

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: -<a href="http://www.journalijar.com">www.journalijar.com</a></p> <h2>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</h2> <p>Article DOI:10.21474/IJAR01/13972 DOI URL: <a href="http://dx.doi.org/10.21474/IJAR01/13972">http://dx.doi.org/10.21474/IJAR01/13972</a></p>	 <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR) ISSN 2320-5407 Journal Homepage: <a href="http://www.journalijar.com">http://www.journalijar.com</a> Journal DOI:10.21474/IJAR01</p>
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### RESEARCH ARTICLE

## A RETROSPECTIVE STUDY ON FUNCTIONAL OUTCOME OF OPERATED INTERTROCHANTERIC FEMUR FRACTURES REDUCED WITH A POSITIVE BEAK VS NEUTRAL VS NEGATIVE BEAK – AN ARTICLE AND REVIEW OF LITERATURE

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#### Manuscript Info

##### Manuscript History

Received: 25 October 2021

Final Accepted: 29 November 2021

Published: December 2021

#### Abstract

**Background:** Inter-trochanteric fracture is one of the most common fractures in elderly population around the world due to global rise of osteoporosis, which is generally due to a simple slip and fall in the house hold[1]. It is growing to be a disease burden for orthopedics of our era to manage. With its rise Understanding the important factors in management of IT fracture like stability, reduction, role of posterior-medial wall support, intact lateral wall configuration, will help in choosing implant for better outcome, thus helping to achieve better post operative results[2]. Hence, understanding the role of posteromedial wall support in IT fracture reduction in terms of positive, neutral(anatomic) or negative beak and its impact on the post operative fracture stability and early ambulation is of great importance. We conducted a retrospective comparative study in our institution to study the outcome of these configuration and its effect post operatively.

**Methods:** A retrospective comparative study was conducted on 60 patients with Intertrochanteric fracture(38 males and 12 females with a mean age of 64.8years) without any associated fractures in elderly population in a time frame between February 2019 to August 2021 using Cephalo-mudullary nailing and Sliding hip screw in our institution. The subject population was graded into 3 groups based on the postero medial cortical wall support in post operative fracture reduction into positive, neutral(anatomic) and negative beak configuration and its effects on post operative fracture stability and early mobilization.

**Results:** In the post operative analysis it was found that the 24 subjects who had positive configuration in the neck shaft angle versus 16 neutral(anatomic) and 10 negative configuration in their neck shaft angle had a superior and better outcome in terms of early ambulation and better long term stability without any statistical differences in terms of age, sex, post traumatic day or any co-morbidities.

**Conclusion:** Thus, we concluded that the fracture reduction with positive reduction achieved a greater stability in terms of early mobilization and better post operative stability and fracture healing than the neutral and negative neck shaft angle. Further it was seen that neutral configuration also had a superior advantage over negative configuration in post operative follow up with a lesser incidence of varus collapse or implant failure.

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**Introduction:-**

Femoral intertrochanteric fractures are one of the most common fractures in the elderly and became more common as the rate of elderly people increases. These fractures can become life-threatening diseases in elderly patients. The incidence of which is increasing over time due to the increase in the rate of osteoporosis. Surgery is one of the choices for treatment of intertrochanteric fractures. After stable fixation of intertrochanteric fractures, patients can mobilize more quickly and return to their previous level of function. The important factors in intertrochanteric fracture management are stability evaluation, reduction, and whether lateral wall or posteromedial wall is intact or not. Considering these factors helps the surgeons choose implants for a better outcome[3].

Over the years various modifications of implants played an important role in an once dreadful Inter trochanteric fractures. Modifications from plain conservative approach to 95 degree dynamic compression plate, to dynamic hip screw to the modern proximal femoral nailing modification of cephalomedullary nailing[4], these modifications greatly improved the post operative outcome of IT fractures in the recent years.

Despite these modifications the elderly population is still suffering with this fracture and its outcome are dreadful, it's still a challenge to doctors around the world. The future union rates have significantly improved with the modifications of various implants but the functional outcomes are still very poor.[5][6] A combination of factors, such as medical comorbidities, patient compliance, fracture pattern, quality of the bone, and environmental factors are thought to be responsible for this poor results[7]. However, the most important factor that plays a part in this fracture management is stability of the fracture reduction post operatively.

The post operative stability greatly depends on fracture reduction both in AP and Lateral radiographs. Here in this article we talk about the postero medial wall stability of the fracture reduction configuration post operatively where we define it into three groups- positive, neutral(anatomic) and negative neck shaft angle based on the AP radiographs. It is defined as the relation of the postero medial cortex of the head-neck fragment and its displacement, located a little bit superomedially to the medial cortex of the femur shaft in AP view. This is the key element as it helps to predict the post operative outcome and prevents the evil outcome of varus collapse of this construct on post operative ambulation[8].

