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Are screws enough? functional outcome in surgically treated posterior acetabular wall fracture using cannulated cancellous screws

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***Abstract*---**Background: Posterior wall fractures of acetabulum are the commonest type of acetabular fractures [1,2]. These fractures are usually associated with posterior dislocation of hip. Anatomical reduction and fixation are important to restore congruity and stability of joint, to decrease the risk of secondary arthritis and thus attain good functional outcome [3]. Fixation modalities comprise of both recon plates in buttress mode, lag screw fixation or combination of both.In our study, we aimed to assess the functional outcome and complications following the use of only cannulated screws as fixation mo Material and methods: A total of 11 patients with a diagnosis of posterior acetabular wall fracture were treated with surgical fixation of posterior acetabular wall using only cannulated cancellous screws. The patients were followed up strictly for 6 weeks, 3 months, 6 months, as well as 1 year and thereafter at yearly intervals as long as possible. Functional and radiological assessment were done using Merle D'Aubigne and Postel grading system and Matta's radiological criteria. Result:In our study, we noticed excellent outcome in 100% of the patients who had posterior wall fractures without hip dislocation. And an excellent outcome of 80% was noticed in those patients who had posterior wall fractures associated with hip dislocation.one patient developed avascular necrosis of head of femur and had fair outcome. Conclusion:Use of cannulated cancellous screws can thus provide stable fixation and give acceptable functional outcome for selected posterior wall fractures. Use of only screws has added advantage of lesser soft tissue dissection thus preserving the vascularity of the fracture fragments and lesser incidence of heterotropic ossification. Shorter surgical time decrease the incidence of surgical site infection. dality in posterior wall fracture of acetabulum.

***Keywords*---**Acetabulum, Hip fracture, Posterior wall fractures, bone screw, fracture fixation, femur head necrosis, cannulated screw fixation.

Introduction

Posterior wall fractures of acetabulum are the commonest type of acetabular fractures[1,2].These fractures are usually associated with posterior dislocation of hip.

The severity of injury is based on the initial traumatic insult. Thetrauma determines the size, comminution, displacement of fracture fragments, presence of marginal impaction in articular surface of acetabulum and femur head dislocation. Anatomical reduction and fixation is important to restore congruity and stability of joint, to decrease the risk of secondary arthritis and thus attain good functional outcome[3].

Apart from anatomical fixation, focus has to be given to meticulous dissection of fragments to prevent vascular insult toposterior wall fragments that can lead to necrosis and resorption of fracture fragments thus causing joint instability[4].
Fixation modalities comprise of both recon plates in buttress mode, lagscrew fixation or combination of both.A cadaveric biomechanical study by Zhang et al[5]comparing fixation methods found no significance in displacement between three methods viz., two lag screws alone, two screws with reconstruction plates and two screws with locked reconstruction plates.

In our study, we aimed to assess the functional outcome and complications following the use of only cannulated screws as fixation modality in posterior wall fracture of acetabulum.

Method

All patients diagnosed with posterior wall fracture of acetabulum operated between 2012 to 2020 at the author's institution were included for this study. Patients with pre-existing arthritis of hip, ipsilateral fracture neck femur and pelvic ring injuries were excluded from the study. Only those fractures which were fixed with screws alone was considered for this study. A clearance from the Instituitional ethical committee was obtained for the same.

We had eleven posterior wall fractures that were fixed with only cannulated screws. Five patients out of eleven (45.5%) had associated posterior hip dislocation. All patients presented to the hospital within 24 hours of injury.
Radiological evaluation comprised of one anteroposterior view &judetviews(obturator and iliac oblique view). CT scan with 3D reconstruction was done to get additional informationabout articular impaction, incarcerated small fragments and fracture anatomy.For fractures associated with hip dislocation, closed reduction was done as soon as the patient was deemed stable. Following joint reduction, joint was tested for stability and later immobilized with

a proximal tibia skeletal traction.CT scan was done following reduction of dislocation.

Open reduction and internal fixation of the fracture was carried out on 5th-7thday from the time of injury. Patient was placed in lateraldecubitus position and Kocher-Langenbeck approach was used. Gluteus maximus muscle was split between the upper third and lower two third of the muscle using the avascular interval.Partial release of insertion of gluteus maximus was done to allow for adequate postero-medial retraction..However, care was taken to avoid damage to the first perforating branch of profunda femoris artery situated closeby. Later piriformis tendon, obturator internus tendon with gemelli muscles were identified, tagged with sutures and were incised about 1.5cm away from their insertion to avoid injury to circumflex femoral vessels and their branches. Both these tendons were elevated from the hip capsule. If gluteus minimus was found to be damaged or contused the muscle was debrided. The joint capsule and the soft tissue attachments to the fracture fragments were not dissected to prevent vascular injury to fragments and joint surfaces were exposed through the fracture[6].Hip joint was distracted by manual traction using a schanz screw to greater trochanter and longitudinal traction .The hip joint was thoroughly cleared of any small incarcerated fragments and fracture fragments were reduced anatomically and held with k wires. Two patients had marginal impaction which was elevated and rotated into an anatomical position before reducing the other fragments.

