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Technical Problems of Trigen Intertan Insertion in Indian Population: How to Overcome Them?

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Technical Note

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ABSTRACT

In this technical note, we are going to discuss the technical problems(based on experience with 5 patients) that we have faced during fixation of inter trochanteric fractures while using the intramedullary nailing system - The TRIGEN INTERTAN nail (Smith & Nephew, Memphis, Tennessee), in Indian subjects.

Keywords: Trigen Intertan insertion; intramedullary nailing system; proximal femur.

1. INTRODUCTION

As per the manufacturer, the shape of the nail should enhance stability and offer greater resistance to implant cutout [1].

We have found that the Indian femora are smaller and the medullary cavity is often narrower compared to the Caucasians. The proximal femoral geometry is also smaller and the proximal femoral diameter at trochanteric and subtrochanteric area (where shaft segment starts) is also proportionately smaller. There have been many studies showing difference in neck length, neck shaft angle and neck width but despite extensive search we could not come

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across any anthropometric measurements of proximal femoral canal in Indian population [2-9].

The TRIGEN INTERTAN nail is of standard length and the minimum diameter available is 10mm. These nails are proportionately large for such femora.

It is also important to know that the proximal femoral nail Trigen Intertan is not a cylindrical design in the proximal part. It has a trapezoidal geometry with the narrower part being medial and broader part being lateral. Many intramedullary nailing systems, such as proximal femoral nailing (PFNA) system from Synthes @, have a cylindrical morphology (circular cross section) in the proximal part. The anatomical design of the original PFNA did not match the femoral geometry of Asian patients. The stature of Asian patients is shorter than that of European patients, and the anterior arch of the physiological femoral curvature is relatively large [10]. Subsequent design changes were needed in the PFNA to overcome the shortcomings.

In TRIGEN INTERTAN nail, the length of the segment from the proximal nail to the slot corresponding to the head and neck screws is 28.3mm. The diameter of the proximal trapezoidal portion is 16.25mm mediolaterally and 15.25mm anteroposterior [1]. The proximal femoral diameter however may change from patient to patient depending on the geometry of the bone and we feel that this distance and the proximal diameter is smaller in many of the Indian femora.

As per the standard surgical protocol for performing intramedullary nailing for trochanteric fractures, a good reduction under image intensifier, in both anteroposterior and lateral views is desirable. This reduction can be achieved in many stable and simple inter trochanteric fractures but in many of the unstable type of trochanteric fractures to get an absolute reduction prior to the surgery is difficult. Intraoperatively, either a closed manipulation of the fragments or an open reduction may be required to align the proximal and distal fragments before performing the intra medullary nailing.

We faced the following technical difficulties in some of our patients undergoing proximal femoral nailing using TRIGEN INTERTAN nail, for trochanteric fracture in Indian patients.

Despite the proper entry point and proximal femoral reaming using a channel reamer up to 16 mm it was difficult for us to introduce a 10 mm nail. The tip was getting stuck at the subtrochanteric area due to canal fill Fig. 1 [1].

Following steps were performed:

(a) A repeat reaming using a channel reamer was performed. The 10 mm diameter of the nail was tight in the proximal femoral shaft area.

(b) To accommodate the nail in the medullary cavity, we performed serial reaming of the medullary cavity over a guide wire using standard flexible reamers. Fig. 2. After performing the reaming, a repeat attempt to insert this 10 mm nail was performed. We found that the nail was getting stuck at the subtrochanteric area and smooth introduction of the nail was not possible.

A proximal femoral anatomical mismatch with the nail and the bone was suspected at this stage.

No further attempt was made to either push the nail forcibly or mallet the nail, as this would either cause the nail to get stuck or even may result in splintering of the lateral wall. As the nail could not be sufficiently pushed into the medullary canal, it would not be possible for the proximal screws be placed in head and neck fragment.

(c) The nail was removed and, the proximal femoral reaming was repeated using a 16 mm channel reamer and the flexible reamers were used to widen the proximal femoral canal.

(d) The guide wire was pushed medially using a retractor, while reaming, to make more space on the medial aspect of the proximal femur to accommodate the nail Fig 3.

The idea of doing it this is to score the medial side of the proximal femur to accommodate the larger diameter of the nail. Despite doing this, there was difficulty in introducing the nail into the femoral canal.

(e) Gentle tapping of the nail was performed to get the nails sufficiently inside the femoral medullary cavity to get the proximal to screws deep into the femoral head.

This tapping has its drawbacks-as the nail is being tapped we found that this causes either distraction or loss of neck shaft angle. Second

there is a risk of the nail getting jammed in the proximal femur so that there could be difficulty of either nail progression or inability to remove the nail leading to a complication. This would also result in improper positioning (superior segment of the head and neck) of the proximal screws Fig. 4.

The second technical issue that we have faced is after introducing the nail into the proximal femur, the guide wire needs to be positioned in the center of the head and neck fragment for fixation of the two screws in the proximal fragment [2].

The proximal geometry of the nail being trapezoidal with the narrower portion being the medial and broader portion lateral Fig 5, the nail gets impacted into the femoral canal (like the uncemented stem in the proximal femur).