**Patient And Methods:-**

In our institution after the approval of the ethics committee a retrospective observational study took place where 60(sixty) patients participated over a period of 2 years from February 2019 to August 2021. Of which the mean age group was around 64.8 years with 38 males and 22 females were taken [chart 3]. All the subjects were chosen randomly admitted in our IPD with intertrochanteric fracture meeting the criteria of-

1. Consent to take part in the study
2. Non pathologic fractures
3. Ambulatory before the trauma
4. No associated fractures
5. Regular follow for about 6 months post op
6. Both stable and unstable fractures under AO/OTA classification

All the patient records were collected from the medical records section and regular follow up was monitored. Their pre-anaesthetic scores were taken into account and checked for any serious co-morbidity that would prevent them from any post operative complication that would prevent them from ambulation and followup. Follow-up data included the timing of full weight bearing walk, patient self-assessment, clinical and radiographic check at 3 and 6 months after surgery. Fullweight bearing was assessed by simply observing the patient walk, without any assistive device, or only one-hand stick was used for body balance. All this data was collected and analysed statistically using different statistical tools with a p value of <0.05.

An overall 60 patients were enrolled using random selection amongst IPD patients. Of which males and females were in a ratio of 0.64:0.36. out of which 34 underwent Cephalomedullary nailing, 20 underwent Sliding hip screw and 6 underwent 95 degree dynamic compressing screw. The fractures were classified under AO/OTA classification for stable and unstable fractures where 22 were stable and rest were all unstable fractures[1]. All patients under went

immediate post op x-ray depending on which they were classified into 3 sub categories of positive, neutral and negative beak under AP radiographs based on the posterior-medial cortical support and the neck shaft angle.

Further more there were around 8 patient who needed revision surgery based on their outcome in post operative period due to varus collapse and implant failure on weight bearing.

### **Results:-**

The overall study showed resulted outlining 2 subject population categories which included pre operative cases depending on their AP/Lateral radiographs using AO/OTA classification into stable and unstable fractures. Further, which was subdivided on the basis AP radiographs on the post operative films into positive (Fig1), neutral (anatomic) and negative postero medial cortical contact (chart 4). These patients were subjected to post operative ambulation depending on their stability of reduction. The positive reduction cases consisted of 38 patients out of which 16 were stable and rest unstable were made to start early mobilization from post operative day 1. Stable IT fractures with positive beak were asked to start full weight bearing and the unstable IT fractures to start partial weight bearing for 2 weeks followed by repeat x-rays to if displacement in reduction and changed to full weight bearing.

The neutral beak (Fig 2) subjects comprising of 5 stable and 9 unstable fractures were all asked to delay weight bearing for 1 week followed by partial weight bearing. The last group of subjects with negative beak were started with nil weight bearing for 3 weeks followed by partial weight bearing.

In general all the patients were subjected to repeat xrays at 3<sup>rd</sup> and 6<sup>th</sup> week followed by 3 monthly and 6 monthly followup. Out of the 60 subject group 2 were lost to follow-up in this period of 3 monthly and 6 monthly xrays.

None in the positive group had any issue with weight bearing and fracture healing. But the neutral and negative beak individuals suffered from complications. In the neutral group 4 individuals in the 3 monthly xrays showed signs of varus collapse and conversion of neutral into negative beak but this problem was tackled with conversion of partial into nil weight bearing with walker for another 4 weeks and followed xrays showed fracture healing prevented construct failure and thus revision surgeries. In the last group of negative beak (FIG3) 10 out of 10 individuals showed varus collapse at 3 monthly followup and subjected to revision surgery due to implant failure, and 2 of which lost to follow-up further. (chart 2)

### **Discussion:-**

In the operation of intertrochanteric fractures intra-operative fracture reduction plays a pivotal part in the post operative outcome of the patient, anatomic reduction is always prior to the recommended positions by the various implants. For good alignment the garden alignments and anteromedial contact between the femoral head-neck and shaft are very important [9], but it should be clarified that the valgus attitude of the fracture alignment are not synonymous to the positive postero-medial support in the fracture configuration.

