



Original Research Article

Fracture neck femur during COVID pandemic valgus reduction for osteosynthesis (inferior calcar buttress reduction)

Shiva Shankar Jha^{1,*}¹Dept. of Orthopaedic and Joint Replacement Surgeon, Mahavir Vaatsalya Asptal, Patna, Bihar, India

ARTICLE INFO

Article history:

Received 21-05-2020

Accepted 25-06-2020

Available online 17-07-2020

Keywords:

Fracture neck femur

Valgus reduction

Osteosynthesis

Cancellous screw

Union

Stress

Reduction

Conventional fixation

Covid

Cytokine reaction and storm

ABSTRACT

Fracture neck femur following high velocity injury is likely to increase after resumption of vehicular traffic and other day to day activities including fall from height, sporting injuries etc. In this covid era, in a positive covid scenario in a patient, surgery should preferably be deferred till four weeks, by which time the “second cytokine storm” response settles down. In a covid negative scenario also, the patient subsequently developing covid positive is a definite possibility. In displaced unstable fracture neck femur, osteosynthesis can be contemplated because of factors present in the fracture and surgeon’s preference requiring emergency intervention since earliest surgical intervention will prognostically give better results in terms of union. This study emphasises on inferior calcar buttress reduction with positive cortical apposition and reverse triangular design of conventional cancellous screw fixation as contributory factors to sustainable reduction and union.

© 2020 Published by Innovative Publication. This is an open access article under the CC BY-NC license (<https://creativecommons.org/licenses/by-nc/4.0/>)

1. Introduction

Valgus reduction over 5 degrees generates increasing compression force between the implants and bones, forms an impediment for loss of reduction at fracture site in fracture neck femur. For achieving this valgus reduction in a displaced fracture, this could be achieved by a radiological nomenclature known as inferior calcar buttress reduction.¹ This reduction pattern of course is a non-anatomic reduction design advocated for displaced Garden Type III and Type IV femoral neck fractures, where osteosynthesis is desirable.² Anatomic cortical apposition with resultant smooth contact of two inferior cortices which naturally is present in Garden’s Grade I, and Grade II or can be achieved by closed reduction in Garden’s Grade III and Grade IV.³

In spite of achieving an anatomical reduction in Grade III and specially in Grade IV, there are chances that

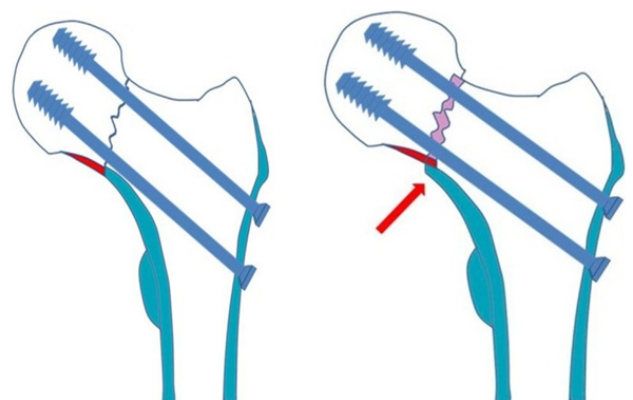


Fig. 1: a. Anatomic Reduction, b. Inferior Cortical Buttress Reduction

* Corresponding author.

E-mail address: drssjha@gmail.com (S. S. Jha).

Table 1: Anatomical or mild valgus

	Pauwel I	Pauwel II	Pauwel III
Garden I	In situ		
Garden II	Anatomical	Anatomical	Valgus
Garden III	Anatomical	Valgus	Valgus
Garden IV	Valgus	Valgus	Valgus

re-displacement into adduction / varus angulation at the fracture site does take place, thereby resulting into definite failure of non-union. To prevent this varus angulation with subsequent neck shortening, early fixation failure, non-union and avascular necrosis of the femoral head, a valgus reduction is an age old procedure, which could be a guarantee against non-union.^{4,5} A valgus reduction to be successful has to be more than 5 degrees. This valgus reduction does not allow re-displacement. This can be ensured on certain post-reduction radiological parameters. In an A P View of the hip taken in 10 degrees internal rotation, buttress cortical apposition with the two proximal and distal inferior cortices should be located in positive support contact in such a fashion that the proximal medial cortex gets lodged lateral to the distal inferior cortex with effective more than 5 degrees resultant valgus. For achieving this reduction, the affected limb is further externally rotated. Traction is now given and limb is abducted first. This is followed by taking the limb back into adduction and 10 degrees internal rotation. A check radiograph confirms the inferior calcar buttress reduction.

