

ORIGINAL RESEARCH

Functional and radiological outcome of posterior column and/or posterior wall of acetabular fracture after open reduction and internal fixation

¹Dr. E Mugunthan, ²Dr. P Murali, ³Dr. A Sudharsan

¹Assistant Professor, Department of Orthopaedics, Thiruvavur Medical College, Tamil Nadu, India

²Assistant Professor, Department of Orthopaedics, Thanjavur Medical College, Tamil Nadu, India

³Associate Professor, Department of Orthopaedics, Tiruppur Medical College, Tamil Nadu, India

Corresponding Author

Dr. A Sudharsan

Associate Professor, Department of Orthopaedics, Tiruppur Medical College, Tamil Nadu, India

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Abstract

Introduction: Acetabular fractures, which reach through into hip joint, are difficult for orthopaedic trauma surgeons to treat. Case reports from 1943 have been the earliest known reports of surgical stabilisation of bone fractures.

Materials and Methods: In our research, series of 29 patients, the utmost common age group was 21 - 40 years. The predominant sex affected were males in our series, the ratio of male to female being 9: 1. Automobile mishaps are the most general mode of wound since tremendous amount of energy dissipation is involved in this injury, acetabular fractures are often associated with a spectrum of injuries to other bony and soft tissues structures, which complicate treatment and often determines the outcome in these injuries. The common soft tissue wound linked with acetabular fracture in our series was the sciatic nerve palsy. The common skeletal injury associated was lower limb fractures. The thorough assessment and early resuscitation is of paramount importance in the management of these critically ill patients. The predominance of posterior wall fracture were comminuted or connected with articular surface impaction damage into the supporting cancellous bone all along fractured line's edge.

Results: The clinical result has been found to be linked to the precision with which these breaks are reduced. Fractures that involved more than half of the posterior wall were deemed unstable. All the other posterior wall injuries were regarded possibly unstable, even if they weren't linked with a previous hip displacement. There were two posterior dislocations and one central dislocation associated with acetabular fractures in our series. Even though posterior wall fissures are the most available and easily stabilised of all acetabular fractures, medicine of comminuted posterolateral wall fractures is linked with a range of possible problems, such as femoral head osteonecrosis, osteoarthritis, osteoclast of the wall shards, and failure of fixing of the wall.

Conclusion: Based on our research, we obtained the longer term excellent functional result was directly predisposed through linked complications like sciatic nerve palsy, heterotopic ossification and the increase in the duration between injury and surgery which may be due to associated life-threatening injuries or associated fractures.

Keywords: Acetabular Fracture, anatomical restoration, weight bearing dome, articular surface

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Introduction

Acetabulum fractures are more commonly the result of higher-speed car accidents ^[1, 2]. Because it involves a key weight-bearing joint inside the lower extremities, they have a lot of therapeutic importance. Developments in vehicular safety, pre-hospital care, resuscitation, and transfer and also standardised treatment methods, have all resulted in better survival after pelvic injuries during the previous 20 years. The acetabulum is only involved in 10% of pelvic

disruptions. The most prevalent type of articular surface fracture is a medial wall fracture, which accounts for 94% of all articular surface fractures ^[3]. It is now easier to categorise these complex injuries and treat them more successfully thanks to the introduction of CT scans and 3D reconstruction. For all displaced fracture fixation, Open Reduction and Internal Fixation has been advocated, thinking that anatomical reduction of the joint surface will reduce late progressive changes. The technical difficulties of

operation reduction. Only 30% of acetabular posterior wall fractures include one big piece. The majority are multi-fragmented or feature impaction zones. More than 80% of treated patients nonsurgically have unfavorable clinical outcomes [4]. The greatest shot of maintaining longer-term joint function is usually surgical therapy, but only if an anatomically restored acetabulum can be performed without complications [5]. The extent of initial velocity, affiliated musculoskeletal injury [6], adequacy of reduction, affiliated harm to neurovascular structures, delayed complexity of avascular Necrosis of the Femoral Head, heterotopic ossification, chondrolysis, and debilitating arthrosis are all factors that influence the outcome. The results of surgery for solitary posterior acetabular wall and column fracture are the subject of this research. The goal of this research was to see how functional and radiographic outcomes of posterior wall or spinal fractures compared.

