

Sacral Fractures: Various Modalities of Treatment and outcomes

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Research Article

Abstract: Introduction: Sacral fractures occur in approximately 45% of all pelvic fractures. From conservative to surgical, various treatment modalities are available to treat sacral fracture. The post treatment outcome also depends on various factors. **Aims and Objectives:** To study the modalities of treatment employed in the management of sacral and sacro-iliac joint injuries (Conservative and Operative) and to compare the results and outcomes of conservative vs. operative interventions employed in the management of sacral fractures and sacro-iliac joint injuries. **Materials and methods:** total 32 patients were selected during the study period and were followed for 6 months post treatment to study the outcome. Majeed Scoring system was used to study post treatment functional assessment. **Results:** post injury displacement was seen in Denis type 3 fracture and vertical shear fractures. And the displacement was much reduced after treatment (both surgical and conservative). Mean ambulatory time in patients managed surgically and conservatively was nearly equal. In surgical procedure plating was required in most of the patients as compared to iliosacral screw and external fixator. It was also observed that patient managed surgically scored better Majeed score as compared to conservatively managed patients. But the difference was not significant. **Conclusion:** sacral fracture can be managed conservatively and surgically depending upon the post injury displacement. Outcome can be improved by selecting appropriate treatment modality.

Keywords: sacral fracture, majeed score.

Introduction

Sacral fractures occur in approximately 45% of all pelvic fractures.¹ The pattern of the associated pelvic fracture has a significant impact on the location, stability, and treatment of the sacral fractures. Sacral fractures associated with vertical shear pelvic fractures are usually unstable patterns. Denis zone II and III fractures are usually associated with high degree of neurological involvement and often need decompression to offer favorable environment to aid neurological recovery.² Delayed surgery for post-traumatic sacral deformity is complex, and the results are often less favorable than those of early surgery. Therefore, determination of an integrated diagnostic and therapeutic approach to sacral fractures should be the goal.

Aims and Objectives

- To study the modalities of treatment employed in the management of sacral and sacro-iliac joint injuries (Conservative and Operative)
- To compare the results and outcomes of conservative vs. operative interventions employed in the management of sacral fractures and sacro-iliac joint injuries.

Materials and methods

This study was intended to be a prospective observational study of all sacral fractures seen at our parent institution and also those referred from elsewhere. All patients with pelvic injuries admitted within the period of study were identified from the trauma registry and hospital records. Immediate post injury and post-operative and follow-up antero-posterior, inlet, and outlet radiographs for a minimum of 6 months post-injury were examined. The radiographic parameters and patient based outcomes of cases with sacral fractures and sacro-iliac joint injuries were evaluated in the operated and non operated groups. All operated patients followed the same postoperative protocol as far as possible based on additional injuries.

Inclusion criteria

- All patients 18 - 80 years of age with sacral fractures and sacro-iliac joint injuries with or without associated posterior pelvic ring injuries.

Exclusion criteria

- Those who were haemo-dynamically unstable and those with open thoracic or abdominal wounds.
- Also patients with degloving pelvic and perineal injuries.
- Patients with associated fractures of the acetabulum were also excluded to avoid confounding influence on outcome analysis.

Sample Size

Thus with respect to above inclusion and exclusion criteria total of 32 patients with sacral and

sacro-iliac joint injuries were enrolled during the study duration.

Treatment modalities and Outcomes of Treatment

Depending upon the type of fracture, condition of patients, age, sex, associated neurological involvement and co-morbid condition patients were managed conservatively or surgically. Then patients were followed for six months to study the post treatment outcome and neurological deficit.

To evaluate post treatment functional assessment Majeed Scoring system was used

Majeed et al³ proposed a clinical scoring system for functional assessment after major pelvic fractures which included the following parameters:

1. Pain
2. Standing
3. Sitting
4. Sexual intercourse
5. Performance at work.

Each of these clinical parameters is scored, the total being a maximum of 100 points for patients who were working before the injury and 80 points for those who were not.

Results

Table 1: Demographic data

Parameter		No. of cases (total 32)	
		Conservative (14)	Surgery (18)
Age(yrs)	Mean ± SD	38.86 ± 17.51	30.28 ± 10.86
	Range	19 – 73 yrs	18 – 55 yrs
Sex	Male	12 (85.7)	13 (72.2)
	Female	02 (14.3)	05 (27.8)

Out of the total 32 patients of Sacral fractures 14 patients were managed conservatively and 18 were managed surgically. The mean age of patients managed conservatively was 38.86 ± 17.51 and of those managed surgically was 30.28 ± 10.86. In the study there were total 25 male and 7 female (Table 1).

