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Prospective study of fluoroscopy guided cannulated screw fixation in pelvic ring and acetabulum fractures through percutaneous or mini incision technique

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Abstract

Open reduction and Internal fixation of pelvis and acetabulum fractures have required extensive surgical exposure of the deep structures of the pelvis, with problems of wound healing, damage to major vessels or nerves and infection. To overcome this percutaneous fixation of the pelvic and acetabulum fracture receiving increasing attention. Percutaneous techniques may offer advantage of soft tissue planes remain intact, which ease later arthroplasty of the hip if necessary. Percutaneous techniques may be an ideal treatment for pelvic and acetabulum in polytrauma. Advantages for percutaneous screw fixation of pelvic and acetabular fractures in these studies include less soft tissue injury, less blood loss, and a lower rate of infection. Furthermore, early weight bearing ambulation will be possible with percutaneous screw fixation. Neurovascular injuries, internal organ injuries, screw misplacement, and screw fracture are some potential complications of this technique.

Aim: To investigate the clinical and radiological outcomes and complications of percutaneous screw fixation of Pelvic ring fracture and acetabulum fracture.

Study design: Hospital based prospective type of observational study.

Materials and Methods: After taking clearance from ethical committee a total 54 patient operated for 62 fractures and 95 cc screw were inserted through different percutaneous and mini incision (windows) approach for fracture of pelvis and acetabulum were operated based on preoperative CT SCAN in between January 2019 to November 2020. The pelvis and acetabulum fractures were classified based on young - burgess and judet-letournel classification system. The outcome variables for radiological outcome was evaluated by matta radiological score and functional outcome were evaluated by Harris hip score and Majeed pelvis score at 6 and 12 months follow up.

Results: In post-operative follow up patient were started with active range of motion without weight bearing for 3 months then partially weight bear as tolerated after 3 months the respective functional Harris hip score, Majeed score were obtained at 6 and 12 months of follow up with p value of <0.001 suggesting highly significant. Matta radiological score was obtained at 12 months follow up with p value <0.001 suggesting highly significant.

Conclusion: From our study we conclude that, treatment of pelvis fractures and acetabulum fracture through percutaneous approach is a challenging task for any orthopaedic surgeon with a definitive learning curve. Good preoperative evaluation, operative planning, surgical technique described above in our study, the use of 6.5 mm long cc screw in a fracture displacement of anterior column, posterior column and SI joint by buttressing of the fracture a good clinical and radiological outcome can be obtained. With good postoperative protocol and early rehabilitation it is possible to obtain improved outcome.

Keywords: Pelvis and acetabulum fracture, percutaneous approach, mini incision technique.

Introduction

Most pelvic and acetabulum are high energy trauma. The mortality is mainly due to haemorrhage and associated thoracic and head injury [2-4]. Internal fixation has required extensive surgical exposure of the deep structures of the pelvis, with problems of wound healing, damage to major vessels or nerves and infection of up to 25% [5]. To overcome this lacuna percutaneous fixation of the pelvic and acetabulum fracture receiving increasing attention [1, 4] with advances in the techniques of imaging and computer navigation facilitating such procedures.

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Percutaneous techniques may offer advantage of soft tissue planes remain intact, which ease later arthroplasty of the hip if necessary [6]. Also, does not decompress the pelvic hematoma, surgical stabilization is possible without the risk of additional hemorrhage [8]. Percutaneous techniques may be an ideal treatment for pelvic and acetabulum especially in polytrauma [9, 10]. Percutaneous fixation is recommended after an accurate reduction, avoiding residual displacement which can lead to neural and vascular structures damage with unfavorable outcomes and function [11].

Percutaneous fixation under image guidance with cannulated screws is a surgical option in cases of column fracture of acetabulum, high anterior column fractures, posterior hemi transverse fractures of the anterior column or vertical fractures of the ilium [1]. In younger patients the technique may be used in any patterns of fracture without comminution which be reduced by using closed or mini open methods. Elderly patients have comorbid condition can benefit from percutaneous procedure [7] with the early assisted active rehabilitation and early discharge from the hospital with advantageous in term of compliance of patient.

Advantages for percutaneous screw fixation of pelvic and acetabular fractures in these studies include less soft tissue injury, less blood loss, and a lower rate of infection. Furthermore, early weight bearing ambulation will be possible with percutaneous screw fixation [13].

Neurovascular injuries, internal organ injuries, screw misplacement, and screw fracture are some potential complications of this technique [12, 14, 15].

