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“A prospective study of Minimally Invasive Percutaneous screw fixation for sacral fractures and sacro iliac joint injuries”

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Abstract

Objectives: Pelvic ring fractures usually associated with poly trauma and management of this is a challenging situation where mobilization is a goal for early rehabilitation.

Materials and Methods: A study is conducted in our institute involving 20 patients who were admitted following poly trauma with associated sacral fractures and sacroiliac joint disruption. Denis & Weber classification for sacral fractures, and Tile/ Young and Burgess Classification for sacroiliac joint disruption were used. We have performed minimally Invasive Percutaneous screw fixation for sacral fractures & sacro iliac joint injuries and achieved good functional outcome.

Results: There were 20 patients with sacral and sacroiliac injuries. The mean followup period of 6weeks, 10 weeks, 16 weeks and 24 weeks was assessed with Majeed score of 89% effectiveness.

Discussion: Pelvic ring fractures which require operative stabilization remain a challenge to the orthopaedic surgeon because of the technical difficulty. The use of sacroiliac screw fixation for sacral and sacroiliac joint injuries is an elegant method of stabilization, but complications may arise because of poor visualization or understanding of the posterior pelvic anatomy.

Conclusion: Even though minimally invasive percutaneous sacroiliac screw fixation is one of the modalities of treatment for sacral and sacroiliac joint injuries, it stands as the best modality of treatment in patients with poly trauma to achieve good fixation and early rehabilitation.

Keywords: Iliosacral screw, Majeed score

Introduction

Pelvic injuries are more serious injuries with high rates of mortality and morbidity due to other associated injuries and due to the pelvic trauma itself. Among the fractures involving pelvic ring, 15% to 45% involves sacrum. Early mobilization and ambulation after fixation of sacral injuries plays a vital role in reducing the morbidity and mortality in these patients. The sacrum takes part in both spinal column and posterior pelvic ring. Hence these injuries of sacrum can lead to biomechanics instability and nerve injuries.

Primary stabilization of these fracture is challenging because inherent difficulty in positioning of these patients during surgery. Treatment modalities for the posterior pelvic ring fractures are non operative, open reduction and fixation and minimally invasive percutaneous screw fixation [1]. The significant morbidity associated with non-operative treatment of displaced, unstable pelvis fractures [2]. Open reduction and fixation is having a risk of infection due to excessive soft tissue stripping [1, 3]

Hence minimally invasive percutaneous screw fixation for posterior pelvic ring fractures has been shown to provide good biomechanics stability and functional outcome. Hence there is a need to study the functional outcome of percutaneous iliosacral screw fixation in sacroiliac injuries.

Aim and Objectives

To study functional outcome in patients treated with minimally invasive screw fixation for sacral fractures and sacroiliac injuries.

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Methodology

It was a prospective study of 20 patients (aged above 18 years) with clinical and radiological diagnosis of partially and completely unstable posterior pelvic ring injuries. It was conducted during the period between June 2018 to September 2020 in the department of Orthopedics, Sanjay Gandhi institute of trauma and orthopedics, Bengaluru, a tertiary care centre. Patients with partially and completely unstable posterior pelvic ring injuries with or without anterior pelvic ring injury were operated percutaneously with one Partially/ Fully threaded cannulated cancellous Iliosacral Screw after closed reduction with manual traction.

Inclusion criteria

1. Partially and completely unstable posterior ring injuries- Type B and C Tile's Classification.
2. Age more than 18years
3. Patients are willing to give written informed consent.

Exclusion criteria

1. Patient with comorbidities such as uncontrolled hypertension and uncontrolled diabetes.
2. Morbidly obese.
3. Concomitant long bone Injuries.
4. Associated acetabulum fractures

Surgical technique

After obtaining institutional ethics committee clearance and written informed consent, patients getting admitted through casualty of Orthopedics department of our institute, satisfying the inclusion/ exclusion criteria, were taken into this study. Fractures are classified by Tile Classification and the

radiological classification was done for each patient. Primarily the patients are stabilized at casualty before taken to operation theatre. The Patients with poor general condition, the surgery is delayed and was put on 8-10kg weight after putting skeleton traction to the limb in which ipsilateral hemipelvis is proximally migrated.

