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Original Article

A retrospective analysis of percutaneous SI joint fixation in unstable pelvic fractures: Our experience in armed forces

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ARTICLE INFO

Article history:
Received 16 November 2015
Accepted 31 January 2016
Available online 29 March 2016

Keywords:
Unstable pelvic fractures
Sacroiliac joint injuries
Percutaneous SI joint fixation

ABSTRACT

Background: Unstable posterior pelvic and sacroiliac joint injuries are challenging fractures mostly managed conservatively in our military hospitals till date. We carried out a retrospective analysis of early fixation of these fractures at our hospital and compared it with the existing literature as regards its safety and efficacy.

Methods: A retrospective analysis of all patients admitted and managed by internal fixation for unstable posterior pelvic fractures was carried out for evaluation of its efficacy and safety. All patients with unstable posterior pelvic fractures were managed by early closed reduction percutaneous sacroiliac fixation using a radiolucent fracture table and image intensifier after a CT evaluation.

Results: A total of 24 patients were admitted with pelvic fractures, out of which 18 who had posterior pelvic ring injuries requiring fixation were included in the study. 21 percutaneous SI screws were inserted in 17 patients. All patients had satisfactory initial reduction as per Starr's criteria and recovered to their full – pre-injury functional status without any major intra-/postoperative complications, at a minimum of 12 months of follow-up.

Conclusion: Unstable pelvic fractures must be managed by early reduction internal fixation to reduce morbidity and mortality arising out of such injuries. Closed reduction percutaneous fixation of these injuries is a safe procedure to be carried out in our set-up equipped with radiolucent fracture table and image intensifier by trained surgeons. The management of these injuries is likely to become easier in future with the advent of navigational aids in management of complex pelvic and acetabular fractures.

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http://dx.doi.org/10.1016/j.mjafi.2016.01.011

Introduction

In view of the increasing incidence of high energy trauma worldwide, unstable pelvic fractures have become much more common than in the past.[1,2] Exponential increase in the number of motor vehicles and inadequate and improper transport infrastructure has led to phenomenal increase in the number of patients with high velocity road traffic accidents presenting with unstable pelvic fractures. Most of these fractures are a component of poly-trauma and are associated with high mortality and morbidity.

Despite being proven that anatomical reduction leads to better outcome, in the past, most of these fractures were managed conservatively.[3] Open reduction and internal fixation, which were used traditionally, were fraught with complications, with most of them being wound related, like wound breakdown and pelvic haematoma due to the extensile surgical approach, wound infections, bowel injury and incisional hernia. They were also associated with other complications, including iatrogenic nerve injury and large volume blood loss, both primary and secondary.[4]

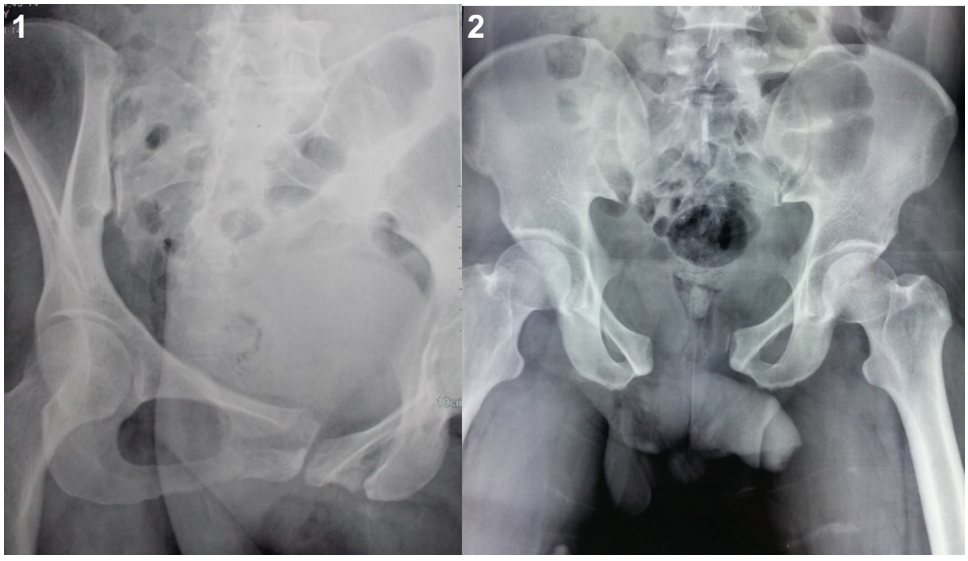
Percutaneous sacroiliac (SI) joint fixation was first described by Routt et al.[5,6] The work of Judet et al. were invaluable in their contribution of evolution of pelvic surgery.[7,8] In recent times, percutaneous sacroiliac joint fixation for posterior pelvic dislocations and sacral fractures has become popular and widespread in view of its minimally invasive nature, comparable biomechanical stability to other modes of internal fixation and finally excellent functional outcomes. Availability of image intensifier and good quality instrumentation has made the surgery safer and quicker to perform especially in patients of poly-trauma. Percutaneous fixation is associated with certain complications like L5 and S1 nerve root injury, misplaced screws, hardware failure and iliac vessel injury. The complications previously reported are neurological injury, with rates reported between 0% and 8%, and misplaced screws between 2% and 12%.[4,7]