Materials and Methods

Patient selection

Thirty patients of operated posterior acetabular wall and column fracture admitted to Institute of Orthopaedic Research and Accident Surgery were included in the study.

Inclusion Criteria

Age range: 18 to 70 years old, male or female, fracture period: lesser than 14 days following hemodynamic stabilisation Clients who give consent and are ready to follow up on a posterior column and/or wall broken bone of the acetabulum with/without posterolateral hip dislocation, as determined by physical exam, x-rays, and CT scans; patients who give consent and are ready to follow up on a posterolateral column and/or side of a building fracture of the acetabulum with/without posterolateral hip dislocation, as determined by clinical assessment, x-rays, and CT scans, Type A and Type B in Judet and Letournel Classification, Posterior Acetabulum column and / or wall fracture with or without sciatic nerve injury [2, 8].

Exclusion Criteria

Compound fractures of pelvis, associated lower limb fractures of long bones, patients lesser than 18 years of age, patients incapable for operation, gestation, linked co morbid circumstances, psychiatric illness, head injury, pathological fractures, periprosthetic breakages, related major visceral wound.

Methodology and type of data collected

Individuals who meet the set of criteria will be involved in this study after receiving informed consent after receiving clearance and approval from the ethical review committee. To use a study proforma, a detailed account will be gathered, with special focus paid to the mechanism of damage. Basic clinical features are included in the examinations.

Other linked complaints will be assessed based on the narrative and allow us to know [9].

Study design: Retrospective study.

This research was carried out in Institute of Orthopaedic Research and Accident surgery Devadoss Multi-specialty Hospital, Madurai, Tamilnadu.

Study period: Three years.

Study Population: Patients admitted in Devadoss Multi-specialty Hospital, who have undergone posterior acetabular wall and column fixation following posterior wall and column fractures satisfying inclusion and exclusion criteria in this study duration [10].

Results from Open Epi, Version 3

Methodology

Pre OP evaluation: Patients with pelvic fractures were received in emergency, initially stabilized with IV fluids, blood components analgesics and immediate reduction if there is any dislocation followed by skin / skeletal traction then thorough history and clinical examination done:

- To rule out other limb injuries
- To rule out medical co-morbidities
- Routine blood investigations (HB, TC, DC, blood grouping, renal function test, blood sugar, viral markers)

Radiological examination for confirming the diagnosis x ray pelvis with both hips antero posterior view and special views (Judet views) taken, CT scan of affected hip joint to assess displacement and comminution of fracture.

Patient role who were all therapeutically fit and x rays and CT scan displays displaced and comminuted posterior acetabular wall and column fractures were posted for open decrease and interior fixation using reckon plates or screws.

All the patients undergo pre anesthetic checkup and if they were rendered fit for surgery they will be taken-up for procedure. Pre-operative antibiotics given 30 mins before skin incision.

Affected pelvis, abdomen, pubic areas are preoperatively prepared. Procedure was done under general anesthesia.

Anesthesia for surgical management of acetabular fractures

General anesthesia is preferred in view of long operating time and lateral decubitus position for patient comfort as it offers the advantages of both. Invasive monitoring using a central venous catheter and intra-arterial blood pressure intensive care may be instituted if major blood loss and fluid shifts are anticipated and hypotensive anesthesia is planned if the patient is medically compromised.

Surgical approach

Posterior Kocher-Langenbeck, Osteotomy of larger trochanter is helpful if more visualization is required.

Position: Lateral decubitus with hip in extension as well as knee in flexion to lessen the sciatic nerve.

Reduction technique for posterior wall portion

A posterior wall segment by the attached soft tissues must be turned back, revealing the fundamental femoral head. Reduction is obtained by gentle longitudinal traction along the femoral neck and all can be wedged into place, which guarantees marginally impacted fragments reduction along its posterior column line.

Reduction techniques for posterior column fractures

During reduction, rotation of posterior wall fragment must be corrected by placing a schanz screw on a T handle to the ischial tuberosity to performance as a grip for rotational control. With this in place and with exposure by the higher and lower notch by removal of sacrospinous ligaments either by blunt or sharp dissection or osteotomy of ischial spine, the medial fracture line can be palpated inside the pelvis, along

the quadrilateral plate, to determine the adequacy of reduction. This reduction may be further facilitated by using the specially devised pointed reduction clamps. For associated posterior wall as well as posterior column fracture, decrease of posterior column component should be carried out first. This allows for articular visualization of the reduction and makes it easier to control the posterior column and apply fixation. The constrain muscles plays the main deforming force of posterior column due to its origin from ischial tuberosity. Reduction of these fractures should be done by the hip extended as well as knee flexed to 90 degrees ^[10].