Posterior pelvic ring injury namely Sacral fracture and sacroiliac disruption was then assessed and reduction was achieved by indirect method I.e traction to the affected limb and confirmed under C arm under three views- AP, inlet and outlet views. The patient was positioned either in supine or prone position. After painting and draping first true lateral view of the sacrum is achieved by taking references of sciatic notch and acetabulum. Then C arm is adjusted so that both acetabulum shadows and both Iliocortical density overlaps. 1-2cm incision was made on the proposed site and 4.5mm steinmann pin is used to make the entry point. Entry point in true lateral view should be posterior and inferior to the iliac cortical density (ICD), which is parallel to the sacral alar slope. Steinmann pin was tapped in the entry point with angulation towards sacral promontory. When steinmann pin was tapped for 1 cm, the placement was confirmed in both inlet and outlet views. Trajectory for the steinmann pin was confirmed towards the contralateral lateral border of the first sacral body. Steinmann pin was removed and a guide wire was passed through the same way and drilled. A suitable length of 6.5mm Cannulated cancellous screw is inserted along the guide wire. Fully threaded was used in case of sacral fracture and partially threaded in case of sacroiliac disruption.

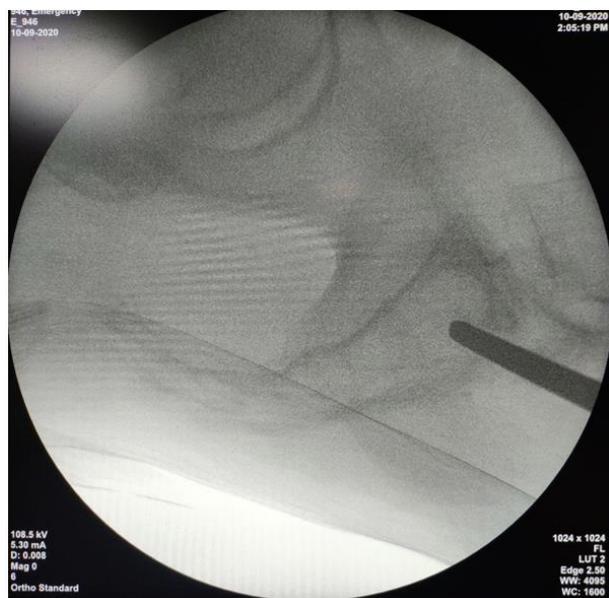


Fig 1: Entry marked with steinmann pin



Fig 2: Positioning of guide wire

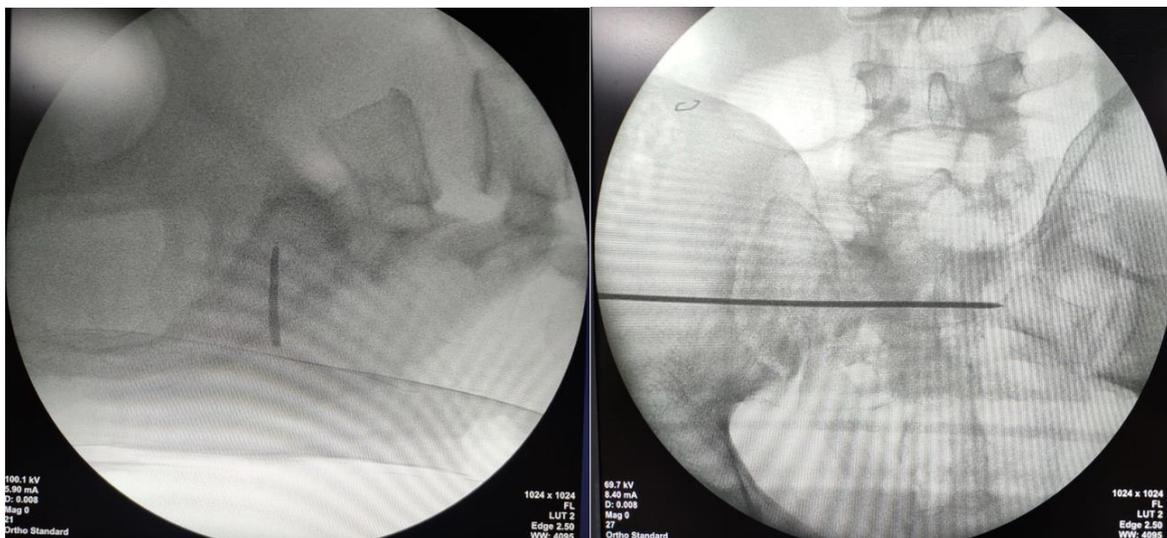


Fig 3 & 4: Guide wire insertion

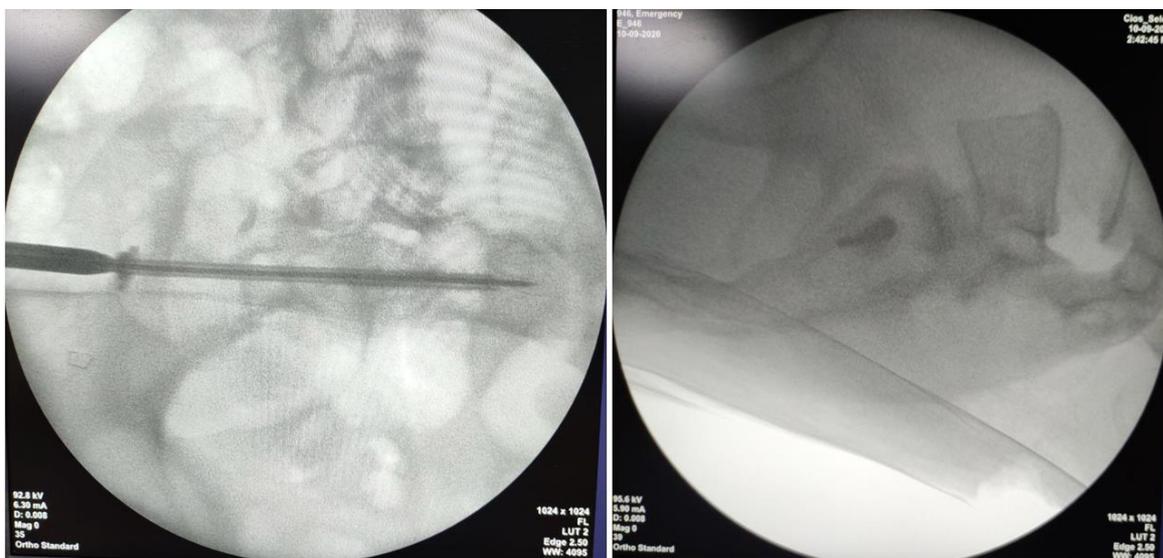


Fig 5 & 6: Screw insertion



Fig 7: Wound site.



Fig 8: Scark mark

In patients with associated anterior ring injuries, anterior ring was internally fixed with Screws/plates or pelvic external fixator. Post operatively x rays were taken to confirm the reduction and placement of the screw. The patient was kept on strict bed rest for minimum of 2 weeks followed by sitting. Based on fracture reduction and associated fractures in the pelvic ring, the patient was advised to weight bear partially, in case of isolated sacral fracture after 6 weeks and in case of associated anterior ring injuries after 12 weeks. Follow up all patients in the study were followed up at 6 weeks, 16 weeks and 24 weeks. At follow-up, a repeat of patient’s Brief Clinical History, Clinical Examination, Radiograph of pelvis, and Documentation of Pelvic Majeed Score was done.

