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ORIGINAL ARTICLE

Clinical Outcome of Percutaneous Iliosacral Screw Fixation in Unstable Pelvic Ring Injury

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ABSTRACT

BACKGROUND
Surgical fixation of unstable pelvic injuries improves fracture reduction, early weight bearing and mobilization, lower mortalities, shorter hospital stays, and superior functional outcomes compared with non-operative treatment. The minimal invasive Iliosacral screws have improved outcomes, reduced complication rates as well as operative time. We aim to find out clinical outcome of percutaneously placed Iliosacral screw in unstable pelvic ring injury in our hospital and also compare our data with the availabale relevent literature

METHODS
A total of 33 cases underwent Iliosacral screw fixation for unstable pelvic ring injury with a complete follow-up of one year. VAS and Majeed pelvic scores were calculated to assess the functional outcome of the surgery.

RESULTS
The median age of the patients was 35 (20-87). The median duration of surgery for the iliosacral screw was 56 (41- 81) minutes. After 1 year of follow-up, the median VAS score was 1 (1-2). The mean Majeed pelvic score was 86.12 ± 5.57. Excellent results were seen in 23 (69.69%) cases and good results were seen in 9 (27.27%) cases.

CONCLUSION
Percutaneous Iliosacral screw fixation has a favourable outcome in unstable pelvic ring injury.

KEYWORDS
Iliosacral screw, Majeed pelvic score, VAS score

INTRODUCTION

Pelvic fractures comprise 3 % of all fractures and among those 40% are unstable due to posterior ring disruption. [1] Ten to twenty per cent of polytrauma cases have a pelvic injury.[2] Injuries to the neural, vascular, bowel and urological structures complicate fracture management.[3] Sacral fracture and Sacroiliac dislocations associated with ramus fracture or symphysis separation and their combinations are common unstable pelvic injuries. Ligamentous disruptions are common among young patients while fractures are common in elderly people.[4] As stated by Letournel et al, the primary goal of treatment is reduction and restoration of the weight-bearing posterior part of the pelvic ring.[5]

Unstable pelvic fractures are stabilized with military antishock trousers and external fixators in emergencies.[6,7] Definitive posterior pelvic internal fixation surgeries in the compromised soft tissue are complex and have infection rates of up to 25%.[8]

The minimal invasive Iliosacral screws have reduced complication rates but is challenging due to narrow corridor. There is minimal blood loss and adequate stability.[9] The safe Iliosacral screw placement relies upon three criteria: accurate reduction, understanding of the posterior pelvic anatomy; and its fluoroscopic visualization.[10] The outcome of iliosacral screw in unstable posterior pelvis ring injury varies in the literature. Our institute is a tertiary care center and Iliosacral screw fixation for unstable pelvic injuries are commonly done procedures. However, the outcome of these surgeries haven't been studied yet.

The purpose of this study is to assess the clinical outcome of percutaneously placed Iliosacral screws in unstable pelvic fractures

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METHODS

A retrospective study was done on 37 cases of unstable posterior pelvic ring injuries that were treated at Chitwan Medical College, Bharatpur, Chitwan, Nepal from December 2015 to December 2022. However, only 33 patients completed a one-year follow-up and were included in the study. Ethical approval was obtained from IRC and informed consent was obtained from all patients. The inclusion criteria were skeletally matured patients with unstable pelvic injury (Young-Burgess classification system (lateral compression or LC type II and III, anteroposterior compression or APC type II and III, vertical shear or VS and combined injury patterns which were unstable. The presence of acetabulum and lower limb bony injury as well as spinal cord injury were excluded.

Standard technique of iliosacral screw fixation was used in our cases.1 In the dysmorphic sacrum when placement of the S1 screw was not possible, the S2 Iliosacral screw was placed. Standard post-op protocol was followed in all cases. Weight bearing was restricted for 6 weeks followed by gradual weight bearing. Patients were routinely followed at 6 weeks, 3 months, 6 months and 1 year. Functional outcomes were measured as VAS score and Majeed pelvic score (MPS) at each follow up.11 SPSS version 23 was used for data analysis. Mean values were used for data following normal distribution while median was used for those not following normal distribution.