The intra-operative fracture reduction are broadly divided into positive, neutral and negative beak depending on the AP radiographs on the basis of their postero-medial cortex support. the positive beak is where the distal fracture fragment is medial to the proximal head-neck fragment is superior as it prevents the fracture fragment sliding leading to varus cut out if the fracture and thus implant failure. The positive beak can be achieved by intraoperative fracture compression and postoperative impaction via controlled sliding along the axis of the instrument device (helical blade or lag screw). The controlled fracture impaction is particularly important for the maintenance of stable reduction during fracture healing, and is compatible with the subsequent dynamic events of cyclic loading and remodelling across the fracture line. Hence, The concept of nonanatomic positive cortex buttress reduction was firstly introduced by Gotfried [10, 11] for displaced subcapital femoral neck fracture in its article. As in positive medial cortical support position, the cortex contact between the two main fragments are achieved, meanwhile, the medial cortex of the femoral shaft can resist the femoral head-neck fragment from further sliding laterally.

Further more the neutral (anatomic) and negative beak form the inferior reduction configuration than the positive beak as the so-called "anatomic reduction" shown in intraoperative fluoroscopy may contain three sub-conditions: some are in exact anatomic cortex-to-cortex position, others in slight positive position, and still others in slight negative position. But as the image resolution was limited, those sub-conditions were hardly to be distinguished clearly. So we used the term "neutral" to instead "anatomic". After bone resorption of the fracture line, slight

negative position might become truly negative position[12]. In our study the 14 patients had neutral beak out of which 4 patients had varus collapse post operatively which is suggestive of the fact they were in slight negative position and hence it becomes very unreliable to just accept neutral beak intraoperatively for “good reduction” as there is a 28.57%(4/14) that they might succumb to implant failure and thus later on might need revision surgery(chart 2).

As per our data the negative postero medial cortical support is an unstable reduction with a very high chances of implant failure and revision surgery becomes absolute necessary for the patient to be able to walk again. The chances of implant failure was seen around 100% (10/10)and out these 80(8/10) needed revision surgery. Thereby increasing the morbidity of these patients.[13]

So our recommendation will be to have a slight positive beak with positive cortico medial support in the AP radiograph with valgus alignment allows limited sliding of the head-neck fragment to the contact with distal femur shaft achieves greater secondary stability providing a good mechanical environment or fracture healing and greater long term benefits.