Results

There were total of 20 patients (13 male and 7 female) in our study. These include 12 sacral fractures and 8 sacroiliac joint disruptions. Mean age was found to be 47.2 years and standard deviation was 12 years. Majeed Pelvic Score at different time points was expressed as mean and standard deviation. Clinical Grade based on Pelvic Majeed Score was presented as percentages.

Follow up X rays were taken at 6 week, 10 week, 16 week and at 24 week. The majeed score in different follow up is depicted in tables below. The mean score at 24th week was

found as 89. There was no case of infection, neurological deficits. All other bony and soft tissue injuries healed well.

Table 1: Showing age distribution

Age distribution among study patients			
Age	21-30 yrs.	2	10%
	31-40 yrs.	5	25%
	41-50 yrs.	8	40%
	>50 yrs.	5	25%

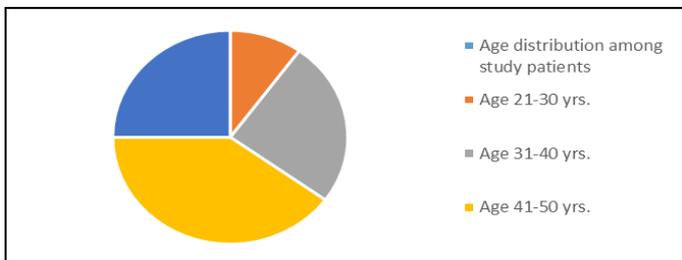


Fig 9: Graph showing age distribution

Table 2: Showing gender distribution

Gender distribution among study patients			
Gender	Males	13	65%
	Females	7	35%

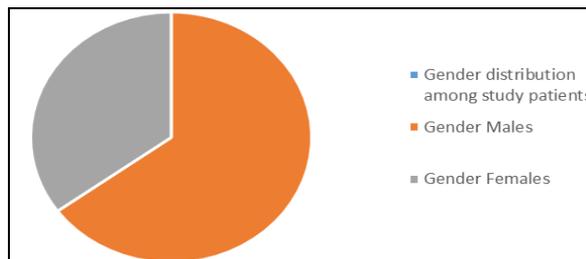


Fig 10: Gender distribution

Table 3: Showing type of fractures distribution

Distribution of type of fractures			
Type of fracture	Sacral #	12	60%
	SI injury	8	40%

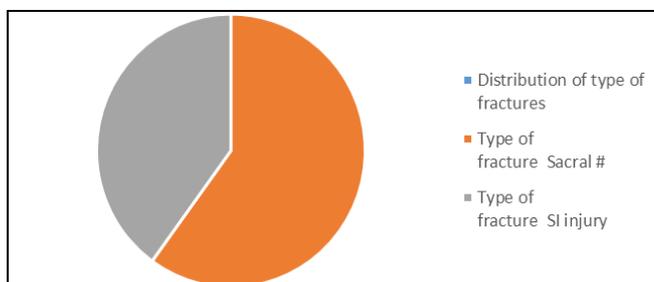


Fig 11: Showing type of fractures distribution

Table 4: Showing Majeed score results at regular intervals

Follow up at regular intervals								
Time	6 Weeks		10 weeks		16 weeks		24 weeks	
	N	Percentage	N	Percentage	N	Percentage	N	Percentage
Excellent	0	0%	2	10%	6	30%	16	80%
Good	2	10%	4	20%	8	40%	3	15%
Fair	6	30%	11	55%	4	20%	1	5%
Poor	12	60%	3	15%	2	10%	0	0%

