Crescent Fracture-Dislocation of the Sacroiliac Joint: Use of Iliosacral Screws


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Abstract

Background: Crescent fracture dislocations are a well-recognized subset of pelvic ring injuries which result from a lateral compression force. They are characterised by disruption of the sacroiliac joint and extend proximally as a fracture of the posterior iliac wing. They are classically fixed using open reduction and plating. We hypothesized that iliosacral screws can provide stable fixation in Day type II and III types.

Methods: A clinical study was conducted with the aim of assessing the clinical results and functional scores of 64 patients 50 males and 14 females, age range 16 to 64 years who sustained 66 lateral compressions pelvic fractures operated between April 2000 and December 2015. X-rays and CT pelvis were used for all patients. We used a classification by Day et al., 2007 with three distinct types of crescent. Percutaneous Iliosacral Screws (IS) were used in 20 fractures, plates in 40 fractures, combined iliosacral screws with plates in 4 fractures and we added LCII (lateral compression screws) in 2 cases. The principal goal of surgical intervention was the accurate and stable reduction of the sacroiliac joint.

Results: Follow-up ranged from 4 to 126 months with an average of 40.6 months, the clinical results were good in all cases, healing rate was 100%, 2 cases died and one case lost and the average Majeed functional score was 83.93 in 61 patients.

Conclusion: Percutaneous IS screw fixation is a good option for types II and III crescent fractures, with fewer complications than the plate option. While plating should be used for type I crescent fracture.

Level of Evidence: Level IV-case series.

Key Words: Crescent – Fracture dislocation – Sacroiliac joint – Iliosacral screws.

Introduction

LC fractures account for more than 50% of all pelvic injuries in most series and are most commonly caused by side impacts [1].

Crescent fracture dislocations are a well-recognized subset of pelvic ring injuries which result from a lateral compression force. They are characterised by disruption of the sacroiliac joint and extend proximally as a fracture of the posterior iliac wing. Day et al., identified three groups of crescent fracture according to the extent of sacroiliac joint involvement. Type I is characterised by a large crescent fragment and the dislocation comprises no more than one-third of the sacroiliac joint, which is typically inferior. Type II fractures are associated with an intermediate size crescent fragment and the dislocation comprises between one-and two-thirds of the joint. Type III fractures are associated with a small crescent fragment where the dislocation comprises most, but not the entire joint [2].

The iliosacral joint is considered a weight-bearing joint [3]. That can potentially be affected by posttraumatic arthritis, chronic instability or malunion (with the consequent pain) if not treated appropriately. Holdsworth and Tile have described a high rate of incidence of lumbar pain and incapacity to perform light work in untreated subjects, in comparison with those that underwent surgery [4].

To avoid painful sequelae it is indispensable to reestablish joint congruence and stability, therefore open reduction and internal fixation of iliosacral joint lesions are necessary, except in those cases in which an acceptable joint congruence may be achieved using closed methods [4].

There was one publication in the literature that reported the use of Iliosacral screws for treatment of crescent fractures, with day type III 8 cases.
were treated with closed reduction and percutaneous iliosacral screw placement and 7 cases treated by plates. Skeletal traction pin placed in the proximal tibia applies traction with the hip in flexion on a specialized radiolucent pelvic reduction table (OSI, Union City, California) allowing correction of both the vertical and the posterior displacement. The internal rotation deformity may be corrected by means of a percutaneous Schanz pin, applied to either the anterior iliac crest or the anteroinferior iliac spine [2].

Two published articles specifically addressed the ORIF of crescent fractures by Borrelli et al., they used a posterior subgluteal approach supplemented by a lag screw and posterior plating technique [2,3,7].

Adam et al., 2002 described a new technique; screws placed from the AIIS to the Posterior Inferior Iliac Spine (PIIS), or vice versa, can be used to stabilize the iliac wing fracture in lateral compression type 2 (LC II) [8].

In a recent review article by Flint and Cryer 2010, they stated that; “most iliac wing fractures associated with hemipelvis instability require plate osteosynthesis either through a retroperitoneal approach or through a lateral or posterior exposure to the iliac wing. Sacroiliac dislocation or sacroiliac joint fracture requires reduction of the hemipelvis displacement and correction of the rotational malalignment. These dislocations are stabilized in most cases with plate and lag screw techniques” [9].