Fixation technique for posterior wall

Predrilling the glide holes through the unreduced fragment, ensures that the screws stay out of the joint. A well contoured buttress plate counterbalances the forces focused into this posterior wall as well as tends to prevent re dislocation. It is anchored at the ischial tuberosity via atleast 2 screws, and in the harder bone bigger to the acetabulum. The aim of post-operative administration were to: Exploit the functional status of individual, so as to enable early reoccurrence to function, early detection and appropriate management of complications.

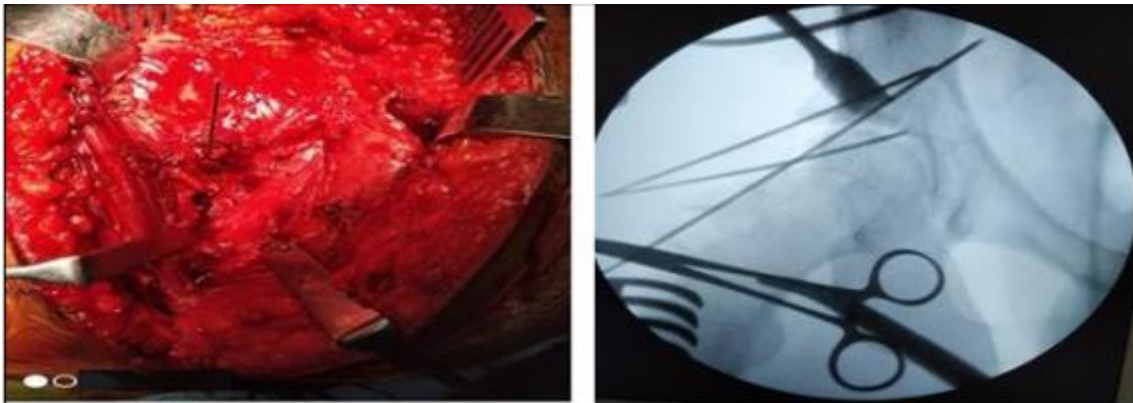


Fig 1: Fixation of the implant using K-wires by c-arm guidance



Fig 2: Fixation of the implant

Post-operative protocol

Broad spectrum antibiotics was given to all patients both pre and post operatively. Individuals are permitted to sit up in bed on 2nd post-operative day. Prophylaxis against DVT and heterotrophic ossification ^[11] in the form of elastic stockings, active ankle mobilization, indomethacin 25mg thrice daily for 6 weeks given. CPM, static quadriceps exercises as well as ankle dorsiflexion exercise was initiated within 24hours after operation. Drains were removed at 48 hours. Suture removal done on 12th post-operative day. Post-operative x-rays done to ensure quality of reduction and position of implants ^[12].

Mobilization procedure

- **Day 1:** Static quadriceps-based exercise was initiated.
- **Day 2:** CPM was started.
- **Day 3-7:** Dynamic quadriceps exercises, gait training on a walker, active flexion, delay and seizure exercises whilst standup were heartened;
- After the fracture had healed for about 12 weeks, full weight - bearing exercise ambulation was allowed, with the walkers progressively removed as desired.

Grading of the outcome

We used the modified Harris Hip Score to assess the functional outcome and Matta’s radiological grading to assess the radiological outcome in the operated patients.

Follow up and evaluation

Patients were followed up on outpatient basis at 1st month, 3rd month, 6th month, one year and three years of surgery at Devadoss Multi-specialty Hospital and nearby medical colleges. Functional and radiological evaluation was done at every visit. Functional evaluation was done using the modified Harris Hip Score. Radiological evaluation was done using Matta Score ^[13].

Results and Discussion

Thirty patients were taken up for study for a follow up period of three years. One patient was lost to follow up. Fracture union occurred at an average of 12 weeks. In our study only one patient required a hospital stay of 1 month, for the soft tissue healing. Two patients had heterotopic ossification, two patients had osteoarthritis of which one patient underwent total hip arthroplasty, three patients had sciatic nerve palsy which recovered following electrical stimulation without any residue. There was no patient of deformity or limb length discrepancy in our follow up study.