Table 2: Analysis Of Fracture Displacements

Parameter		Conservative (N=14)	Surgery (N=18)
Post – injury Displacements	Mean	3.35 mm	15.55 mm
	Range	2 to 4 mm	7 to 24 mm
Post Treatment residual displacements	Mean	3.21 mm	4.22 mm
	Range	2 to 4 mm	2 to 8 mm

The average post-injury displacement in the conservative group of patients was 3.35 mm (range: 2 to 4 mm) whereas the average post-injury displacement in the Surgery group was 15.55 mm (range: 7 to 24 mm). The average post treatment residual displacement in the conservative group of patients was 3.21 mm (range: 2 to 4 mm) whereas that in the Surgery group was 4.22 mm (range 2 to 8 mm).

Table 3: The average post-injury displacements as analyzed according to the injury types

Injuries Types	Conservative	Surgery	Total
	Average(mm)	Average(mm)	Average(mm)
Denis Type 1	3.5 mm	13.7 mm	9.87 mm
Denis Type 2	3.25 mm	17.33 mm	11.7 mm
Denis Type 3	4 mm	21 mm	12.5 mm
Vertical Shear Injury	3.66 mm	20.4 mm	14.12 mm
Lateral Compression Injury	3 mm	12.5 mm	7.75 mm
Antero-posterior Compression Injury	3.6 mm	14.71 mm	10.08 mm

The average post injury displacement was analyzed and it was observed that maximum displacement was seen vertical shear injury followed by Denis type 3 and type 2.

Table 4: The average post treatment residual displacements as analyzed according to the injury types

Injuries Types	Conservative	Surgery	Total
	Average(mm)	Average(mm)	Average(mm)
Denis Type 1	3.16 mm	3.10 mm	3.31 mm
Denis Type 2	3.25 mm	5 mm	4.3 mm
Denis Type 3	4 mm	6 mm	5 mm
Vertical Shear Injury	3.66 mm	4.6 mm	4.25 mm
Lateral Compression Injury	3.0 mm	3.33 mm	3.41 mm
Antero-posterior Compression Injury	3.2 mm	4.42 mm	3.91 mm

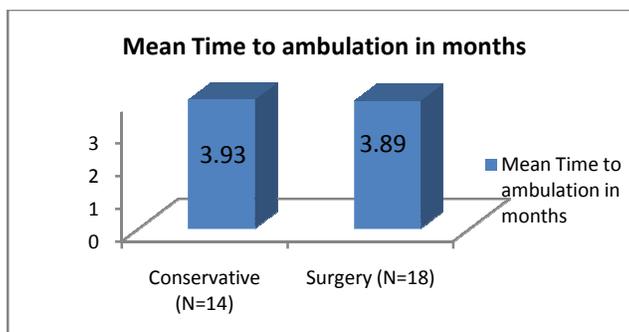
The average post treatment residual displacement was almost equal in all types of the fractures.

Table 5: Analysis of Operative Procedures

Sr no.	Procedures	Surgery (N=18)	
		No	%
01	Anterior pubic symphysis plating	01	05.6
02	Anterior SI Plating	05	27.8
03	Anterior SI Plating + Ex fixator	02	11.1
04	Ex fixator	03	16.7
05	Iliosacral screw + Ex fixator	01	05.6
06	Iliosacral screws with Anterior SI Plating	01	05.6
07	Posterior SI Plating	01	05.6
08	Posterior SI Plating + Ex fixator	02	11.1
09	Posterior SI Plating + Trans-iliac bar + pubic symphysis plating	01	05.6
10	Trans-iliac bar + Anterior pubic symphysis plating	01	05.6

Table 6: Comparison of Time to Ambulation

Groups	Mean Time to ambulation in months ($\bar{X} \pm SD$)
Conservative (N=14)	03.93 \pm 0.73
Surgery (N=18)	03.89 \pm 01.02
P value	0.8985 (not significant)



