

## COMPARATIVE STUDY OF KUNTSCHER'S NAIL VS. INTERLOCKING NAILING FOR FEMORAL ISTHMUS FRACTURES

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### ABSTRACT

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#### BACKGROUND

Interlocking intramedullary nailing is suitable for comminuted femoral isthmus fractures, but for non-comminuted fractures its benefit over unlocked nailing is debatable. This study was undertaken to compare outcomes of interlocking nailing versus k-nail in such fractures.

#### MATERIALS AND METHODS

40 cases of noncomminuted femoral isthmus fractures treated with interlocking nailing and K-nail from April 1, 2015, to December 1, 2016, were reviewed. Radiological and clinical union rates, bony alignment, complication and knee function were investigated.

#### RESULTS

There was no statistical significant difference with regard to union rate, implant failure, infection and fracture alignment in both study groups. Open fixation with K-nail is technically less demanding and requires less operating time; additionally, there is no exposure to radiation and cost of the implant is cheaper.

#### CONCLUSION

We therefore conclude that unlocked nailing is still useful for the management of noncomminuted isthmus fractures of the femur.

#### KEYWORDS

Fracture, Femur, Kuntscher Nail, Interlocking Nail, Isthmus.

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#### BACKGROUND

Intramedullary nailing is the gold standard for the management of femoral shaft fractures.<sup>1,2,3,4</sup> Various studies have shown that it is superior to plate fixation due to lower rates of infection and nonunion.<sup>5,6,7</sup> As a load-sharing implant, it allows earlier weightbearing after surgery.<sup>8</sup> The Kuntscher nail (K-nail), one of the earliest intramedullary nails, which was frequently recommended for fixation of noncomminuted femoral shaft (isthmus) fractures. The advent of Interlocking Intramedullary Nails (ILN) has extended intramedullary nails applicability to a wider variety of femoral fractures. The current trend is towards increasing usage of interlocking nail for all types of femoral shaft fractures, although the benefit for more simple fractures is not well established. We therefore conducted this study to compare the outcome between the use of the K-nail and the ILN for fixation of femoral isthmus fractures.

#### MATERIALS AND METHODS

All patients who underwent intramedullary nailing (with either K-nail or ILN) from April 1, 2015, to December 1, 2016, for femoral shaft fractures at the isthmus were retrospectively reviewed. Only cases with isolated femoral fractures and with follow up records of more than 6 months were included in the study. Patients with vascular injuries, compartment syndrome, open fractures or polytrauma were excluded. Radiological union was defined as the presence of bridging callus across the fracture site in 3 cortices.<sup>9</sup> The fracture was considered healed when there was radiological union and the patient was able to weightbear pain-free.<sup>9</sup> Fractures taking longer than 6 months to unite were defined as delayed union whilst an absence of callus at the fracture site at 6 months was considered nonunion.

The degree of comminution of the fracture was graded according to Winquist classification<sup>10</sup> (Table 1). Postoperative fracture alignment was assessed using the Thoresen scoring system that includes parameters such as valgus/varus, procurvatum/recurvatum, shortening and rotation (internal and external). The former two parameters were determined by examining the radiographs in both anteroposterior and lateral views. Rotation was determined clinically by the position of the patella relative to the anterior superior iliac spine and the presence of shortening was established by clinical measurement for limb-length discrepancy.

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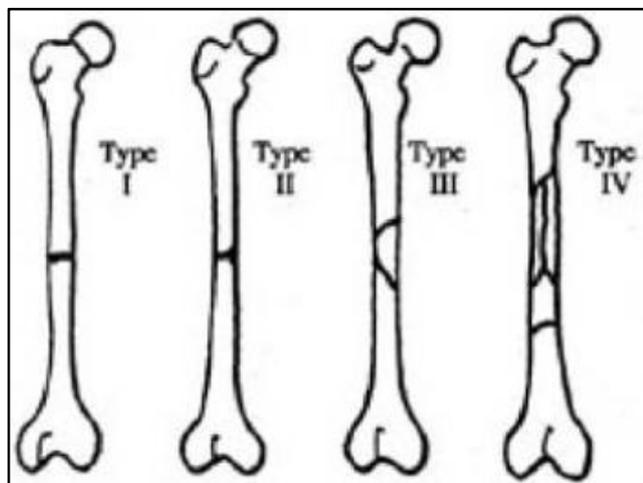
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Type	Description
1.	No or minimal comminution
2.	Comminution involving less than 50% of the circumference
3.	Between 50-100% of the circumference of two major fragment is comminuted
4.	Cortical contact is lost, cortex is circumferentially comminuted