Rommens 2007 advised that a closed anatomical reduction of this fracture is not usually possible, limited open reduction of the iliac wing fracture and percutaneous sacroiliac screw placement can be combined here [10].

In a biomechanical study by Kent et al., they compared all the 9 common forms of posterior pelvic fixation and found that stiffest fixation consists of two iliosacral screws and two anterior sacroiliac plates and an iliosacral screw, and least stiffness in single iliosacral screw, two anterior sacroiliac plates, a tension band plate in isolation or in combination with an iliosacral screw, and two sacral bars. These findings were contrary to most of the other studies [12,13]. That found no differences between strength of fixation techniques [9,13].

**Patients and Methods**

A prospective clinical study was conducted with the aim of assessing the clinical results and functional scores of 64 patients 50 males and 14 females, age range 16 to 64 years who sustained 66 lateral compressions (crescent) pelvic fractures operated between April 2000 and December 2015. All patients sustained high energy accidents; 23 patients motor vehicle accidents, 26 were hit by cars, 11 fell from heights, 2 were crushed by heavy objects, one exposed to blast and one involved in a motorcycle accident.

Twenty seven patients sustained a Combined Mechanism of Injury (CMI) according to YOUNG classification, and 37 were Lateral Compression injuries (LC), according to tile classification 31 had type C and 33 type B. Percutaneous Iliosacral Screws (IS) were used alone in 19 fractures, plates alone in 40 fractures, both plates and IS screws in 3 fractures, and we added LCII (lateral compression screws) to plate once and to IS screws in another fracture.

Anterior fixation was done in 40 patients; as follow, 17 plates, 20 external fixators, 2 anterior column screws (in one case we used both fixator and column screw), and one case we used external fixator with plate.

We used a classification by Day et al., [2] with three distinct types of crescent. Type I a large crescent fragment and the dislocation comprises no more than one-third of the sacroiliac joint. Type II an intermediate-size crescent fragment and the dislocation comprises between one-and two-thirds of the joint. Type III a small crescent fragment where dislocation comprises most, but not the entire joint. We had 17 fractures day I, 31 day II and 14 day III and 2 cases bilateral fractures. The principal goal of surgical intervention was the accurate and stable reduction of the sacroiliac joint. We chose to do closed reduction and percutaneous fixation using Iliosacral screws in cases of day II and III where the entry point of the screws remained intact and there was a part of the outer table of the ilium at the site of screw insertion large enough to allow guide wire placement and insertion of the screw head and washer without risking to break the fragment. This was based on Day et al., [2] and Giannoudis et al., [5]. Otherwise the plate was the implant of choice through anterior approach. The anterior approach for sacroiliac joint allows visualizing the anterior face of the joint as an aid to accurate reduction. The posterior approach does not allow the surgeon to assess joint congruence accurately, and relies on an indirect reduction technique which may be compromised by plastic deformation, comminution, and small key-in areas [6]. LCII screw was added to 2 cases to add interfragmentary compression of the fracture site.
Intraoperatively, there was no blood loss in cases of IS screws, blood loss between 200cc to 1000cc in ORIF cases, operative time was shorter for IS screws (about 30mins to 1 hour) than plates (1-2.5hrs).

Closed reduction techniques included reduction of rotation using schanz screw inserted in ilium, ball point pusher, and manual rotation by manipulating the freely draped lower limb. We used also reduction of anterior fracture through a Pfannenstiel approach with a pelvic reduction clamp or Matta clamps then an anterior reconstruction plate and this helped us to reduce the sacroiliac joint, or an external fixator through anterior inferior iliac spine.

Post-operatively we looked for residual displacement on X-rays, limb length discrepancy, wound condition, healing of fracture and any other complications. The clinical results were good in all cases; no wound complications, neurological complications, or residual rotational deformity of the limb, the healing rate was 100%.

Follow-up ranged from 4 to 126 months with an average of 40.6 months, one Sudanese patient was lost to follow-up and two cases died in the ICU 10 days post-operatively due to complicated associated injuries of the head and abdomen. Majeed score was used for functional evaluation and the average score for the 61 patients was 83.93 points, range 53 to 100 points, 41 scored >85 (excellent), 17 scored 66 to 84 (good), and 3 scored 53 and 64 (poor). The average Majeed score for the group fixed with plates was 86.81 points, for (IS) screws were 87.61 points, and for cases with plates and (IS) screws was 86.66 points. However the sample size is small and will not present statistical significance.

