Technical Note

Trauma International | 2020 July-December; 6(2): 19-21

Removal of Elastic Stable Intramedullary Nail

Vivek M. Sodhai[1], Sandeep A. Patwardhan[1], Parag K. Sancheti[1], Ashok K. Shyam[1,2]

Abstract

Introduction: Removal of the elastic stable intramedullary nail (ESIN) after the union is routinely performed in the pediatric population. However, ESIN removal can be lengthy and difficult due to the strong bonding between nail and bone.

Technique: We preferred keeping the nail tip tangentially flush (<5mm) to the bone to avoid skin irritation. In our technique, after incision and subcutaneous dissection, the nail tip is identified and exposed using a 6-mm osteotome, and a trough is created around it sufficient enough to pass the hollow mill over it. In cases with buried nail tip, a rectangular cortical window may be required. The nail tip is then gently bent at 90° using the hollow mill as the lever taking care not to cause an iatrogenic fracture. The nail tip is held at the bent from sideways with a plier and the nail is removed by rotatory backward motion or reverse impaction using a mallet in cases of strong bonding between nail and bone. Using this technique, ESIN removal was successful in all 28 cases using the previous incision. Of these cases, 10 were forearm (36%), 8 were tibia (28%), 7 were femur (25%) and 3 were humerus (11%). 6 cases (21%) were considered difficult due to increased thickness of the nails, deeper location of the nail tip, and increased bone growth around the tip of nails.

Conclusion: Our technique is simple, innovative, and can be easily reproduced by all Orthopaedic Surgeons. The use of this technique is recommended for all ESIN removals.

Keywords: Diaphyseal fractures; Elastic stable intramedullary nail; Hardware removal; Paediatric long bone.

Introduction

ESIN is the well-established treatment method for displaced, unstable pediatric long bone fractures. Initially, it was described for femoral diaphyseal fractures but indications were later extended to other long bones [1,2,3]. Hardware removal is a routinely performed procedure in children once the union is achieved. Generally, it is recommended to remove the nails after 6 months of injury to avoid refractures [4]. The common reasons for removal are elective nail removal to avoid hardware related problems in the future, nail irritation, and fractures due to stress-shielding [5,6]. Complications like nail irritation, back out, loosening would arise if an improper technique is used for fracture fixation using ESIN or if it is done for unindicated cases as described by Slongo [7]. In these cases, nail removal is not a task since it is loose or easily visible rather it leads to early hardware removal before union or requires additional procedures like nail trimming. Nail removal is considered to be a benign procedure without any increase in the rate of complications other than some intraoperative difficulty [8,9] and leaves a minimal scar. However, Simpson-white et al do warn that the procedure of implant removal can be lengthy and difficult [10].

The inability to retrieve the nail is one of the major complications of hardware removal [5]. It may be attributed to strong bonding between nail material and bone or irregular patient follow-up as is in our country. There are fewer studies on techniques of ESIN removal. We present our simple technical tip that can be utilized in ESIN removals of the upper limb as well as the lower limb.

Technique

During the insertion of ESIN, the nail tip is kept tangentially flush to the bone for a distance less than 5mm approximately (Fig. 1). Under general anesthesia and tourniquet effect, the incision is taken over the previous scar, subcutaneous dissection is done to trace the nail tip. Once the nail tip is identified, exposure of the nail tip is done using a 6-mm osteotome. At an angle perpendicular to the nail tip, excessive bone is removed circumferentially to create a shallow trough around the nail tip (Fig. 2) sufficient enough to pass a 4.5mm hollow mill over it (Fig. 3). In cases with buried nail tip, a rectangular cortical window is created to expose the nail tip. After complete exposure of the nail tip for 1-2cm approximately and using the hollow mill as a lever, the exposed nail tip is gently bent 90° to the bone at its insertion point (Fig. 4). A narrow metal suction tube can also be used at this step for thin nails of the upper limb. Ideally, a nail extraction kit should be utilized. However, it is not readily available at all institutes in our country. The bent nail tip is held firmly with a plier at its base and an attempt is made to remove it with rotatory backward motion (Fig. 5). In some cases, it can be difficult to remove

[1]Department of Paediatric Orthopaedics, Sancheti Institute for Orthopaedics & Rehabilitation, Shivaji Nagar, Pune, Maharashtra, India.
[2]Department of Research, Indian Orthopaedic Research Group, Thane (W), Maharashtra. India.

Address of Correspondence
Dr. Vivek M. Sodhai,
Clinical fellow, Department of Paediatric Orthopaedics, Sancheti Institute for Orthopaedics & Rehabilitation, Shivaji Nagar, Pune, Maharashtra, India.
E-mail: vivek.sodhai89@gmail.com


Dr. Vivek Sodhai


Dr. Sandeep Patwardhan


Dr. Parag Sancheti


Dr. Ashok Shyam

Figure 1: ESIN tip is kept outside flush tangentially to the bone without bending

Figure 2: Nail-tip is exposed by making a circumferential trough using 6-mm osteotome

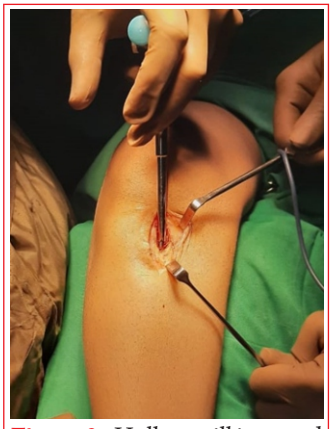

Figure 3: Hollow mill is passed over the nail tip

Figure 4: Using the hollow mill as the lever, the nail tip is acutely bent at 90°

the nail due to excessive bone growth or due to the titanium to bone interface. In this situation, reverse impaction with a mallet is sufficient to remove the nail under fluoroscopic control. Fig. 6 shows the retrieved nail with a bent tip. It is important to document successful hardware removal with a radiograph in the immediate postoperative period (Fig. 7).