Chart 1:-

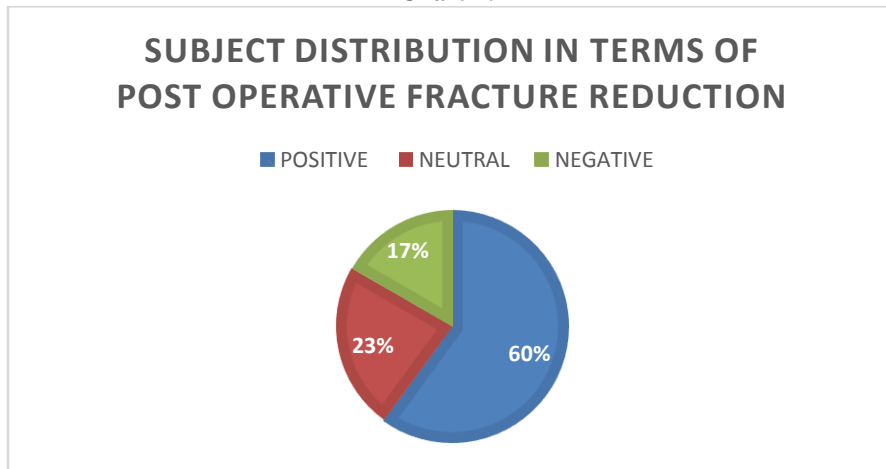


Chart 2:-

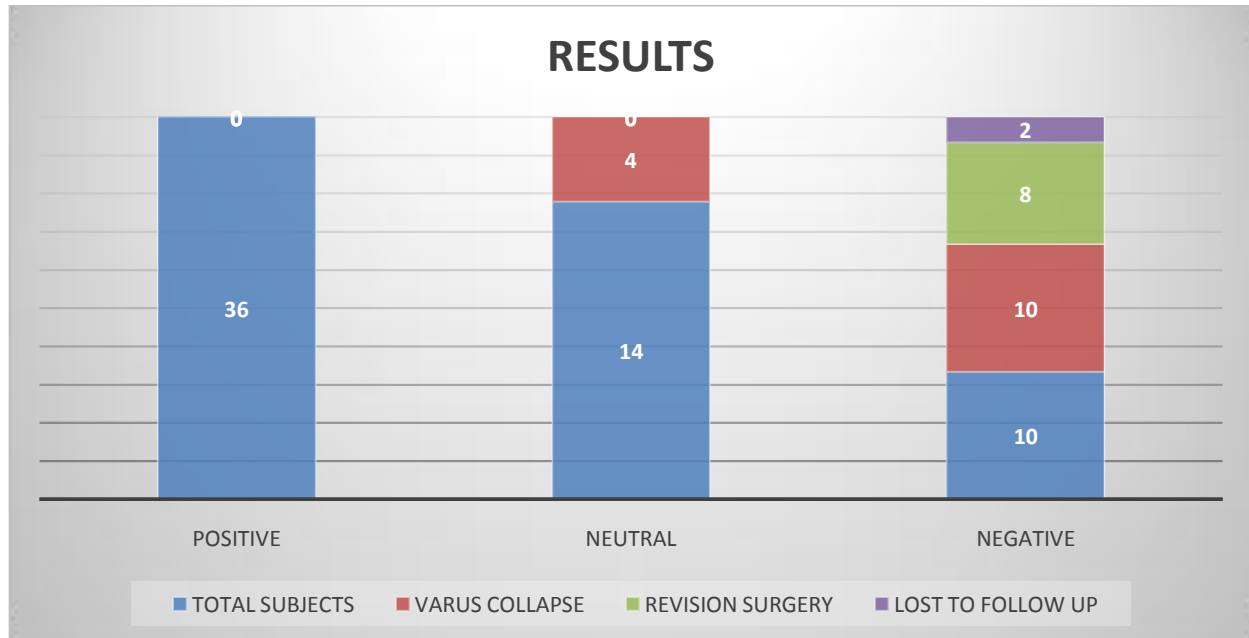


Chart 3:-

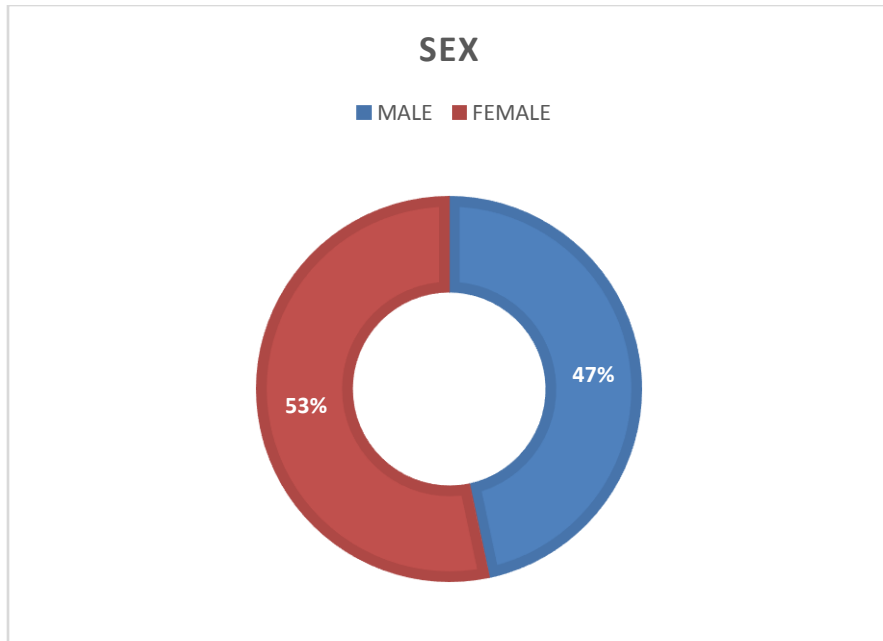
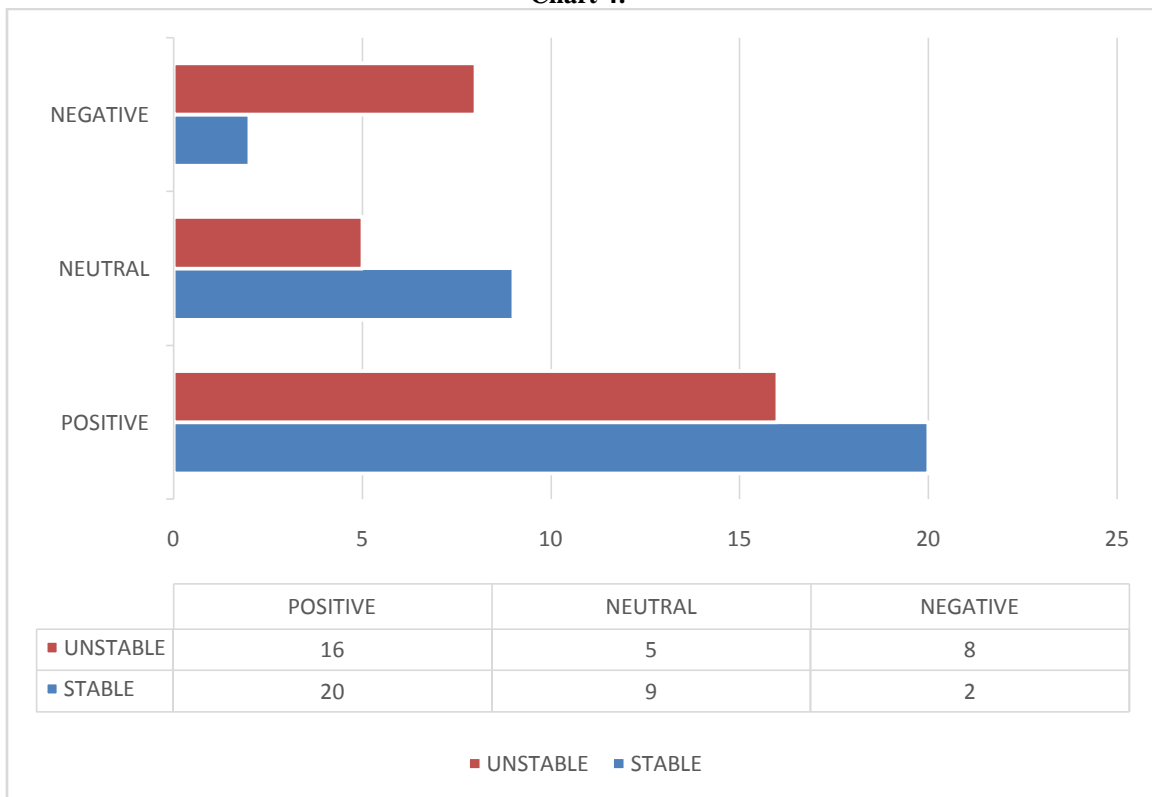