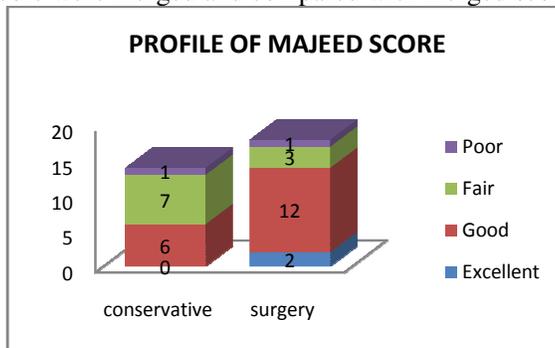
As per above data mean time to ambulation was 3.93 months amongst Conservative group which was comparable to 3.89 months amongst Surgery group and the difference was not statistically significant.

Table 7: Profile of Majeed Score

Assessment	Conservative (N=14)		Surgery (N=18)	
	No	%	No	%
Excellent	00	00	02	11.1
Good	06	42.9	12	66.7
Fair	*07	50.0	03	16.6
Poor	01	07.1	01	05.6

$\chi^2 = 4.10, df = 1, p < 0.05$

(Patients with excellent and good score were merged and compared with merged score of patients of fair and poor score.)



As per above table 42.9% of the total cases had good to excellent Majeed score among conservative group which were significantly less as compared to 77.8% of cases among Surgery group. 50.0% of the cases among conservative group had fair Majeed score which was more as compared to 16.6% cases among Surgery group.

Table 8: Analysis of the Relation between the Residual Fracture Displacements and Majeed Score

Majeed Score	Conservative (N=14)	Surgery (N=18)
	Average Residual Displacement (mm)	
Excellent (>85)	0	2 mm
Good (70 - 84)	2.83 mm	3.83 mm
Fair (55 - 69)	3.57 mm	7 mm
Poor (<55)	3 mm	6 mm

It was observed that residual fracture displacement was seen more in patients of fair and poor Majeed score. And this pattern was observed in both patients groups (conservative and surgically managed patients.)

Table 9: Profile of Complications

Assessment	Conservative (N=14)		Surgery (N=18)	
	No	%	No	%
Pin site infection	NA	NA	01	05.6
Infection, implant failure	NA	NA	01	05.6
Urethral stricture	01	7.1	00	00

1 patient (7.1% of the cases) amongst the conservative group had urethral stricture. This was a case with Denis type 1 injury with straddle injury type pattern and was managed conservatively in view of low injury grade and mild fracture displacements (<5mm) . 1 patient (7.1%) had a persistent neurological deficit in the form of paresthesias. In the Surgery group 1 patient (5.6% of the cases) had pin site infection secondary to external fixator application and 1 patient (5.6%) had complication of infection and implant failure following which debridement and re-instrumentation was done. This patient had an AP compression type pelvic injury with Denis type 2 pattern and was treated initially with posterior sacro-iliac plating and trans-iliac rod fixation and anterior pubic symphysis plating which was later revised. If compared between two groups the difference was not significant.

Discussion

In our study it was observed that male patients were more as compared to female patients. It may be because, male are involved in outdoor activities and are more prone to RTA and other types of accidents. Patients with more displacements were managed surgically and it was observed that post treatment residual displacement was much reduced in surgically managed patients. It was observed that there was little difference in post injury displacement and post treatment displacement in patients managed conservatively. Because of this the mean time for post operative ambulation in both conservatively and surgically managed group was may be nearly equal. The assessment of functional outcomes in our study was done at a follow up period of 6 months using the Majeed score³. Parameters used in this scoring system were chosen to reflect the major problems which may arise after pelvic injuries. Pain forms the major part of a patient's dissatisfaction and is relatively easy to score. Problems with sitting were more common than expected. Work performance was difficult to assess accurately