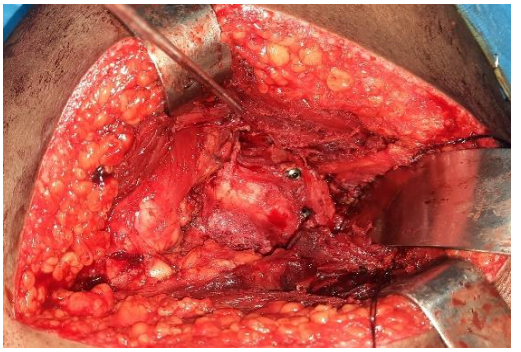

Image1: Intra-operative picture showing minimal soft tissue dissection and screw fixation

Depending on the size of the fracture fragments two or more 3.5mm screws were used to fix the fracture. In communited fractures, each fracture fragment was fixed with one screw after ensuring perfect anatomical reduction by matching the fracture interdigitation to get rotational stability and in single fragment posterior wall fracture two screws were fixed in divergent fashion, one directed superiorly towards the dome and inferior one directed between ischial tuberosity and ischial spine to the posterior column.(fig).Finally hip is taken through the full range of movements to check for joint stability and to assess the freedom of motion. Intra-operative check radiographs are taken to assess the reduction and fixation intra-operatively.

Post operatively check radiographs are taken including judet views.On the second post-operative day patient was started on hip range of movement exercises and non-weight bearing walker assisted ambulation. At six weeks of post-operative period, after check x-rays, we started partial weight bearing and full bearing was allowed after three months. Patient was followed up at sixth week, twelfth week, sixth month, yearly afterwards.In every follow-up the patient was assessed clinically using Merle D'Aubigne and Postelhip scoring[7] and radiologically using Matta's criteria[8].

As per Merle D'Aubigne and Postel grading system, absolute estimate of hip function was evaluated considering pain & morbidity of hip joint. Based on this we considered hip function as very good with a score of more than 10, good is a score of 10, medium is a score of 9, fair is 8 and poor is 7 and below.

The grading of the radiological results was considered as per matta's radiological criteria. Excellent was when hip was normal. Good was when there were small osteophytes, >1 mm joint space narrowing with minimal sclerosis. Fair was with moderate osteophyte, <50% joint space narrowing, moderate sclerosis & femoral head collapse. Results were considered poor with large osteophytes, >50% joint space reduction, severe sclerosis & femoral head collapse.

Results:

Among all the posterior wall fractures operated between 2012 to 2020, we had eleven cases of posterior wall fractures fixed with screws alone. Five of the cases (45.5%) had associated posterior dislocation of hip joint. The mean age of the patients in this study group was 41.7± 13.5. Patients were followed up at 6 weeks, 12 weeks, 6 months and yearly thereafter. The mean duration of follow-up in our study group was 3.3 years ± SD 2.1 years.

		PWF+D*		PWF**	
		Count	Column N %	Count	Column N %
Clinical assessment					
At-6 weeks post op	Fair	0	0.0%	2	33.3%
	good	1	20.0%	1	16.7%
	excellent	4	80.0%	3	50.0%
At-12 weeks post op	good	1	20.0%	0	0.0%
	excellent	4	80.0%	6	100.0%
At-6 months post op	Fair	1	20.0%	0	0.0%
	excellent	4	80.0%	6	100.0%
At-1 year post op & yearly follow-up	Fair	1	20.0%	0	0.0%
	excellent	4	80.0%	6	100.0%
Radiological assessment (Matta's criteria)					
At 6 weeks post op	excellent	5	100.0%	6	100.0%
At 12 weeks post op	excellent	5	100.0%	6	100.0%
At 6 months post op	excellent	4	80.0%	6	100.0%

	Good	1	20.0%	0	0.0%
At 1 year post op & yearly follow-up	excellent	4	80.0%	6	100.0%
	fair	1	20.0%	0	0.0%

P value for the above comparison

HIP SCORE	Fishers exact test p value	Remarks
At 6 weeks post op	0.712	Not significant
At 12 weeks post op	0.455	Not significant
At 6 months post op	0.455	Not significant
At 1 year & yearly follow-up	0.455	Not significant
Matta's criteria		
At -6 weeks post op	..	Not significant
At -12 weeks post op	..	Not significant
At -6 months post op	0.455	Not significant
At -1-year post op and yearly follow-up	0.455	Not significant

The clinical outcome was very good in all patients who had only posterior wall fracture without dislocation. In fractures associated with dislocation of hip 80% had very good results. Only one of these patients developed avascular necrosis of femoral head, joint space reduction and resorption of fragments and thus had a fair outcome. He probably had a violent injury considering the amount of soft tissue damage. His posterior capsule, pyriformis and short external rotators were all damaged significantly. This patient had peroneal nerve palsy too, but recovered completely later-on.

Radiological healing was achieved at 6-12 weeks post-operatively. Excellent outcome was noted in all the patients except for the one case who developed necrosis of femoral head.

None of our patients had complications like deep vein thrombosis, heterotropic ossification, fixation failure and hardware penetration to the joint. Superficial wound infection was noted in one of the patients, however it healed without any functional consequences.