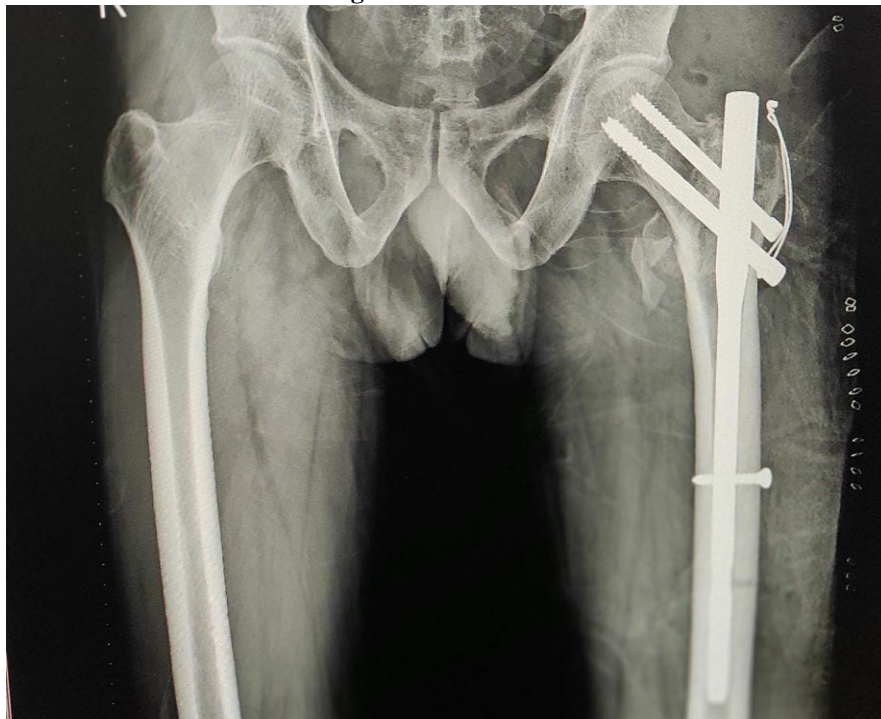
Chart 4:-



**Fig 1:- Positive Beak.**



**Fig 2:- Neutral Beak.**



**Fig 3:- Negative Beak.****Conclusion:-**

Thus, we concluded that the fracture reduction with positive reduction achieved a greater stability in terms of early mobilization and better post operative stability and fracture healing than the neutral and negative neck shaft angle. Further it was seen that neutral configuration also had a superior advantage over negative configuration in post operative follow up with a lesser incidence of varus collapse or implant failure.

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