RESULTS

A total of 33 patients completed one year of follow-up. Among them 18(54.54%) were male and 15 (45.45%) were female. The median age of the patients was 35 (20-87) years at the time of surgery. The mechanism of injury was road traffic accidents in 21 (63.63%) cases and fall injuries in 12 (36.36%) cases. Among all, 17 (51.51%) cases had associated other injuries (Chest, abdomen or head) while 16 (49.49%) cases had isolated unstable bony pelvic injuries requiring surgery. The mean duration for Injury to pelvic surgery is 3.123 ± 0.39 days. The mean Injury Severity Score was 15 ± 12.68. High ISS (>16) was seen in 14(42.42%) and is associated with poor outcomes when compared with low ISS (P<0.05). According to AO/OTA, partially stable AO B2 fractures were 11(33%), AO B3 were 3(9.09%), AO C1 were 10(30.30%), AP C2 were 5(15.15%) and AO C3 were 4(12.12%). Seven cases (21.21%) had dysmorphic lumbosacral transition vertebra. Due to dysmorphism, S2 screws only were placed in 2 (6%) cases and both S1 and S2 in 2 (6%) cases. The median duration of surgery for the Iliosacral screw was 56 (41- 81) minutes. The median VAS score improved from 3 (2-4) at 6 weeks to 2 (1-3) at 3 months, 2 (1-2) at 6 months and 1 (1-2) at one year follow up. The mean Majeed pelvic score were 62±9.67, 76.06±6.67, 81.97±5.56 and 86.12±5.57 at 6 weeks, 3 months, 6 months and 1 year respectively. Excellent results were seen in 23 (69.69%) cases and good results were seen in 9 (27.27%) cases. All fractures united well without loss of reduction, screw loosening, backout or breakage. No neurovascular injury was seen. However, one case had a superficial surgical site infection which healed with debridement and resuturing.

Fig. 1: S1 and S2 screws in 25 years young patient at 1-year follow-up

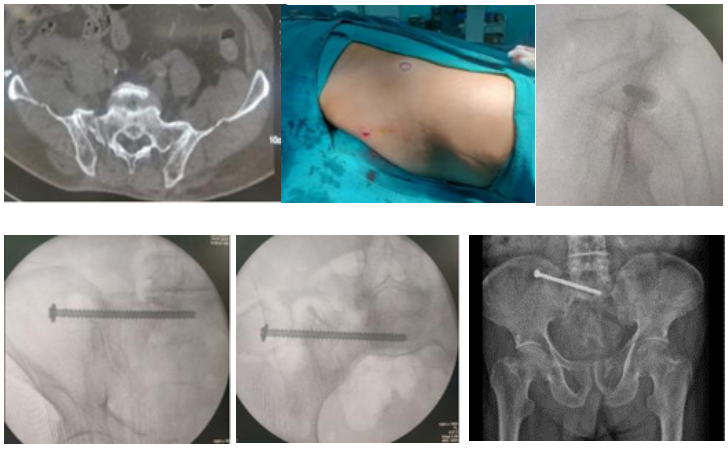

Fig. 2: S1 in 77 year male patient

Table 1: Data showing Age, Mechanism of Injury, ISS, Time to surgery, Duration of surgery, VAS score and Majeed Pelvic Score