There are definite advantages of early percutaneous reduction and internal fixation of injuries involving fractures/fracture dislocations in posterior pelvic ring. These include quick surgery, minimal blood loss in an already compromised patient, early pain relief, improved nursing care by early mobilisation, early weight bearing ambulation and definite reduction in long-term low back ache. We carried out a retrospective analysis of percutaneous SI joint fixations carried out in patients admitted between 2011 and 2015 at our tertiary care hospital and compared it with the existing literature as regards its safety and efficacy.

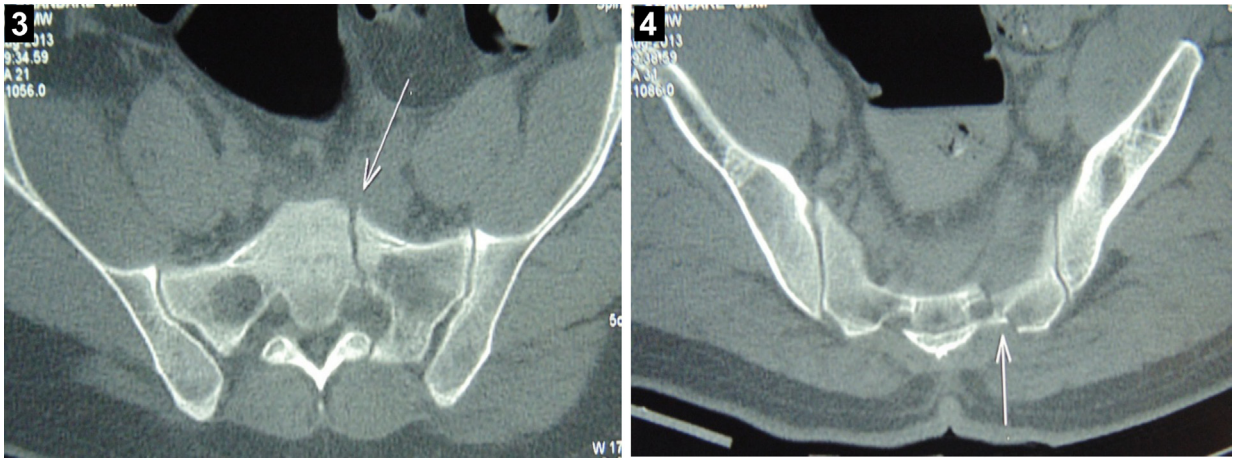
Material and methods

All patients admitted at our institution with pelvic fractures were included in the study and a retrospective analysis was carried out. Following initial resuscitation, all patients were offered damage control surgical and orthopaedic procedures, as per institutional protocol. Once stabilised, a CT scan in addition to digital radiographs were obtained and patients with AO Type B and C injuries were offered surgery. All patients were operated on a radiolucent table with image intensifier guidance. A radiolucent orthopaedic table was used and the patients positioned such that the image intensifier could clear the base of the table to allow inlet and outlet view visualisation in addition to AP and lateral views (Figs. 1–4). Initial closed reduction was done by manual traction on ipsilateral lower limb to align the hemi-pelvis in acceptable alignment. If this procedure failed, a 5 mm stainless steel Steinmann pin was inserted into ipsilateral iliac bone to be used as joystick for aiding reduction of fracture/dislocation. Fifteen patients were operated in supine position and three in prone position. Prone position was used in patients requiring an isolated posterior pelvic fracture fixation.