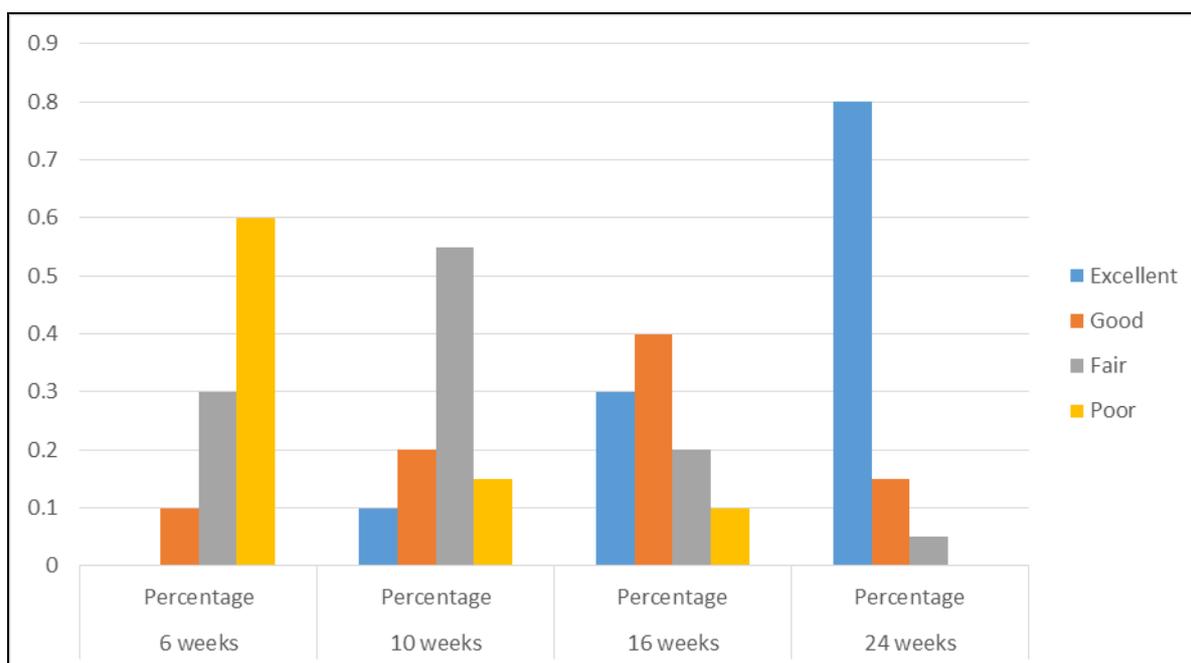


Fig 12: Showing Majeed score results at regular intervals

Table 5: Showing Majeed score results at regular intervals with mean and standard deviation

Distribution of Mean and stand deviation			
Category	Mean	SD	n
6 weeks	58.2	10.4	37.4-78.6
10 weeks	66.3	10.2	45.9-86.7
16 weeks	78.6	8.6	61.4-95.6
24 weeks	89	7.8	73.8-100