2. When to operate during covid pandemic

Timing of surgery specially when deciding in favour of osteosynthesis in fracture neck femur becomes vital. During this covid pandemic Indian Orthopaedic Association has recommended neck femur surgery as a relative indications for emergency surgery. British Orthopaedic Association has recommended to defer surgery in Garden Grade I and Grade II stable fracture neck of femur but Grade III and Grade IV for unstable fractures allows the surgeon the freedom to operate earliest. Though, there are recommendations in favour of replacement (hemiarthroplasty more than THA) as compared to osteosynthesis but, apart from age, presence of comminution of the posterior cortex specially, low or high velocity trauma and presence or absence of comorbid conditions, decision for osteosynthesis can also be taken.

As far as covid pandemic is concerned, even a negative RT-PCR patient can become a positive patient post-operatively. Hence, it is imperative to consider all the patients to be a potential likely case of covid. With this knowledge, the surgeon must be aware of the two stages of the covid-19 disease when the patients have higher immune reaction and are likely to be highly infective as well. Hence, the surgery should be deferred wherever to possible to end of fourth week. This timing will also prevent infection

from the patient to the members of surgical team. From beginning of the disease till the end of five to seven days is the stage of ROBUST IMMUNE RESPONSE⁶ whereas by the end of second week, a second cytokine storm takes place which may take a serious turn leading to even death of the patient.^{7,8} Patient invariably recovers in third week and stabilizes by four weeks. All the acute phase reactants are elevated like ESR, C-reactive protein, Serum Amyloid A and Ferritin. During second cytokine storm in severe disease, lymphopenia is evident and is a bad prognostic indicator. Fracture neck of the femur is riddled with factors like multi-proned problem with Small proximal fragment, bathed in synovial fluid, lacks periosteal layer and callus formation is limited. A dictum "An Unnecessary Brush Stroke Can Spoil A Painted Portrait" is more relevant here and hence, the surgeon has to - Know How To Proceed and also - Know When To Stop.

30-day mortality rate after femoral neck fracture is a well utilised marker of clinical outcome. In an elderly fragility fracture it is as high as 9.6% but 1-year mortality rate increases to 33%. It is a matter of concern that fragility displaced femoral neck fractures, the preferred method of treatment is total hip arthroplasty (THA) or hemiarthroplasty (HA) in the geriatric population. In high volume THA centers, total hip arthroplasty has better performance results as compared to low volume THA centers.

**Fig. 2:** Pre-operative

Conventional fixation (CFIX) utilising three parallel cannulated cancellous screw standard method of fixation for reconstruction of the femoral neck. An additional controversial fourth screw can be placed only if there is comminution of the posterior neck. These three parallel screws counters bending and shearing forces at the fracture site but presence of a comminuted fragment exerts increased usual force in the proximal femur. It has the disadvantage that it cannot withstand the deforming forces and can lead



Fig. 3: Post-operative, 12 weeks

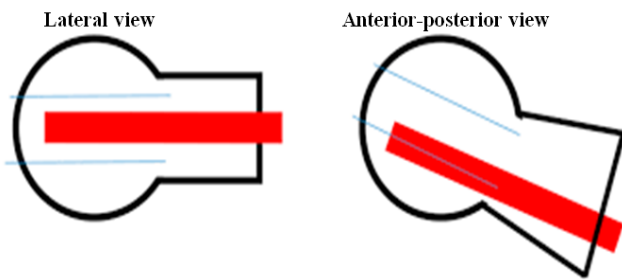


Fig. 4: First screw placement

to early failure of both fixation and reduction.⁹ Avascular necrosis is a complication, which altogether is a separate phenomenon. After achieving valgus reduction, temporary fixation of reduction is done with K-wires. The first screw should be passed in the centre of neck in the lateral view and in A. P. view, it should lie in the inferior part of the head and neck. Two more parallel screws are now placed from lateral cortex to the head completing the fixation.¹⁰ The distance between tip of the screw and the internal head surface added in both A. P. and lateral views should not exceed 25 millimeters.

The pattern of introduction of three cancellous screws has been vertical, triangle with apex up, reverse triangle with apex down, medial triangular design with apex medial, lateral triangular design with apex lateral. The principal strains generated at various entry points at screw heads are dissipated locally by placement of washers. Higher risk of

cutout can be visualised by the orange regions at screw heads (figure 8). Various biomechanical studies conclude in favour of reverse triangle model. The apex screw should not be placed below the lesser trochanter to minimise possibility of sub-trochanteric fracture.