As per the standard AO technique, the entry point was determined on the lateral view in the S1 segment just below the iliac cortical density. Once the entry point was established,



Figs. 1 and 2 – Preop radiograph images of pelvis obturator oblique and AP with right SI joint dislocation and pubic diastasis.



Figs. 3 and 4 – Preop axial sections showing fracture of left ala of S1.

the image intensifier was changed to outlet and inlet views alternatively to ensure the safe advancement of guide wire. Thereafter, cannulated drill was used prior to measurement and insertion of partially threaded cannulated cancellous screws within S1 and S2 segments, where indicated.[15–17]

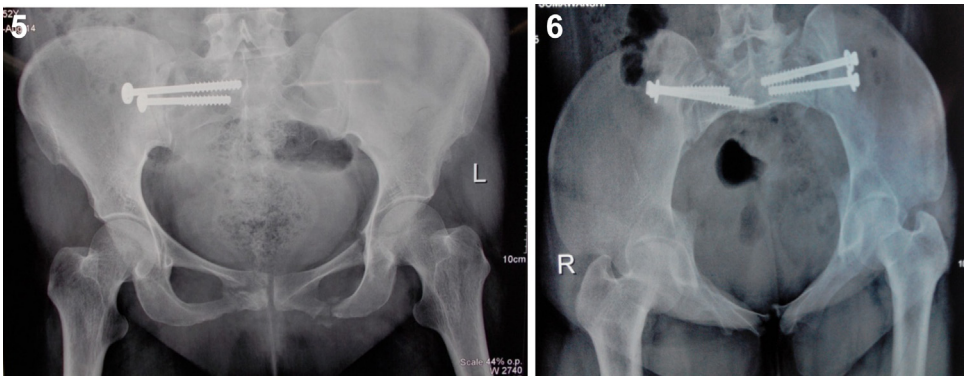
7 mm partially threaded cannulated cancellous screws with washer were used for fixation of SI joint dislocation. Usually one screw was used, however, in cases where either reduction or fixation was felt inadequate peroperatively, two screws with washers. Postoperatively, AP, inlet and outlet radiographs were assessed according to Starr's criteria for satisfactory reduction. As per Starr's criteria, a displacement at fracture/dislocation site within 10 mm of normal in AP, inlet and outlet views after reduction and fixation is considered adequate for best outcome[9] (Fig. 5–8).

Follow-up was done for minimum three times at 12 and 24 weeks and 1-year postoperatively. Patients were assessed for pain on activities of daily living, hardware failure, loss of reduction and screw misplacement. The patients who had complaints of pain were followed up for a longer period.