Material and Methods

The present study was approved by ethics committee of SMS Medical College Jaipur (RUHS) to investigated the clinical and radiological outcomes and complications of percutaneous screw fixation of Pelvic ring fracture and acetabulum fracture with objectives of to assess 1) postoperative anatomical reduction and stability of pelvic ring 2) radiological outcome of pelvis and acetabulum fractures in terms of Matta radiological score. 3) Functional and clinical outcome in terms of Majeed pelvic score and Harris hip score. In total 54 patient were fracture of pelvis and acetabulum were operated for percutaneous fixation based on preoperative CT SCAN in between January 2019 to November 2020. The pelvis and acetabulum fractures were classified based on young-burgess and judet-letournel classification system.

The inclusion criteria were fractures of pelvis and acetabulum within 14 days of injury with hemodynamically stable for surgery. Based on site of fracture, pattern of fracture and degree of displacement, no or minimally displaced fracture (5mm) to displaced fracture which can be reduced via percutaneously or via mini incision of iliofemoral and ilioinguinal approach in supine position. All the patients were operated same centre by single surgeon and team via fluoroscopy guidance.

Anaesthesia of choice was preferred according to the patient condition and tolerability. Closed reduction was achieved via trochanteric traction with mini incision at different sites and long hohmann retractor were used to reduce the displaced fracture. Confirmation of the reduction was done with different radiographic view intraoperatively via c arm. Different screw was utilised like for anterior column (antegrade/retrograde), posterior column (antegrade/retrograde) sacroiliac joint screw, iliac wing screw,

posterior wall screw and ramus screw.

Postoperatively x-ray was obtained on day two, with partial weight bearing advised as per tolerated after two weeks. Then further follow-ups were obtained on 6 weeks, 3, 6 and 12 months via Matta radiological score and functional Harris hip score and Majeed pelvis score.

Results

Total 54 patient operated for 62 fractures and 95 cc screw were inserted through different approach. The patient preoperative characteristics were summarised in table 1, intraoperative data is explained in table 2 and follow up at 6 and 12 months with Harris hip score, Majeed score and Matta radiological score at each visit is noted in table 3. We can appreciate that the total no of patient was 54 but according to fracture fixation total 95 screw were inserted through different approach to achieve the reduction of fractures.

In post-operative follow up patient were started with active range of motion without weight bearing for 3 months then partially weight bear as tolerated after 3 months the respective functional Harris hip score, Majeed score were obtained at 6 and 12 months of follow up with p value of <0.001 suggesting highly significant.

Matta radiological score was obtained at 12 months follow up with p value <0.001 suggesting highly significant.

Table 1: Preoperative patients characteristics.

Gender	Male	46 (85.2%)
	Female	8 (14.2%)
Mean age		37.22+-11.35
Type of fracture	Transverse	7 (11.3%)
	Anterior column	17 (27.4%)
	Posterior column	4 (6.4%)
	T type	2 (3.2%)
	Posterior wall	1 (1.6%)
	Iliac blade	7 (11.3%)
	Quadrilateral plate	1 (1.6%)
	LC 1	2 (3.2%)
	LC 2	8 (12.9%)
	LC 3	2 (3.2%)
	APC 1	0
	APC 2	3 (4.8%)
	APC 3	1 (1.6%)
Vertical sher	2 (3.2%)	
SI Joint dislocation	5 (8.3%)	

Table 2: Intraoperative patients characteristics.