S no	Age	MOI	ISS	Time to Surgery from injury (days)	Duration of Surgery (posterior) (Minutes)	VAS 3 months	VAS 6 months	VAS 1 year	Majeed Pelvic Score (3 months)	Majeed Pelvic Score (6 months)	Majeed Pelvic Score (1 year)
1	31	RTA	29	12	55	3	2	1	70	85	90
2	24	RTA	12	1	62	2	2	2	76	79	80
3	25	RTA	5	2	48	2	1	1	81	87	91
4	65	RTA	24	6	69	3	1	2	88	90	91
5	77	Fall	17	4	55	3	2	2	68	74	81
6	24	RTA	14	4	78	2	1	1	80	89	92
7	27	Fall	5	2	45	2	2	1	87	89	93
8	29	RTA	5	1	49	3	1	1	77	81	84
9	55	Fall	34	4	57	2	2	2	70	80	84
10	35	Fall	50	7	72	2	2	1	76	81	86
11	58	RTA	18	2	56	2	1	1	81	82	89
12	33	Fall	29	3	49	2	1	1	65	67	69
13	58	Fall	5	1	52	2	2	1	77	81	86
14	32	RTA	34	5	68	2	1	1	76	79	81
15	22	RTA	5	2	71	1	1	1	69	76	80
16	57	Fall	29	2	51	1	1	1	57	71	76
17	62	RTA	11	1	52	2	2	2	76	85	91
18	50	Fall	17	3	62	3	2	2	80	86	92
19	22	RTA	26	5	49	3	1	1	81	86	90
20	51	Fall	5	2	56	2	2	1	76	79	80
21	33	Fall	5	3	59	2	2	1	61	74	79
22	25	RTA	13	4	72	2	2	1	72	79	84
23	87	RTA	26	4	81	2	2	2	81	86	89
24	67	RTA	1	1	41	1	1	1	79	81	84
25	57	RTA	5	2	52	2	1	1	82	90	93
26	35	RTA	5	2	56	2	2	1	78	80	87
27	20	RTA	34	6	71	2	2	1	73	79	86
28	46	RTA	5	1	59	1	1	1	76	81	88
29	29	Fall	8	3	68	2	1	1	80	88	92
30	44	RTA	12	3	70	2	2	2	79	87	90
31	38	Fall	5	1	49	2	1	1	79	87	91
32	27	RTA	17	3	50	2	2	1	80	86	89
33	51	RTA	5	1	56	2	1	1	79	80	86