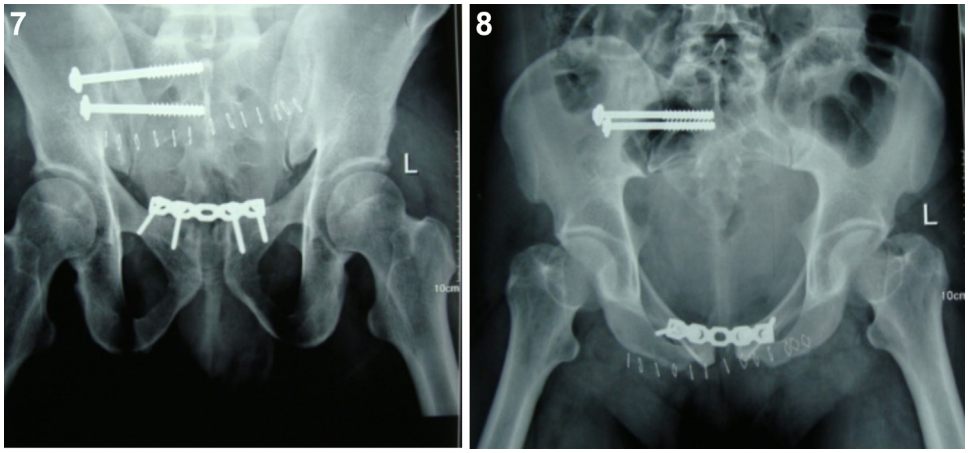
Results

A total of twenty-four patients were admitted with pelvic fractures, out of which 18 patients had posterior pelvic ring injuries during the study period. Fracture types included each of nine AO type B and AO type C. A total of twenty-one percutaneous sacroiliac screws were inserted in 17 patients (9 AO Type B and 8 AO Type C). One patient had two ipsilateral screws inserted in body of S1 and S2 vertebrae and another patient had four screws inserted bilaterally in body of S1 and S2. The remaining one patient with AO Type C pelvic injury was managed by open reduction by posterior tension band plating using two 3.5 mm reconstruction plates. Three patients amongst the study group had sacral fracture, which was also managed by percutaneous cannulated cancellous screw fixation. Remaining seven pelvic injuries were of AO type A, which was treated non-operatively. The average age of the patients was 34.6 years (range 22–52 years). The mean follow-up period was 12.3 months (range 12–39 months). Surgery was performed within 14 days of injury (mean 6.7 days).

All the patients had satisfactory initial reduction as measured using Starr's criteria. The maximum displacement was measured on the antero-posterior, inlet and outlet views of the pelvis. One patient (5.5%) had a screw back out with no loss of reduction at 03 months postoperative follow-up. She underwent screw removal and revision with a longer screw. The patient went on to full recovery without any other complication. None of the other patients had any postoperative neurological deficit, vascular complication, infection or hardware failure. All patients were made to sit up in bed the



Figs. 5 and 6 – Radiograph images of pelvis in AP and inlet view with multiple CCS screws in the body of S1 and S2.



Figs. 7 and 8 – Postop radiograph images of pelvis outlet and inlet views showing both anterior and posterior fixation.

same postop evening and ambulated using a walker or a pair of axillary crutches as soon as the other injuries allowed rehabilitation. Nursing care was facilitated in patients with poly-trauma by allowing early turning in bed. Unassisted full-bearing ambulation was allowed at eight weeks in all patients, irrespective of the treatment modality.