Results

28 ESIN removals were performed using this technique at our institute. Out of 28 cases, 10 were forearm (36%), 8 were tibia (28%), 7 were femur (25%) and 3 were humerus (11%) ESIN removals. Nails were successfully retrieved using the same incision in all cases. However, 6 cases (21%) were considered difficult. 3 of these cases were of the femur (50%), 2 were radius (33%), and 1 of the humerus (17%). Femur ESIN removals were considered difficult due to increased thickness of the nails and deeper location of the nail tip, while radius and humerus were difficult due to increased bone growth around the tip of nails. A hollow mill of appropriate size was used in all difficult cases. No complications occurred in any case.

Discussion

There are few publications discussing problems of hardware removal and as per Peterson, hardware removal is rarely discussed in publications, conferences, or even resident training years [3]. It is considered to be the procedure for senior surgeons since they have spent more hours tackling these situations. This technique is evolved from similar situations in the operating room.

During insertion, Simanovsky et al used a nail with a ball-shaped end kept outside the bone. They used a bone biter to grasp the ball-shaped end for removal. Even with this technique, they encountered three cases of unsuccessful nail removals. However, this can be attributed to the strong bonding between the bone and titanium material [5,11]. Based on the findings of longer operative time and inability to retrieve the nails, authors recommended not to remove nails on an elective basis. Nails should be removed in situations where it causes symptoms of irritation or when the surgeon can palpate the nail tip [5]. Gibon et al recommended bending the nail tip 180° rather than 90° during insertion to avoid the problems of skin irritation and early hardware removal [12]. In our technique, we preferred to keep the nails flush to the bone rather than bending during insertion. During removal, it was easier to bend the nail tip at 90° and grasp it with a plier that has serrations to allow a better grip than a bone nibbler. We did not encounter any case of inability to retrieve the nail with our technique. This technique was useful in all difficult nail removals. Due to the ease of the technique, the approximate time is taken to retrieve the nail ranged from 10-30 mins at our institute depending on the diameter of the nail, number of nails, and the anatomical location of bone during insertion. It is much easier to remove the forearm, humerus, and tibial nails than the femur. This is due to the superficial location of nail tips in former and deeper for femur around the knee.

Figure 5: Nail-tip is held sideways with a plier and removed with backward rotator motion

Figure 6: Completely retrieved nail with a bent nail tip

Figure 7: Postoperative radiograph following nail retrieval

Conclusion

Our technique of ESIN removal is simple, innovative, and easily reproducible by all orthopedic surgeons using routine instrumentation. We recommend this technique for all ESIN removals.

Clinical message

ESIN removals can sometimes be lengthy and difficult due to strong bonding between the nail and bone. Our technique is simple and can be performed for all ESIN removals using easily available instruments like a hollow mill.

References

1. *Ligier JN, Metaizeau JP, Prevot J (1983) Closed flexible medullary nailing in pediatric traumatology. Chir Pediatr 24;383-385*
2. *Ligier JN, Metaizeau JP, Lascombes P, et al (1987) Treatment of diaphyseal fractures of both bones of the forearm in children using elastic stable pinning. Rev Chir Orthop Reparatrice L'ppar Moteur 73;(Suppl. 2):149-151*
3. *Ligier JN, Metaizeau JP, Prevot J (1985) Elastic stable intramedullary pinning of long bone shaft fractures in children. Z Kinderchir organ Dtsch Schweiz Osterr Ges Kinderchir Surg Infancy Child 40;209-212*
4. *Fernandez FF, Langendorfer M, Wirth T, Eberhardt O (2010) Failures and complications in intramedullary nailing of children's forearm fractures. J Child Orthop 4:159-167*
5. *Simanovsky N, Tair MA, Simanovsky N, Porat S (2006) Removal of Flexible Titanium Nails in Children. J Pediatr Orthop 26:188-192*
6. *Peterson HA (2005) Metallic Implant Removal in Children. J Pediatr Orthop 25:107-115*
7. *Slongo TF (2005) Complications and failure of the ESIN technique. Injury 36; S-A78-S-A85*
8. *Schmalzried TP, Grogan TJ, Neumeier PA, Dorey FJ (1991) Metal removal in a pediatric population: benign procedure or a necessary evil? J Pediatr Orthop 11:72-76*
9. *Lovell ME, Galasko CSB, Wright NB (1999) Removal of orthopedic implants in children: morbidity and postoperative radiologic changes. J Pediatr Orthop B 8:144-146*
10. *Simpson-white RW, Bryant R, Davies AG (2018) REMOVAL OF ELASTIC TITANIUM NAILS IN PAEDIATRIC PATIENTS: DIFFICULTY AND COMPLICATIONS. Orthopaedic Proceedings Vol. 95-B, No. SUPP_11*
11. *Resemyer B (1981) Bone-metal bonding after Kirschner wire studding. Arch Orthop Trauma Surg 98:153-155.*
12. *Gibon E, Béranger JS, Bachy M, Delpont M, Kabbaj R, Vialle R (2015) Influence of the bending of the tip of elastic stable intramedullary nails on removal and associated complications in pediatric both bone forearm fractures: A pilot study. Int J Surg 16;19-22.*

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Sodhai VM, Patwardhan SA, Sancheti PK, Shyam AK | Removal of Elastic Stable Intramedullary Nail | Trauma International | July-December 2020; 6(2): 19-21.