When we tried to introduce the guide wire in the proximal fragment in a lateral view, slight manipulation of the distal fragment by lifting the shaft fragment may be required to align the proximal and distal fragment in one line to enable passing of the nail distally and have a good position in head and neck . This alignment is important to place the guide wire deep in the

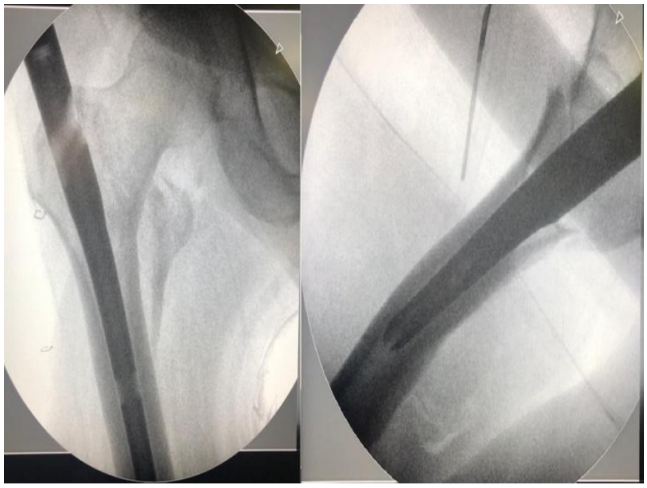

Fig. 1. The image intensifier pictures showing the snug fitting size 10 mm INTERTAN nail in the proximal femur

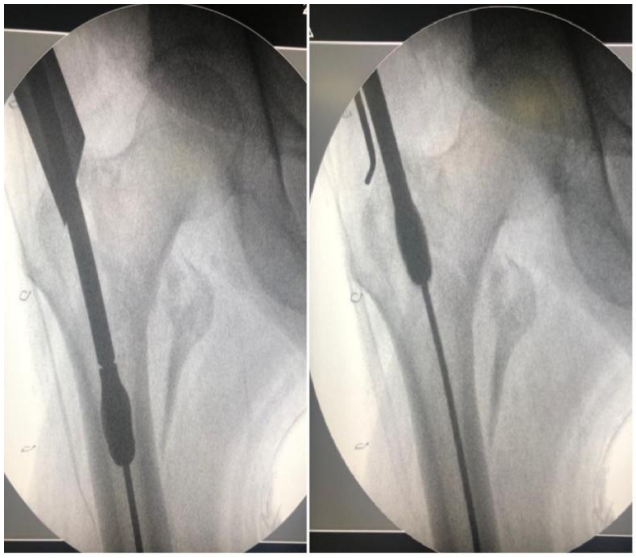

Fig. 2. The serial reaming of the medullary cavity over a guide wire using standard flexible reamers

head and neck fragment in the centre. A small rotation of the nail using the external jig is often required in the sagittal plane, to guide the pin into the femoral head and neck fragment considering the anti-version of the proximal fragment.

Fig. 3. The guide wire was pushed medially using a retractor, while reaming, to make more space on the medial aspect of the proximal femur to accommodate the nail

Fig. 4. The positioning of the proximal screws in superior segment of the head and neck

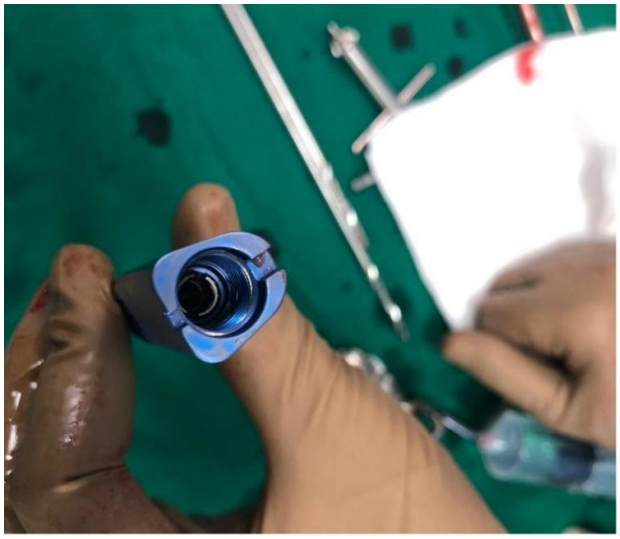

Fig. 5. The proximal trapezoidal geometry of the INTERTAN nail - with the narrower portion medially and broader portion lateral

This slight rotation of the nail using the external jig was difficult in our cases as the nail was impacted in the proximal femoral portion. We attribute this to the trapezoidal nature of the proximal portion of the nail getting impacted. Disimpaction and mild rotation of the nail was performed for accurate placement of the guide pin.

Proximal femoral nail of other designs such as PFNA2 of Synthes has a circular design in the proximal portion. This design allows the slight rotation of the femoral nail using the external jig to align the neck fragment and to place the guide wire accounting for the anti-version.

2. CONCLUSION

We propose that the anatomy is the reason for these technical problems and suggest modifications to overcome these technical issues during the procedure.

1. We propose that a smaller diameter nail and the nail which suits the proximal geometry of the femur for Indian population is required to solve the mismatch between the nail design and the femoral size in this subset of patients.
2. We propose that a smaller diameter nail which can both match the proximal femoral geometry and medullary canal or altered configuration like a rounded proximal geometry of the nail would help in overcoming the problem of manipulating the jig in proximal fragment.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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