**Table 1. Winqvist Classification for Femoral Shaft Fracture**

**RESULTS**

During the study period, there were 40 cases of intramedullary nail fixation used on Winqvist I and II femoral isthmus fractures - 20 cases using K-nail and 20 with ILN. The age range of patients in the study was 20 to 75 years with a mean of 26 years for those who underwent K-nail procedure and 34 for ILN. There is no significant difference in between both groups in terms of sex, number of closed and open fractures and percentage of Winqvist I vs. II fractures (Table III). There was no difference in the union rate between both groups ( $p = 0.3282$ ). In the ILN group, 94% of patients achieved union within 6 months and 95.3% of the K-nail group did so. There were 2 cases of nonunion and none of delayed union in the K-nail group. The two non-union patients were treated with exchange nailing (both with ILN) and eventually proceeded to union. There was one case of nonunion and 2 cases of delayed union in the ILN group. The patient with nonunion was successfully treated with dynamisation without bone grafting while the 2 with delayed union were bone grafted and dynamised and both went on to achieve union. The ILN and K-nail groups did not differ significantly in their speed of radiological union ( $p = 0.1082$ ) or fracture healing ( $p = 0.3279$ ). Although, the fractures fixed with ILN united somewhat earlier as compared to those treated with K-nail. The difference was not statistically significant. There was no significant difference in postoperative fracture alignment between the 2 groups. Both groups had more than 90% of its scores in excellent range for each of the Thoresen parameters (Table IV). One case in the K-nail group developed superficial wound infection, a condition that resolved after a course of antibiotics with no further evidence of deeper infection or

osteomyelitis. There were 2 cases of implant migration and 2 cases of bent implant in the K-nail group. All 4 cases were subsequently treated with exchange nailing that led to fracture union. There were no cases of implant failure in the ILN group.

Criteria	Excellent	Good	Fair	Poor
<b>Malignment</b>				
Varus/valgus	5	5	10	>10
Procurvatum/recurvatum	5	10	15	>15
Rotation	10	15	20	>20
<b>Range of Motion</b>				
Flexion	>120	120	90	<90
Extension deficit	5	10	15	>15
Pain and swelling	None	Minor	Significant	Severe

**Table 2. Thoresen Scoring System**

**DISCUSSION**

With the introduction of proximal and distal locking screws, intramedullary nailing has become the implant of choice for the treatment of virtually any femoral shaft fractures. The locking mechanism has enabled stabilisation of even the most comminuted and unstable fractures that leads to more successful early rehabilitation. Most hospitals routinely use interlocking intramedullary nails to fix all types of femoral shaft fractures including Winqvist type I and II femoral isthmus fractures. The use of unlocked nailing has been virtually abandoned. Unlocked intramedullary nails were initially developed for fixation of transverse and short oblique fractures around the midshaft region or the isthmus. Nails of the same diameter as the narrowest part of medullary canal were usually used as they resist rotational displacement by friction. Interdigitation of the fracture ends provided further resistance against rotation. Therefore, K-nails were usually reserved for Winqvist I and II femoral shaft fractures around the isthmus. Indeed, the current study demonstrates that there is no significant difference in outcomes between ILN and K-nail fixation of patients in regards to rate of union, speed of union and femoral alignment. The percentage of delayed union and nonunion encountered in the K-nail group of patients is also not significant. Of concern is fact that the K-nail group had a higher rate of implant failures involving migration and bending. Surgeons should probably proceed more slowly in initiating weightbearing protocols when unlocked intramedullary nail fixation is employed. Inadvertent cracking of the fracture ends maybe reduced and fixed with additional encirclage wire fixation. On the other hand, one advantage of using the Kuntscher nail is that the surgery is technically less demanding. Additionally, the K-nail procedure and does not require the use of an image intensifier (as the fracture is reduced via open method), so there is no unnecessary exposure to radiation and no radiographer is needed. The K-nail is also much less expensive as compared to standard ILN, an important factor in countries with limited financial resources. Therefore, for economic and technical reasons, use of the Kuntscher nail is still a viable option.

**CONCLUSION**

Unlocked intramedullary nailing can provide comparable rate of union with interlocking intramedullary nailing when used for fixation of noncomminuted femur fractures at the isthmus. There is however a higher incidence of implant migration and bending associated with the use of unlocked nailing. Considering the cost and surgical aspects of this treatment option, unlocked nailing is still a viable option for selected femoral fractures in many hospitals, especially those with limited financial resources or less technical expertise.

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