We have used the Modified Harris hip scoring system for assessing the outcome in this patient with acetabular fractures. Outstanding outcomes are attained in 15 individuals while better results were obtained in 6 patients and fair results were obtained in 6 patients. Poor results were obtained in 2 individuals of which one had heterotopic ossification and another patient had osteoarthritis for which total hip arthroplasty was done ^[14, 15].

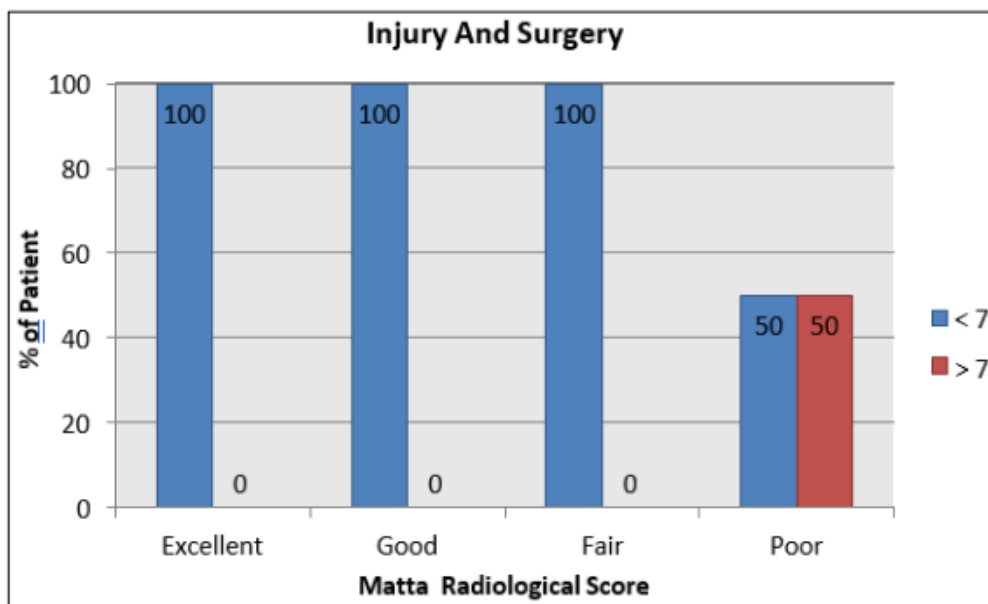


Fig 3: Duration between injury and surgery.

Table 1:Functional outcome

Functional outcome		Patients	%
Variable	Excellent	15	51.7
	Good	6	20.7
	Fair	6	20.7

	Poor	2	6.9
	Total	29	100.0

Table 2:Details of heterotopic ossification and osteo arthritis changes

Variable		Patients	%
Complications	Heterotopic Ossification	2	22.2
	Hip Osteo Arthritis	2	22.2
	Sciatic Palsy	3	33.3
	Wound Infection	2	22.2
	Total	9	100.0

Table 3:Final functional outcome

Variable		Final Functional Outcome				P-Value
		Excellent	Good	Fair	Poor	
Sex	Male	14	5	5	2	.809 NS
		93.3%	83.3%	83.3%	100.0%	
	Female	1	1	1	0	
		6.7%	16.7%	16.7%	0.0%	

Table 4:Age distribution in final functional outcome

Variable		Final Functional Outcome				P-Value
		Excellent	Good	Fair	Poor	
Age	< 30	10	0	2	0	.062 NS
		66.7%	0.0%	33.3%	0.0%	
	31 - 40	4	2	1	0	
		26.7%	33.3%	16.7%	0.0%	
	41 - 50	1	2	2	1	
		6.7%	33.3%	33.3%	50.0%	
	51 - 60	0	1	1	0	
		0.0%	16.7%	16.7%	0.0%	
	> 60	0	1	0	1	
		0.0%	16.7%	0.0%	50.0%	

Table 5: Functional result at the period of 3 years

Parameter	3 Years				P-Value
	Excellent	Good	Fair	Poor	
Average	93.6	85.2	76.0	69.0	.001 Sig
SD	2.0	3.0	3.5	0.0	