because it tends to change with the passage of time. Also Majeed *et al.*³ in his classification has graded the scores into excellent, good, fair and poor categories for two separate group of patients i.e. those who were working (max score 100) and those who were not working (max score 80) prior to the injury. All the patients in our study however were found to be working and ambulating independently prior to sustaining the injury. Hence the analysis of the Majeed score for assessment of functional outcomes in our study was restricted to a maximum score of 100. In our series, patients in the operative group scored better as compared to those in the conservative group in terms of the functional outcome scores and this difference turned out to be of statistical significance ($p < 0.05$). This could be attributed to achieving on table, as near an anatomical reduction as possible, to ensure minimal residual displacements and also addressing the problem of fracture site and pelvic ring stability. Though, the patients in this study who were conserved in view of their low injury grades and minimal fracture displacements had lower functional outcome scores at 6 months follow up period, it cannot be ascertained that surgical interventions produce better results in these scenarios. A longer follow up period as well as relatively larger sample size would be required to draw any meaningful conclusions. The Majeed scores of patients in this study correlated well with the residual fracture displacements, a radiographic parameter used in this study to access the quality of fracture reduction. Patients with lower post treatment residual displacement values whether operated or conserved had higher functional outcome scores at follow up. However a formal statistical comparison was not done for this parameter since the pre-treatment radiographic displacements amongst the two groups were not comparable. Most of the patients who had minimal pre treatment displacements (<5 mm) without any neurological injury and those with lower Denis and Young and Burgess injury grades were

conserved^{4,5}. Hence the residual displacements in this group also tended to be on the lower side in this group. Whereas those who were offered surgery had higher pre-operative fracture displacements and the residual post-operative displacements in this group were more of a reflection of the quality of reduction. Although no randomized clinical trials exist which compare long-term results of operative versus nonoperative treatment, there are indications that operative treatment may have superior results. Tornetta showed that after operative treatment all fractures were reduced to <1cm residual displacement, which was related to fewer pain complaints.⁶ Amongst the complications encountered in this study were pin site infection in a case with pelvic external fixator application, urethral stricture in a case with concomitant urological injury and persistent neuro-deficit in a case who complained of residual paresthesias. A severe complication encountered was in a case with Denis type 2 injury pattern with an unstable open pelvic book type injury who was treated with posterior sacro-iliac plating and trans-iliac rods with anterior stabilization with pubic symphysis plating. The patient developed an infection within two weeks post-operatively with failure of the anterior construct. This had to be revised with wound wash and re-implantation. The patient had a delayed time to ambulation and poor functional outcome score (Majeed score 52) at 6 months follow up.

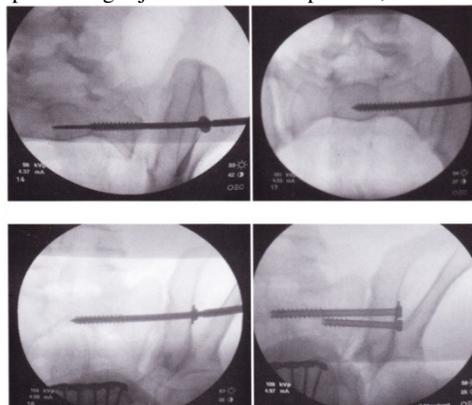
Conclusion

In the end we can conclude that patients with minimum post injury displacement can be managed better conservatively. And other patients can be managed surgically. Post operative ambulation time nearly equal in both conservatively and surgically managed group. Patients with more post treatment residual displacement have poor Majeed score.

References

1. Hasenboehler EA, Stahel PF, Williams A. Prevalence of sacral dysmorphism in a prospective trauma population: Implications for a "safe" surgical corridor for SI-screw placement. Presented at: 75th Annual meeting of the American Academy of Orthopaedic Surgeons; March 5-9, 2008; San Francisco, CA

2. Vaccaro AR, Lim DH, Brodke DS, Harris M, Chapman J, Schildhauer T, *et al.* Diagnosis and management of sacral spine fractures. *J Bone Joint Surg Am* 2004;86:166-75.
3. Majeed SA. Grading the outcome of pelvic fractures. *J Bone Joint Surg [Br]* 1989;71-B: 304-6
4. Latenser BA, Gentilello LM, Tarver AA, Thalgott JS, Batdorf JW. Improved outcome with early fixation of skeletally unstable pelvic fractures. *J Trauma*. 1991 Jan;31(1):28-31.
5. Kellam JF, McMurtry RY, Paley D, Tile M. The unstable pelvic fracture: operative treatment. *Orthop Clin North Am* 1987;18:25-41.
6. Matta JM, Tornetta P, III. Internal fixation of unstable pelvic ring injuries. *Clin Orthop*. 1996;129-140.



Figures 1: Figures demonstrating the instrumentation and the technique of iliosacral screws



Figure 2: A case of Denis type 2 sacral fractures with an Antero-posterior compression type injury treated with posterior plating with trans-iliac rods and anterior stabilization with pubic symphysis plating