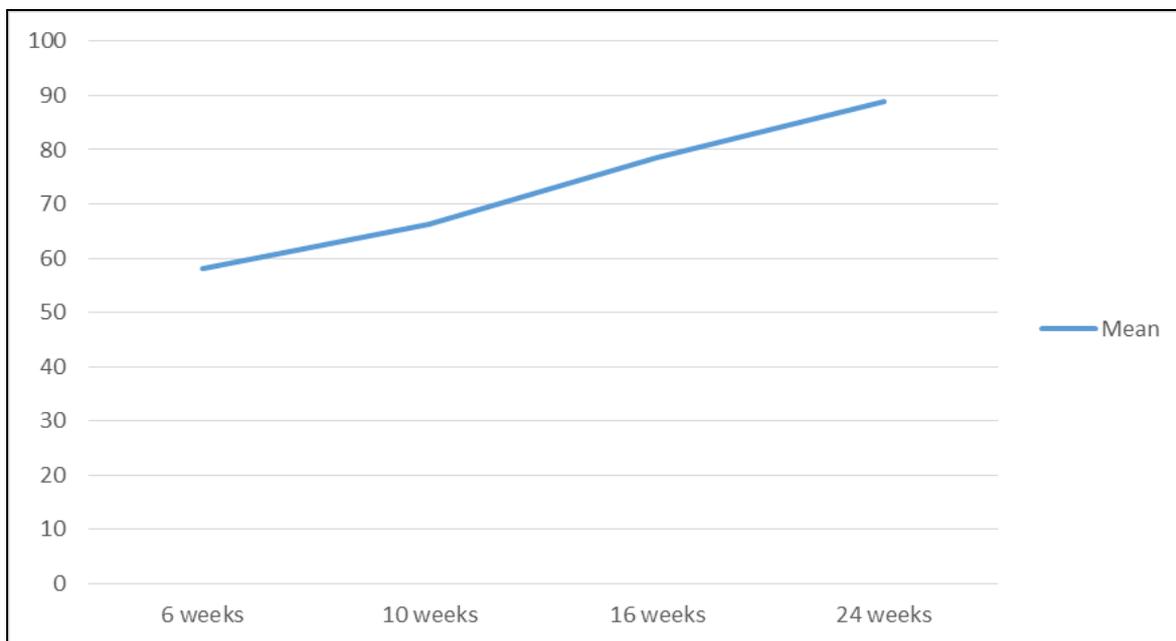


Fig 13: Graph showing mean Majeed score at regular intervals

Discussion

Most of the pelvic fractures are unstable, which requires anatomic reduction and internal fixation. As external fixation is life saving but it doesn't produce stable fixation as of internal fixation. But these open reduction and internal fixation has more soft injuries, haematoma formation and post operative infection. Letournel *et al.* was found open reduction and internal fixation with screw at ilium to sacrum through posterior approach has better outcome for sacro-iliac joint disruption or sacral fracture [4]. Routt *et al.* (1993) described minimally invasive ilio sacral screw fixation [14]. It minimizes haematoma formation and decreased soft tissue injury. These techniques has steep learning curve and challenging for the surgeons.

Detail evaluation of radiographs (AP view, Inlet view and outlet view), CT scan and three dimensional understanding of pelvic anatomy and injury pattern is important for safe placement of ilio-sacral screw. Entry point for the screw fixation is inferior and posterior to ICD and cranial and anterior to S1 nerve root tunnel on true lateral view of sacrum. In the present study, no screw malpositions were found because we started all screw placements with ensuring entry point in true lateral view. Rate of screw malpositioning with C arm guidance has been reported up to 2-15% and nerve injury up to 0.5-7.7% [5, 6, 7].

Majeed functional score and pelvic grade score is the most

widely used scoring system for the SIJ injuries⁽⁸⁾. Majority of our patients (80%) were in excellent and 15% good category at 24 weeks follow up, which is similar with other studies in these types of injuries [1, 9-13]

Complications in percutaneous sacro-iliac joint fixation are related with poor understanding of the pelvic osseous anatomy and correlation of various radiographic images in relation to pelvic anatomy. In few case of altered anatomy of pelvis and inaccurate reduction can cause inadvertent screw placement. It may injure fifth lumbar and first sacral nerve roots and superior and inferior pubic gluteal vessels use to faulty technique.

For sacroiliac joint disruption partially threaded Cannulated cancellous screws is used to produce lag effect. Fully threaded CCS is used for sacral fracture because partially threaded CCS will cause narrowing of sacral foramina and compression sacral nerve roots. For adequate stability screws can be passed through midline into sacral body. Number of screws is decided by purchase of first screw. If it is not sufficient, second screw is inserted.

Routt ML *et al.* reported no infection in 177 patients with percutaneous sacro-iliac joint fixation [14]. Similarly we also have no patients with infection where as Keating *et al.* have reported 7.5% of infection in open technique of ilio-sacral screw fixation [15].