Table 6: Sex distribution

Parameter		Matta Radiological Score				P-Value
		Excellent	Good	Fair	Poor	
Sex	Male	14	5	5	2	.809 NS
		93.3%	83.3%	83.3%	100.0%	
	Female	1	1	1	0	
		6.7%	16.7%	16.7%	0.0%	

Table 7:Age distribution

Parameter		Matta Radiological Score				P-Value
		Excellent	Good	Fair	Poor	
Age	< 25	1	0	0	0	.711 NS
		6.7%	0.0%	0.0%	0.0%	
	26 - 50	13	4	5	2	
		86.7%	66.7%	83.3%	100.0%	
	> 50	1	2	1	0	
		6.7%	33.3%	16.7%	0.0%	

Table 8:Radiological assessment following initial displacement

Parameter		Matta Radiological Score			
		Excellent	Good	Fair	Poor
Initial Displacement	< 2 mm	14	6	6	2
		93.3%	100.0%	100.0%	100.0%
	> 2 mm	1	0	0	0
		6.7%	0.0%	0.0%	0.0%

Table 9:Duration between injury and surgery

Parameter		Matta Radiological Score				P-Value
		Excellent	Good	Fair	Poor	
Injury and Surgery	< 7	15	6	6	1	.709
		100.0%	100.0%	100.0%	50.0%	
	> 7	0	0	0	1	
		0.0%	0.0%	0.0%	50.0%	

Table 10:Comparison between the functional and radiological outcome

Variable	1 month	3 month	6 months	1 Year	3 Year
Mean	62.9	73.8	77.6	82.8	86.5
Std. Deviation	13.0	12.7	11.1	9.4	8.8

Table 11:

Variable		Final functional outcome				P-Value
		Excellent	Good	Fair	Poor	
Matta's Radiological Grading	Excellent	15	0	0	0	.000
		100.0%	0.0%	0.0%	0.0%	
	Good	0	6	0	0	
		0.0%	100.0%	0.0%	0.0%	
	Fair	0	0	6	0	
		0.0%	0.0%	100.0%	0.0%	
	Poor	0	0	0	2	
		0.0%	0.0%	0.0%	100.0%	

Functional outcome based on modified Harris hip score

The final functional result was good in 51.7% of the individuals, good & fair results in 20.7% of the patients & poor results in 6.9% of the patients. In our study, only 22.2% of the patients had complications like heterotopic ossification and osteoarthritis changes. In our study, 93.3% of males had excellent results and age distribution as 66.7% of patients had excellent results were less than 30 years of age.

Radiological assessment

In our study, we used Matta Radiological Scoring for assessing the radiological outcome of the patients. Fracture of the pelvis and acetabulum are relatively common injuries in adults. These fractures were produced by higher energy trauma and were linked by substantial morbidity and mortality. Anatomical decrease is required for adequate long-term functioning in articular injuries, particularly in weight-bearing bones of the lower extremities. As a result, acetabulum injuries provide a difficult obstacle to the orthopaedic surgeon. The frequency of acetabular fracture peaks in the 2nd and 3rd decades of life, indicating the class of the population who are susceptible for higher energy trauma. In our series of

29 patients, the most common age group was 21 - 40 years. The predominant sex affected were males in our series, the ratio of male to female being 9: 1. Automobile fortunes are the most general mode of injuries since tremendous amount of energy dissipation is involved in this injury, acetabular injuries were often linked by a spectrum of fractures to other bony and soft tissues structures, which complicate treatment and often determines the outcome in these injuries. The common soft tissue fracture linked with acetabular fracture in our series was the sciatic nerve palsy. The common skeletal injury associated was lower limb fractures. The thorough assessment and early resuscitation is of paramount importance in the management of these critically ill patients [15]. Radiography remains the principle identification tool in an evaluation of individuals with acetabular fractures. Computer tomography was essential for viewing the finer feature in the acetabular breakage. Eighteen categorized it as a basic fractures type, but its simplicity on plain radiographs conceals its complicate matters. The bulk of posterior wall fracture were macerated or connected with articular surface infiltrative damage into the supporting cancellous along the fractured line's edge. The therapeutic result has been found to