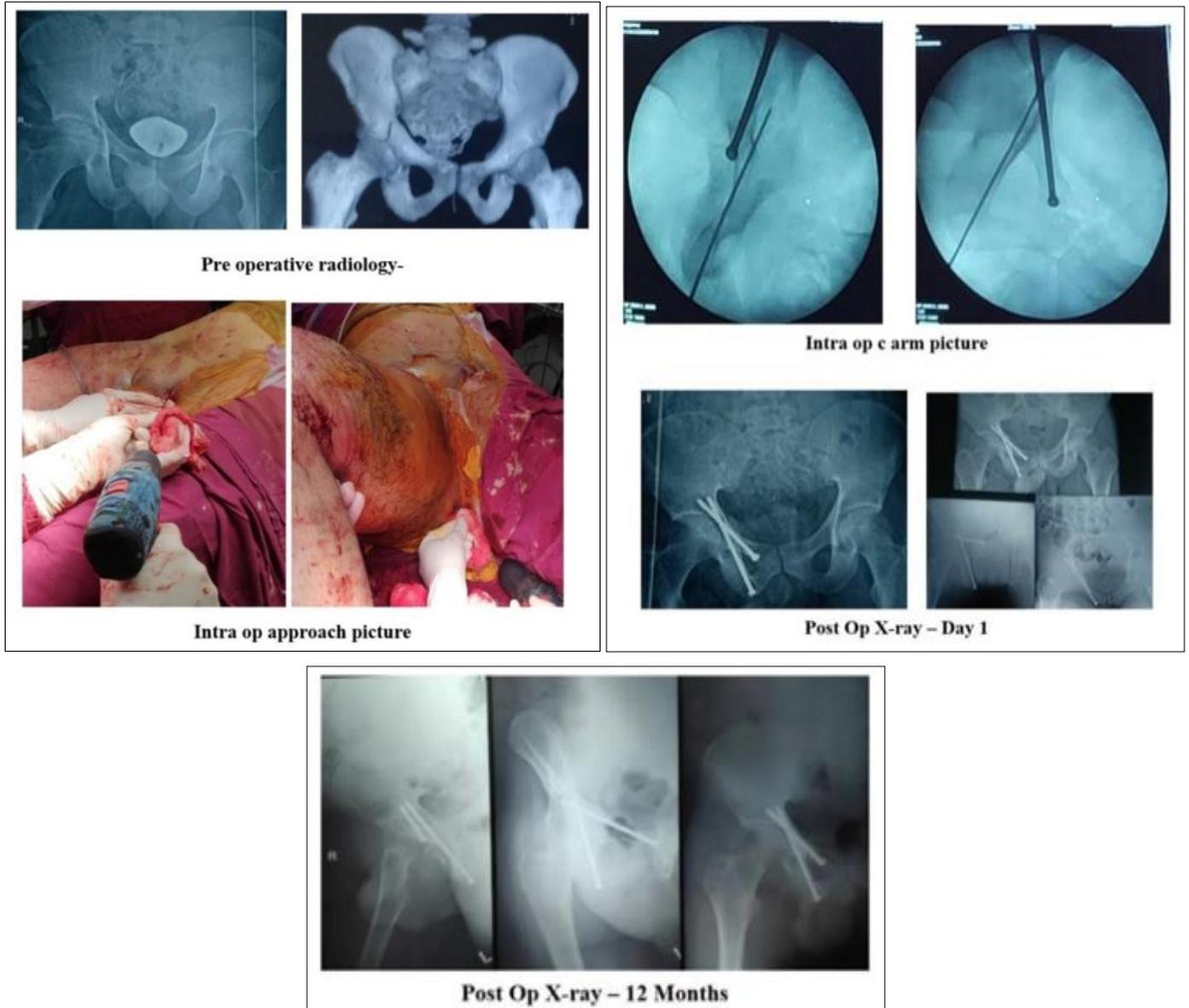
Mean duration of surgery (mean+-SD)	71.74+-10.29
Anaesthesia of choice	General Anaesthesia -5 (9.2%)
	Spinal Anaesthesia -49 (90.8%)

Surgical procedure	
Antegrade anterior column (AAC)	30 (31.5%)
Retrograde anterior column (RAC)	11 (11.6%)
Antegrade posterior column (APC)	6 (6.3%)
Retrograde posterior column (RPC)	5 (5.3%)
SI Joint fixation	13 (13.7%)
Iliac blade fixation	15 (15.8%)
Posterior wall screw	1 (1.1%)
Ramus screw	14 (14.7%)
Approach percutaneous	45 (83.3%)
Mini incision through window	9 (16.7%)

Table 3: Follow up characteristics of patients.

Majeed score	Time	No.	Majeed score	SD	P<0.001
	6 months	54	71.7	8.38	
	12 months	54	89.5	5.34	
Harris hip score	Time	No	HHS	SD	P<0.001
	6 months	54	83.31	6.67	
	12 months	54	91.12	5.99	