We did not notice any statistically significant difference in the functional and radiological outcome between patients who had isolated posterior wall fractures and those with associated posterior hip dislocation.However, we had a small number of patients to draw a sound statistical conclusion.

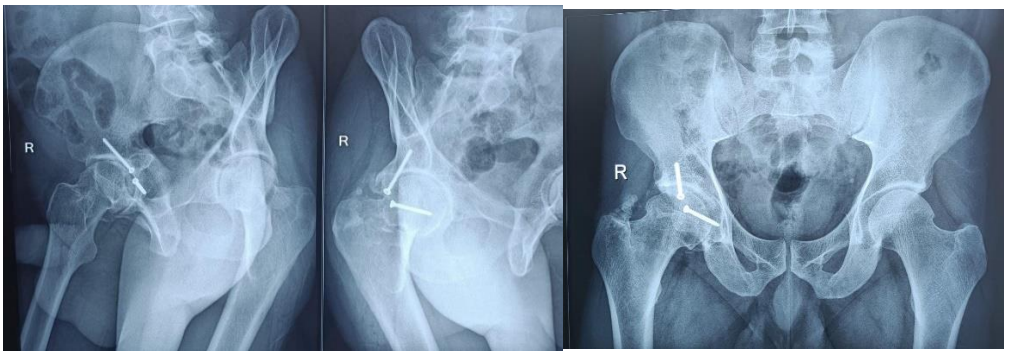

Image2&3: ten years post-op follow-up x-ray images

Discussion

Surgical treatment of acetabular fractures is technically demanding in view of the complex pelvic anatomy and the proximity of hip joint. However, access to posterior wall fracture is relatively easier considering the familiarity of posterior approach to many surgeons. In spite of familiarity of surgical approach, the reported clinical results have not always been good. In the series of Letournel and Judet[1], only 82 % had good results despite perfect reduction in 94% of patients.
Various factors play a role in determining the outcome following such fractures. Timing of surgery, meticulous soft tissue dissection, quality of reduction and internal fixation are definitely surgeon dependent factors.

Aho et al[9]had a series with 20 patients treated with screw fixation for posterior wall fractures with a follow-up of 5 years. In their study 70% had good results and 30% had avascular necrosis of femoral head. Pantazopoulos et al[10] had 52 patients treated with screw fixation for posterior wall fractures. They had excellent results in 87% of patients. In our study, we noticed excellent outcome in 100% of the patients who had posterior wall fractures without hip dislocation. And an excellent outcome of 80% was noticed in those patients who had posterior wall fracturesassociated with hip dislocation. We feel the following as reasons for having less incidence of avascular necrosis in our study: 1. During reduction and fixation of the fracture, we always worked through the fracture without effacing the soft tissue and capsular attachments from the posterior wall fragment, thus avoiding iatrogenic cause for necrosis and resorption of fragments. 2. Meticulous soft tissue dissection of short external rotators probably helped in preserving the remaining vascular supply to femoral head. 3. Early reduction of the hip joint dislocation also might have contributed in preventing incidence of avascular necrosis in our patients.

As noted in the study by Bosse MJ et al[11]the challenging aspect of this surgery is to position the lag screw through a small fracture fragment while controlling the angle of advancement, so that the joint is not penetrated. We did not have any case with hardware penetration in our study. What we noticed is that, when buttress plates were not used for augmenting posterior wall fixation, it was easier to direct the lag screws away from joint to secure the fracture fragments. We place a depth gauge in the drilled hole and feel for the breach into the joint. Once the integrity of the screw hole is established, we place the screw over a guidewire to

fix the fracture. This technique probably helped us not to have a complication of joint penetration of hardware in our cases.Not using buttress plate provided us with two advantages.firstly as we were only using cannulated screws the soft tissue dissection was lesser and the surgical time was also shorter.both these factor reduced the incidence of surgical site infection.secondly the absence of the plate allowed us the freedom to place the screws in the perfect position to get accurate fixation of the fragment without worrying about interfering with the plate.

Posterior wall fractures have a wide variety of fracture patterns and displacements. In our study group, we had fractures with single fragment configuration as well as few were with minimal comminution. We had no case of fixation failure in our series. So, buttress plate might not be always required to supplement the screw fixation. Only cannulated cancellous screws can be used as fixation modality if fragment size is big enough to be held by screw without splintering the fragment. In a case of single fragment posterior wall fracture, two screws placed in the same fracture fragment will provide rotational stability. However, in comminution when only one screw could be applied to each small fragment, rotational stability was achieved by accurateanatomical reduction of inter-digitations of the fractured fragments. The screws were angulated enough to get good purchase and not to produce shear at the fracture site. Most of the times screws were placed almost tangentially to the acetabulum as a whole.

Conclusion

Use of cannulated cancellous screws can thus provide stable fixation and give acceptable functional outcome for selected posterior wall fractures. Use of only screws has added advantage of lesser soft tissue dissectionthus preserving the vascularity of the fracture fragments and lesser incidence of heterotropic ossification.Shorter surgical time decrease the incidence of surgical site infection.
We declare that there is no conflict of interest concerning this article.

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