accompanied with them, and the associated medial subluxation of the femoral head [5]. Various methods have been described for management of this heterogeneous group of fractures. In 1993, Letournel and Judet described a screw inserted through the thin quadrilateral plate. However, this method is associated with a high risk of joint penetration, and is only possible in simple non-comminuted fractures [6]. Others described methods include the use of plates placed directly on the quadrilateral surface (Infrapectineal plate) [7–9], spring plate fixation of the quadrilateral plate [10], and the use of cerclage wires [11]. In addition, new implants are currently in the market that aim to buttress the quadrilateral plate. Although medial subluxation of the femoral head is one of the challenges, the femoral head is nevertheless needed for indirect anatomical reduction as the joint most times can not be seen intraoperatively.

In the current study, we present a novel screw technique, the Cairo University Hospitals (CUH) Buttress screw for fixation of the quadrilateral plate component of acetabular fractures. We report the

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early results in 40 patients that were underwent this novel surgical method.

## Patients and methods

### Demographics

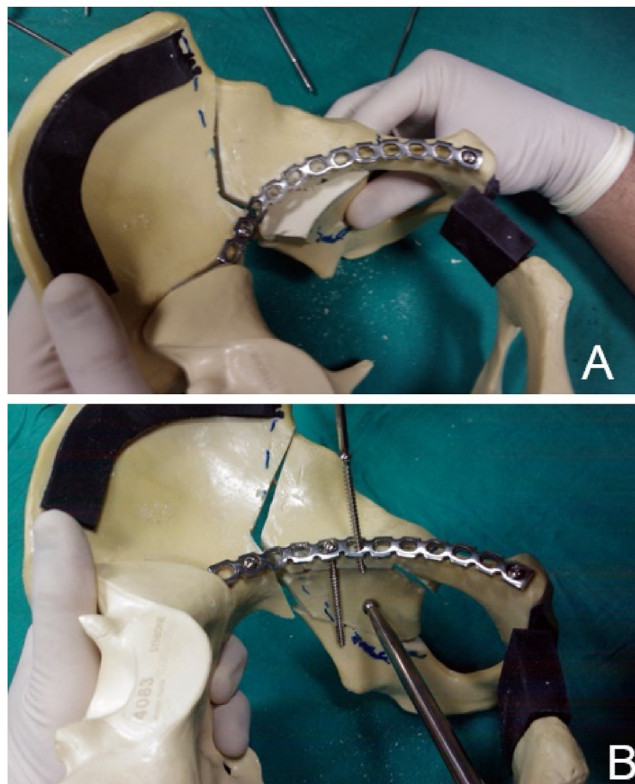
A total of 40 patients (19 females and 21 males), admitted to the Cairo University Hospital, Egypt, between January 2011 and December 2012, were included in the study. The inclusion criteria were patients presenting with acetabular fractures with an associated fracture in the quadrilateral plate. The exclusion criteria included pathological fractures, neglected fractures (>3 weeks). Quadrilateral plate fractures involving a complete or incomplete fracture line, separating the quadrilateral plate from both the anterior and posterior columns, were included in the study. Nineteen fractures showed variable degrees of comminution in the quadrilateral plate, while 21 patients had simple separation of the quadrilateral plate without comminution. Mean patient age was 34.9 years (range, 16 – 60 years). Motor vehicle accidents constituted 50% of the mode of trauma, followed by 35% road traffic pedestrian accidents, followed by 12.5% falls from heights and 2.5% simple falls.

The majority of the fractures were associated both column fractures (23 fractures; 57.5%), followed by T-Fractures (16 fractures; 40%), and anterior column fractures (1 fracture; 2.5%). Seven patients had associated injuries that required operative intervention (6 ipsilateral lower limb fractures and one bilateral upper limb fracture). Four patients had associated pelvic fractures (1 Tile B3, 2 Tile C2-2, 1 Tile C2-3). Seven patients had associated posterior wall fractures that required a separate posterior approach.

### Operative technique of CUH Buttress screw fixation

General anesthesia was used in 17 patients (42.5%), and combined spinal/epidural anesthesia was used in 23 patients (57.5%). All patients received first generation cephalosporin 1 gm 1 h prior to induction. Patients were placed in the supine position on a radiolucent fracture table, and standard pre-operative draping was carried out. Surgeries were conducted by one of three experienced acetabular surgeons within the same institute. The standard ilio-inguinal approach was utilized in 90% of the fractures (36 fractures), while the modified Stoppa method was utilized in four cases. An additional Kocher Langenbeck approach was needed in seven cases to address the posterior component.

Reduction of the anterior column fracture and fixation with a 3.5 mm (in 35 out of 40 cases; 87.5%) or 4.5 mm reconstruction plate (in the remaining 5 cases; 12.5%) was the first step in the reduction of the acetabular fracture. Care was executed to properly position the plate on the pelvic brim; the plate had to be partially protruding medially into the true pelvis (an essential step to the success of this technique). The next step was reduction of the quadrilateral plate into position. The quadrilateral plate can be temporarily reduced by a pointed ball pusher or a pelvic reduction clamp, the means of temporary reduction would vary according to fracture configuration and surgeon preference. Following temporary reduction, one, two or three screws were inserted through the plate, rubbing on the inner surface of the quadrilateral plate, thus maintaining reduction of the quadrilateral plate component into position (Fig. 1). The number of screws were increased according to the degree of comminution of the quadrilateral surface (1 screw was used in 20 cases, 2 screws in 16 cases, and 3 screws in 4 cases). The direction of screws were also modified according to the position of quadrilateral plate fragment. This allowed the plate, together with the screws, to act as a single unit to buttress the fracture. Finally, the screw was tightened into position (the screw



**Fig. 1.** (A) Plate must first be properly positioned at the medial edge of the pelvic brim. (B) Reduction of the fragment against the femoral head and placement of the 3.5 mm screws (40 – 60 mm), using the concept of 3-point fixation.

usually feels tight in the beginning, then loose, and subsequently tight again when it rubs against the quadrilateral plate fragment effectively reducing it into its anatomic position), forming the 3-point fixation between the plate and bone.

The length of the screw varied according to the fracture pattern, the aim was to effectively buttress the fragment. A 3.5 (in 35 cases) or 4.5 mm (in 4 cases) or 6.5 screw (in one case) screws (corresponding to the plate size) was used. The screw length ranged from 40 to 60 mm in length (Figs. 2–4). During screw insertion, utmost care was exerted to avoid injury of the intrapelvic structures, by insuring a safe distance and proper retraction from the intra-pelvic structures. In certain cases, the buttress screw was utilized to indirectly reduce the posterior column together with the quadrilateral plate component.

Operative time, blood loss, intra-operative complications, and quality of immediate post-operative reduction in all patients were assessed according to the methods described by Matta 1996 [2], and documented. Anatomical reduction was considered when a maximum of 1 mm displacement was observed in the antero-posterior (AP) and oblique views in the post-operative radiographs. Imperfect reduction was considered when there was a gap of 2–3 mm in the post-operative radiographs. Poor reduction was considered when there was a gap of 4 mm or more. Additionally, the reduction of the quadrilateral plate component was assessed as a separate entity, using the same criteria.

### Post-operative management

Range of motion and anticoagulation treatment with enoxaparin sodium 40 mg daily was commenced from post-operative day 1, and continued for 4 weeks. Weight bearing was delayed till full radiological and clinical unions were evident. Post-operative follow-up visits were scheduled at post-operative weeks 2, 6 and

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