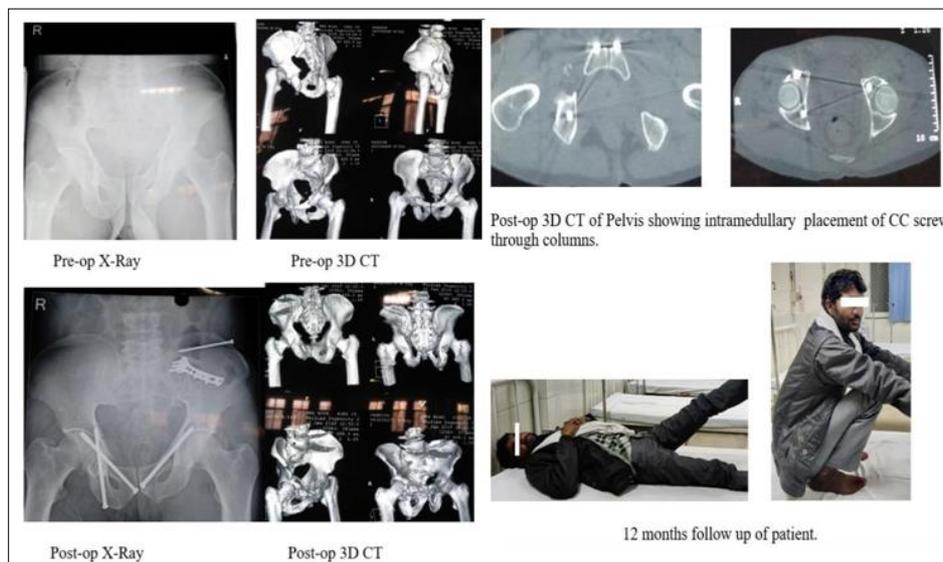
Matta radiological score at 12 months Follow up	Poor	1	1.8%	P<0.001
	Fair	2	3.7%	
	Good	13	27%	
	Excellent	38	70.5%	



Case 1: A 50 year old male with transverse fracture of right acetabulum operated by percutaneous approach through retrograde anterior and posterior column fixation.



Case 2: A 24 year male with transverse fracture acetabulum rt side operated percutaneously with mini incision technique (Lateral window) right side.



Case 3: A 38 year male with fracture right ilium and b/l ramus fracture (LC 3) injury operated percutaneous mini incision technique.

Discussion

Recently studies show significant good results of different pelvis and acetabulum fractures using percutaneous approach with excellent functional and radiological outcomes without significant risk of neurovascular injuries. Various ORIF technique is still the gold standard for fixation of pelvis and acetabulum fractures. ORIF like anterior, posterior plating

and tension band plating is the standard method [20-22]. But with ORIF intra- and postoperative complications like high blood loss, infection, Heterotrophic ossification abduction mechanism failure and distortion of internal anatomy making further revision arthroplasty difficult remains major issues [16-18].

For above limitation percutaneous or mini incision techniques gaining popularity. Percutaneous fixation of pelvic was first described by Routt *et al.* in 1993 [19]. Currently use of percutaneous fixation of pelvis gaining popularity with better results and good patient compliance. The difficulty in operating procedure and surgically demanding with learning curve this technique is still in its early stage to convince majority of surgeons.

In our study the functional clinical outcome was assessed in all 54 cases by Harris Hip score showed Excellent results in 42 (77.8%), good in 8 (14.8%), fair in 2 (3.7%), poor in 2 (3.7%) of patients at 12 months follow up study and Majeed score shows excellent in 50 (92.4%), good in 2 (3.8%) and fair in 1 (1.9%) with 1 (1.9%) poor score. The P value of above score were <0.00001 suggestive highly significant. Anatomical reduction quality was assessed by Matta radiological scores, showed Excellent to good results in 51 (94.4%) of patients at 12 months follow up.

We encountered complication related to percutaneous fixation like two screw cut-out, two screw back out, one screw breakage and one wrong placement of screw. The main problem behind the screw back out may be due to osteoporotic bone to overcome it delayed weight bearing and medication was done. The screw cut-out was mainly due to inadequate length of screw. The screw breakage was due to excessive early weight bearing and not follow up protocol. The wrong placement of screw was mainly due to inadequate accessibility through c arm fluoroscopy visualizer and interpretation of the same.

Conclusion

Pelvis and acetabulum fracture with displacement is a technically difficult fracture to treat. Minimal bone stock and proximity to the hip joint with limited access, and difficulty in obtaining a stable fixation at this area contribute to the surgical challenges of percutaneous internal fixation of these fractures without proper knowledge of anatomy and safe corridor of pelvis for fixation.

From our study we conclude that, treatment of pelvis fractures and acetabulum fracture through percutaneous approach is a challenging task for any orthopaedic surgeon with a definitive learning curve. Good preoperative evaluation, operative planning, surgical technique described above in our study, the use of 6.5 mm long cc screw in a fracture displacement of anterior column, posterior column and SI joint by buttressing of the fracture a good clinical and radiological outcome can be obtained. With good postoperative protocol and early rehabilitation it is possible to obtain improved outcome.

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