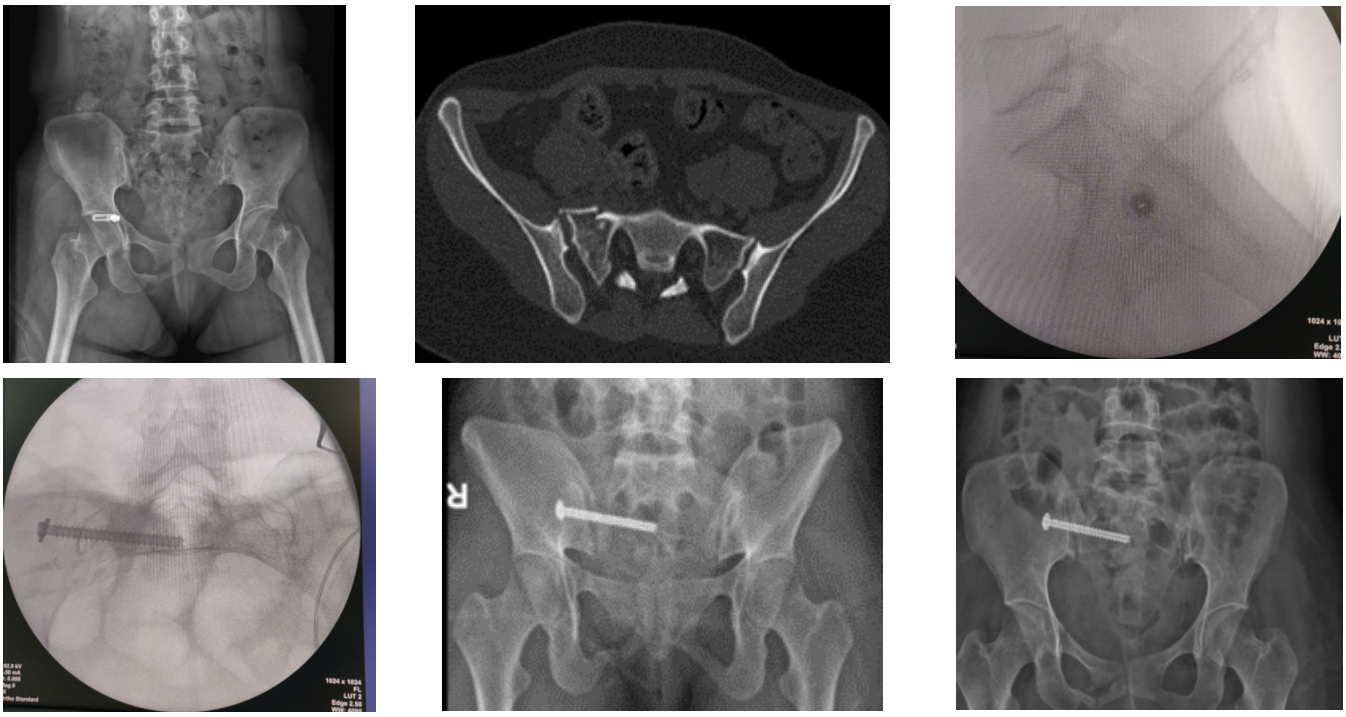

Fig. 3: S2 screw in a dysmorphic sacrum

DISCUSSION

Displaced and unstable pelvic ring injuries have high morbidity and mortality.[12] Most of these injuries are high-velocity injuries due to road traffic accidents and were more common in young populations as seen in our study. Early anatomic reduction and stable fixation in unstable pelvic fractures result in improved outcomes.[13] The associated injuries can compromise the overall outcome and also can be a confounding factor for the interpretation of the outcome.[14] Presence of other injuries was associated with delay in surgery in our study (mean 1.56 days vs 4.58 days). Studies show that higher Injury Severity Scores (ISS) are associated with poor outcomes and are consistent with our findings but in the study done by Suzuki et al, the higher ISS score was not associated with poor outcomes.[15,16] However, it is still not clear which factors affect the functional outcome after high-velocity pelvic injuries.[16] Open surgeries like posterior plating are associated with high complication rates from 14-25%.[17] Percutaneous Iliosacral screw fixation can be done in less operation time with minimal soft tissue injury as well as provides adequate biomechanical stability to the posterior pelvic ring.[18] However, it is technically demanding, and the surgeon must have a good understanding of sacral osteology on CT scans as well as fluoroscopic images.[19] Prevalence of sacral dysmorphism ranges from 14 to 41%. This makes the screw fixation more challenging with an increase in complication rates. [20, 21] We used the VAS score and Majeed pelvic score to analyze the outcome of surgery. The median VAS score in our study was 3 (2-4) , 2 (1-3), 2 (1-2) and 1 (1-2) at 6 weeks, 3 months, 6 months and one year respectively. Our VAS score is comparable with the study done by Li et al where they studied the modified technique of Iliosacral screw and anteriorly INFIX.[22] The mean Majeed Pelvic Score was 62±9.67 at 6 weeks, 76.06±6.67 at 3 months, 81.97±5.56 at 6 months and 86.12 ± 5.57 at 1 year follow up. There was statistically significant improvement in Majeed pelvic Score ($P<0.05$) at each follow up compared to previous till 1 year. In the study done by Stolberg J et al, the mean Majeed Pelvic Score was 83.32±19.26 and is comparable with our study.[23] Our 96.96% good to excellent results on Majeed pelvic score is comparable with Stolberg J et al but better than Suzuki et al who had studied the overall outcome of an operation as well as a conservatively treated unstable pelvic fracture.[16,23] In a similar study done by Shrestha et al, they had good to excellent results in 76.19% of cases and fair in 19.04% of cases on Majeed pelvic score.[24] Liu et al in their study of Iliosacral screw fixation using 3D patient-specific template guidance had 100% good to excellent results on Majeed pelvic score.[25] The complications are generally due to poor preoperative planning, inadequate intraoperative fluoroscopic imaging, inaccurate posterior pelvic reductions and posterior pelvic anatomical variations.[26] Screw malposition is a common complication. A systematic review by Zwingmann et al showed that CT navigation had the lowest malposition rate followed by 2D and 3D navigation. The conventional technique has a screw malposition rate of 2.6%.[27] We didn't assess the screw malposition postoperatively on CT scan due to cost issue. Routt et al had complications in 7% of cases.[26] We had 1 (3%) complication as superficial infection which was controlled with debridement and resuturing.

Limitations of our study are limited sample size, single-centered data and lack of age-matched control. Out of 37 cases included in the study, only 33 completed 1 year follow up . All patients had anterior ring injury as well but anterior surgery of symphysis or ramus fracture was not done in any.

CONCLUSION

Percutaneous Iliosacral screw fixation has a favourable outcome in unstable pelvic ring injuries. Currently, percutaneous Iliosacral screw fixation is the standard technique for posterior pelvis stabilization. However, further study with a larger sample size is required to validate the outcome.

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