be linked to the accuracy with which these fractures are reduced. Fractures that involved more than half of the posterior part were deemed unstable. All other posterior walled fractures were regarded possibly unstable, even if they weren't linked with a known hip displacement. There were two posterior dislocations and one central dislocation associated with acetabular fractures in our series. Although posterolateral wall fractures are the most available and easily stabilized of all acetabular fractures, medicine of mineralized posterior wall fractures is linked with a range of possible problems, such as femoral head osteonecrosis, post-traumatic osteoarthritis, resorption of the wall shards, and failure of fixation of the wall. Preventing severe consequences like broken failure requires rigid stability at the time of the operation and the application of suitable postoperative safeguards. Report showed that the only form of fixation for stabilization of mashed breakages of the posterior wall was buttress plating augmented with spring plates. We used 4.5 mm/3.5 mm reconstruction plates and cancellous screws for fixation of posterior wall fractures. Two patients developed heterotrophic ossification of which one patient initially underwent native treatment and presented after five days while two patients had neuropraxia of the sciatic nerve at the period of presentation and one patient developed after surgery following stretching of the nerve. The palsy in such individuals was assumed to be induced by an inadvertent implantation of a plunger in the superior aspect notch. We agree with a study that, as a common rule, the quality of the therapeutic outcome based straightly on the quality of deduction that was attained when open decrease and interior fixation was performed. We also agree with Judet *et al.*² that anatomical reduction of acetabulum injuries is dependent on the right operative exposures being based primarily on the kind of fractures. Similarly, in our study, 27 patients who had perfect anatomical reduction and no other complications like sciatic

nerve palsy, heterotopic ossification had good and excellent functional outcome. A study showed that in a sample of 492 acetabular fractures, the incidence of perfect reductions with such a single operational technique was 73 percent generally. Despite achieving a perfect reduction in 94 percent of such broken bones, only 80 percent had satisfactory to outstanding treatment outcomes. A total of 262 acetabular fractures were studied in Matta's⁴ series, although the reduction was anatomic in more than 90% of cases, only 68% had good to excellent results. In another series by Saterbak *et al.*⁵, 85% had better to outstanding therapeutic score, that twinned the exactness of injury deduction. In our series of 29 patients, 15 (52%) had excellent, 6 (21%) had better, 6 (21%) had fair and 2 (6%) had poor clinical results. The following factors directly influenced the functional outcome *viz.*, old age, delayed presentation after the injury, native treatments, sciatic nerve palsy, heterotopic ossification. In our study we found that patients who had clinical and radiological arthritis has shown poor functional outcome during their follow up period.

Conclusion

The goal of our study was to attain constant internal fixation by anatomical restoration of an articular surface, particularly in the weight bearing dome. If operative therapy was designated and accomplished, every exertion should be completed to attain congruency, since these similar to be the main features in reasonable longer term functional outcomes without any residual deformity. On retrospective analysis, the longer term excellent functional result was directly predisposed through the related complications like heterotopic ossification, sciatic nerve palsy, and an increase in the duration between injury and surgery which may be due to associated life-threatening injuries or associated fractures.

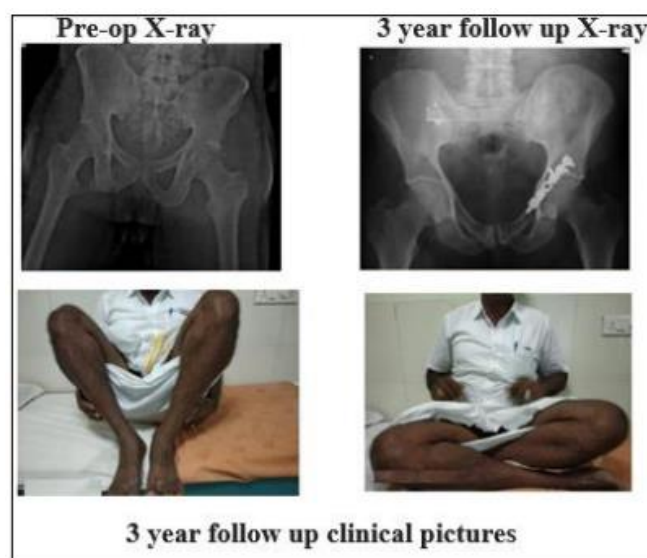


Fig 4: Case 1 pictures



Fig 5: Case 2 pictures

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