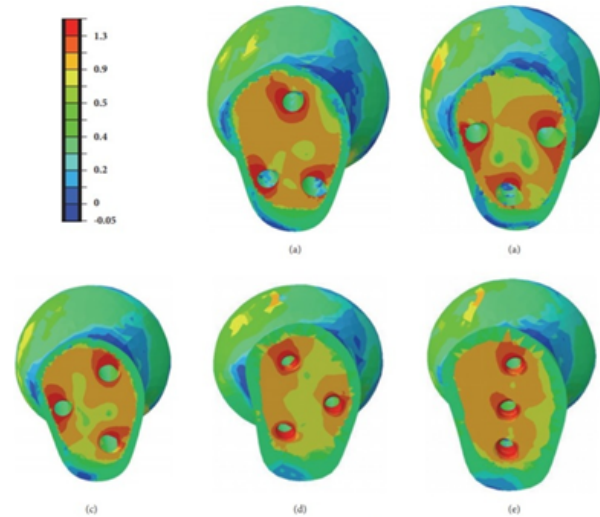


Fig. 5: Various designs of screw fixation

(a) Triangle model (b) Inverted triangle model (c) Anterior triangle model (d) Posterior triangle (e) Vertical model. Orange regions indicating the stress with higher risk of cutout.

3. Summary

Valgus reduction in displaced unstable fracture neck femur can provide a safe passage in terms of union of the fracture. This valgus reduction on radiological parameters has been nicknamed “inferior calcar buttress reduction” contemplating proximal calcar locked medial to the distal calcar. Correlation of desirability of valgus reduction over anatomical reduction in terms of Pauwel’s classification has been recommended. The conventional fixation with three parallel cannulated screws has been described with preference for the reverse triangle design because of better biomechanical stability.

4. Source of Funding

None.

5. Conflict of Interest

None.

References

1. Ye Y, Chen K, Tian K, Li W, Mauffrey C, Hak DJ, et al. Medial buttress plate augmentation of cannulated screw fixation in vertically

- unstable femoral neck fractures: Surgical technique and preliminary results. *Injury*. 2017;48(10):2189–93.
2. Liporace F, Gaines R, Collinge C, Haidukewych GJ. Results of Internal Fixation of Pauwels Type-3 Vertical Femoral Neck Fractures. *J Bone Joint Surg-Am*. 2008;90(8):1654–9.
 3. Krischak G, Beck A, Wachter N, Jakob R, Kinzl L, Suger G, et al. Relevance of primary reduction for the clinical outcome of femoral neck fractures treated with cancellous screws. *Arch Orthop Trauma Surg*. 2003;123(8):404–9.
 4. Yang JJ, Lin LC, Chao KH, Chuang SY, Wu CC, Yeh TT. Risk factors for nonunion in patients with intracapsular femoral neck fractures treated with three cannulated screws placed in either a triangle or an inverted triangle configuration. *J Bone Joint Surg Am*. 2013;95:61–70.
 5. Zlowodzki M, Ayieni O, Petrisor BA, Bhandari M. Femoral Neck Shortening After Fracture Fixation With Multiple Cancellous Screws: Incidence and Effect on Function. *J Trauma*. 2008;64(1):163–9.
 6. Peiris JS, Cheung CY, Leung CY, Nicholls JM. Innate immune responses to influenza A/H5N1: friend or foe? *Trends Immunol*. 2009;30:574–84.
 7. Peiris JS, Hui KP, Yen HL. Host response to influenza virus: protection versus immunopathology. *Curr Opin Immunol*. 2010;22(4):475–81.
 8. Suntharalingam G. Cytokine storm in a phase 1 trial of the anti-CD28 monoclonal antibody TGN1412. *N Engl J Med*. 2006;355:1018–28.
 9. Gardner S, Weaver MJ, Jerabek S, Rodriguez E, Vrahas M, Harris M, et al. Predictors of early failure in young patients with displaced femoral neck fractures. *J Orthop*. 2015;12(2):75–80.
 10. Haidukewych GJ, Rothwell WS, Jacofsky DJ, Torchia ME, Berry DJ. Operative Treatment of Femoral Neck Fractures in Patients Between the Ages of Fifteen and Fifty Years. *J Bone Joint Surg (Am Vol)*. 2004;86(8):1711–6.

Author biography

Shiva Shankar Jha Director Head

Cite this article: Jha SS. Fracture neck femur during COVID pandemic valgus reduction for osteosynthesis (inferior calcar buttress reduction) . *IP Int J Orthop Rheumatol* 2020;6(1):31-34.