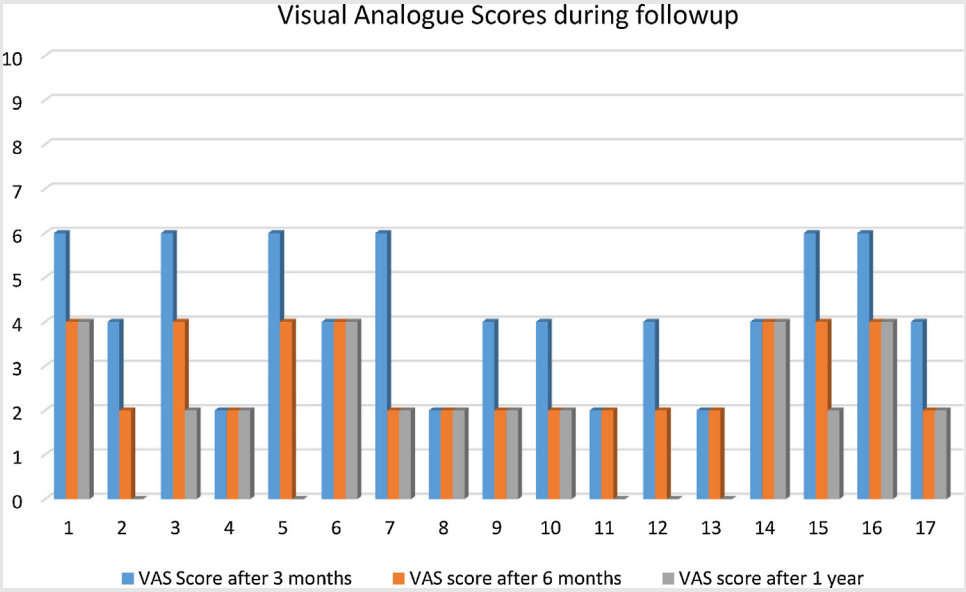
One patient (5.5%) had pain on unassisted walking, which continued even at 01 year postop follow-up. Two patients (11%) complained of pain and difficulty in squatting at 06 months, which resolved at 18 and 24 months follow-up, respectively. Four of the patients (22%) had pain and difficulty in climbing stairs at 06 months follow-up, which improved at 12 months. There was significant improvement in the VAS scores taken at regular intervals of follow-up (Table 1). All the rest of the patients recovered to their full pre-injury functional status after 06 months of internal fixation.

Discussion

In the past few decades, the incidence of high velocity trauma has increased with an analogous rise in pelvic fractures. However, the unstable pelvic fractures requiring surgical stabilisation constitute <0.28% of all trauma patients operated in our centre.

Traditionally, pelvic fractures were treated by open reduction and internal fixation when indicated. The methods of fixation included anterior and posterior plating, trans-sacral bars and tension band plating. Open treatment of these injuries allows direct visualisation and therefore anatomical reduction of the fractures. However, the rate of complication reported following open reduction internal fixations has been especially high, with as much as 27%.[10] Apart from iatrogenic

Table 1 – Follow-up visual analogue scores of patients operated by percutaneous cannulated cancellous screw fixation.



neurovascular injury, these approaches generally left large wounds, which were susceptible to postoperative wound breakdown, infection, heterotopic ossification and pelvic haematoma and secondary haemorrhage.

All these have led to an increasing interest in percutaneous techniques to fix these unstable fractures. The major advantages were decreased blood loss, surgical time, exposure and earlier postop recovery. Various modalities have been described to assist screw placement, including fluoroscopy, sonography, CT scan and computer-assisted navigation.[11]

Many of these injuries require extensive internal fixation of entire pelvic ring. In such a scenario, open reduction will be an extensive surgery. Percutaneous SI joint fixation can be done in both supine and prone positions, and it allows combined internal fixation of remaining pelvic ring without compromising the extent of exposure. As 85% of body weight is transmitted through posterior pelvis, addressing posterior pelvic instability in unstable pelvic ring injuries is of paramount importance. Failure to address the SI joint injury will lead to loss of anterior fixation.

It has been shown before that patients with residual posterior instability or displacement have worse outcomes.[12–14] Relative contraindication to this technique would include cases of sacral dysplasia, which would narrow the safe zone for screw placement. Open fixation is warranted in cases of poor intraoperative visualisation due to various reasons including inadequate bowel preparation.

Conclusion

Percutaneous fixation of sacroiliac joint dislocation is rapidly gaining popularity worldwide due to fewer complications as compared to open reduction internal fixation. Our rate of complications is comparable to those published in existing literature.[4,7] However, this is a technique that has relatively steep learning curve and requires prior training under an experienced surgeon. An adequate preoperative assessment including CT scan of pelvis and availability of fluoroscopy is a must for attempting this procedure. These above requirements may have precluded its practice being commonplace especially in peripheral hospitals. The operative management of these injuries is likely to become easier in future with the advent of navigational aids in percutaneous reduction and fixation of complex pelvic and acetabular fractures.[18] The drawback of our study is that it is a retrospective study with a relatively smaller sample size.

Conflicts of interest

The authors have none to declare.

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