Results

64 patients with pelvic fracture were treated in our department between April 2000 and December 2015. 50 males and 14 females, age range 16 to 64 years who sustained 66 Lateral compressions pelvic fractures. We used a classification by Day et al., 2007 with three distinct types of crescent fractures. Percutaneous iliosacral screws (IS) were used in 20 fractures, plates in 40 fractures, combined iliosacral screws with plates in 4 fractures and we added LCII (lateral compression screws) in 2 of the cases. The majority of Type I fracture fixed by ORIF using plate and screws, while most of Type II and III fractures were stabilised with iliosacral screws fixation percutaneously. Follow-up ranged from 4 to 126 months with an average of 40.6 months. The clinical results were good in all cases and pain free with movement. Radiographic healing rate was 100%, 2 cases died and one case lost and the average Majeed functional score was 83.93 in 61 patients.
Discussion

Our results were difficult to compare to Day et al., as they treated only 6 cases with Day type III with closed reduction and percutaneous iliosacral screw placement and their functional scoring was done using SF 36.

In comparison with other publications of iliosacral screw fixation for posterior fractures, our results were similar to the study by Schweitzer et al., [14] in 2008 on 73 patients although they had no patients with LC injuries, 86% were able to get back to their preinjury level, they used Majeed score, but did not report it. Most of our patients were fully united in less than 6 months (the minimum follow-up period).

Searching for literatures in comparison concerning with crescent pelvic fracture using Day classification, Majeed score for assessment, there were limited.

Xiaolong Shui et al., and Leo Afshin Calafi et al., are most recently published series concerning with crescent pelvic fracture using Day classification.

In Xiaolong Shui et al., the authors reviewed 117 patients diagnosed with Crescent fracture-dislocation of the sacroiliac joint. Closed reduction and percutaneous fixation by screws was performed in 73 patients (Group 1) and 44 underwent ORIF (Group 2). Patients in the 2 groups were well matched for age, sex, and fracture classification. Patients in the 2 groups were well matched for age, sex, and fracture classification, they included open fracture in the study.

Treatment selection was based on Day fracture classification. In (Group 1) using percutaneous cannulated screws for fixation, for type I fractures, fixation perpendicular to the fracture line were performed. For type II fractures, crossed fixation was performed. For type III fractures, fixation was performed with iliosacral screws. While patients in (Group 2) were treated by open reduction and plate fixation. All 117 patients were followed for more than 6 months (mean, 14 months [range, 6-24 months]) [15].

While in Leo Afshin Calafi et al., study, the authors identified 100 patients met the inclusion criteria of at least 3 months of clinical and radiographic follow-up. There were 57 males and 43 females, with a mean age of 42 years and a mean injury severity score of 25.5. Treatment selection was based on fracture type according to Day classification. There were 16 type I, 47 type II and 37 type III crescent fractures. Percutaneous iliosacral screw fixation was utilised in 60% of all crescents after either closed or open reduction of the posterior iliac crescent fracture with associated sacroiliac joint disruption. Open fractures are included in the study [16].

The comparison is made based on Day classification used and Majeed scoring systems for comparing the results in pain, loss of reduction (radiological assessment), post-operative infection, return to work.

Conclusion:

Conventional techniques of open reduction and internal fixation remain the standard of care for definitive treatment of pelvic ring and acetabular fractures. As these are not frequent lesions, recommendations for treatment and surgical techniques must be taught consequently. Anatomic reduction of articular lesions (sacroiliac joint, acetabulum) is the primary goal, adequate stabilization the following. Only the experienced pelvic and acetabular surgeon is able to decide if it is possible to achieve these goals through smaller incisions or even with a percutaneous procedure. In my view, minimally invasive procedures can never completely replace conventional techniques for treatment of these lesions, if we do not want to accept compromises in obtaining anatomic reduction. As a consequence, percutaneous fixation is a complementary possibility for distinct fracture patterns, almost never a first choice procedure. The only exception may be the sacroiliac joint screw fixation [10].

Percutaneous IS screw fixation is a good option for types II and III crescent fractures, with fewer complications than the plate option and less operative time. While plating should be used for type I crescent fracture.

References

4- F.J. RICÓN RECAREY, P. CANO LUIS, P. SÁNCHEZ GÓMEZ and A. FUENTES DÍAZ: Treatment of iliosacral.