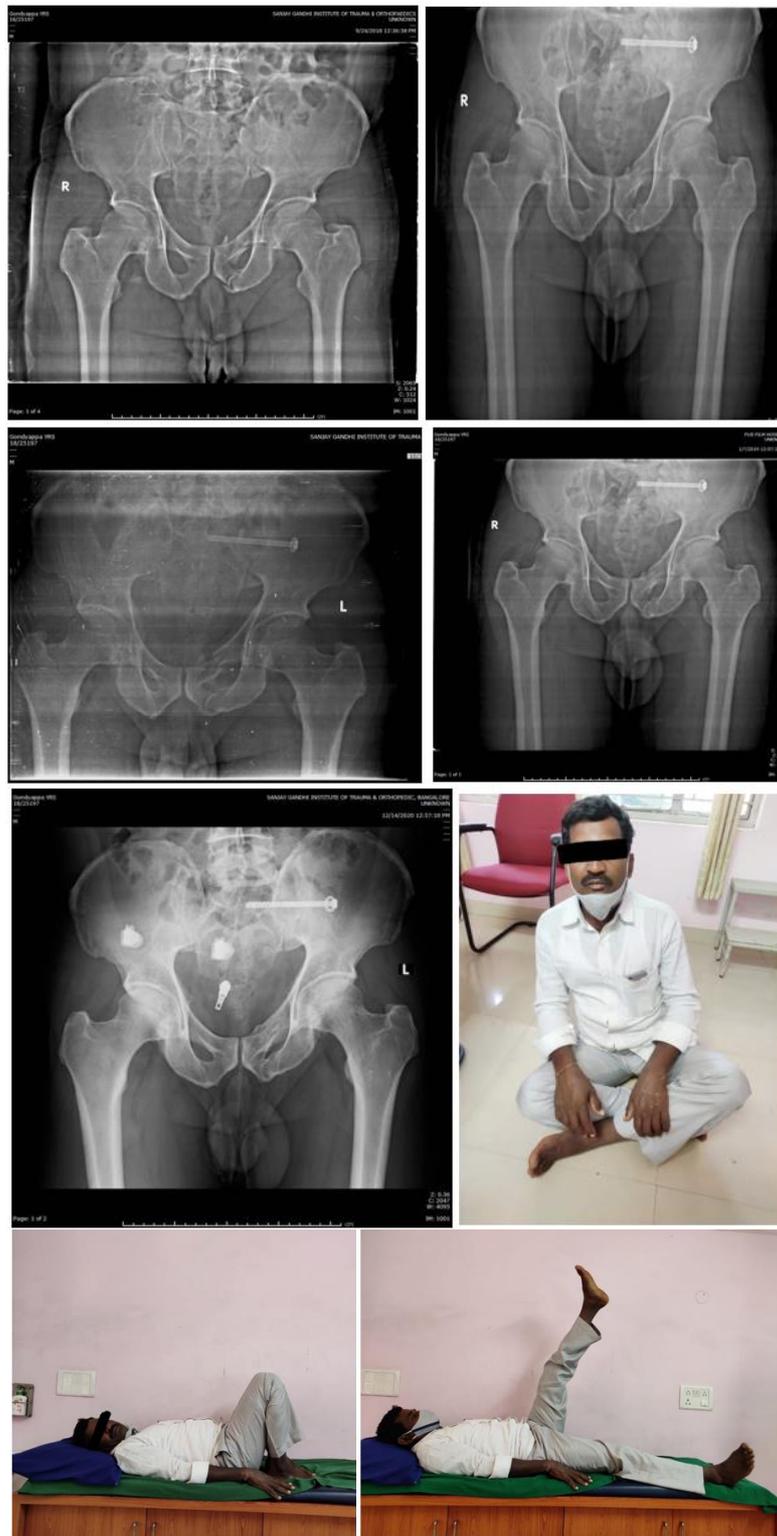


Fig 14: Images showing left Sacroiliac injury and fixed results with screw Preoperative, Postoperative, at 6 weeks at 3 months and 6 months. Clinical images showing supine position, with Straight leg raise and sitting cross legged.

Conclusion

The results obtained in our study, which is compared with other studies undertaken in the past and shows that single percutaneous ilio sacral a screw fixation is safe and efficacious procedure for fixation of the sacral fracture and sacroiliac injuries. There is low rates of complications and the minimally invasive nature are the advantages of this method.

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