
Tibial intramedullary implant in a cadaver- A rare case report

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Abstract

A rare case of *in-situ* intramedullary nail was observed in a cadaver during the routine dissection in the Anatomy Department of Regional Institute of Medical Sciences, Imphal, Manipur. The case is reported for its utility in teaching not only clinical anatomy but also a good tool in learning instrumentation by trainees in orthopaedic surgery. Intramedullary nail of tibia is an implant placed in the medullary canal of tibia for the treatment of fracture of shaft of tibia.

In the present cadaver a proximal and two distal screws were detected in the right tibia. Radiograph of the tibia with *in-situ* implants was taken. The tibia was sawed to remove the implant due to non availability of appropriate orthopaedic instruments. Such an incidental finding of surgical implants in the cadaver proved beneficial for clinicians and anatomists alike.

Keywords: Intramedullary nail, tibia, surgical implant, clinical anatomy

1.Introduction

Tibia is the medial and much stronger of the two bones of the leg. It is the second largest bone of the body. The upper end of tibia includes the medial and lateral condyles, non-articular intercondylar area and the tuberosity of tibia. The lower end is smaller than the upper end and on its medial side is a stout process, the medial malleolus. Tibia contributes significantly to transmission of weight. Fibula, the lateral bone of leg does not significantly contribute to transmission of weight; however, its continuity helps in stabilizing unstable fracture and maintaining length in severely comminuted fracture [1].

One third of tibial surface is subcutaneous therefore is exposed to frequent injury. It is the most commonly fractured long bone and specifically, the open fracture. Currently, locked intramedullary nailing is the preferred treatment for most tibial shaft fractures requiring operative fixation. Distinctive features of tibia include extreme narrowing of the medullary canal, axial lateral rotation of the medullary canal, and extreme anterior bowing of the tibial shaft. These anatomical characteristics of tibia pose a hurdle

in the use of intramedullary nail despite of this method being treatment of choice in the fracture of long bones [2]. The success of an operative intervention lies in the in-depth knowledge of anatomical structure [3]. During the routine dissection in the dissection hall of the Anatomy Department of Regional Institute of Medical Sciences, Imphal, Manipur, two screws in the distal third of tibia and a screw in proximal third were found in a male cadaver. Presence of such surgical appliances in cadaver could be a good source for teaching clinical anatomy.

2. Case report

A well-built male cadaver of about 50-60 years was dissected by MBBS students. During the lower limb dissection, two screws in the distal third of right tibia and a screw in proximal third were detected. Inferior most screw was situated 6.5cm from the tip of medial malleolus and the second distal screw was 2.5cm superior to the first (Figure 1).

Figure 1: Two locking screws at the distal third of right tibia (arrow in medial malleolus)



A third screw was observed 8cm proximal to tibial tuberosity. Dissection of proximal tibia revealed three screws, one was directed anteroposteriorly and the other two were directed obliquely (Figure 3) Surprisingly, the instruments used by the orthopedics surgeons of our Institute failed to remove the screw. Using pliers from instrument box, the screws were removed. After the removal of the screw, the right tibia was sawed under a Ben Saw machine. Prior to any instrumental handling a radiograph was taken to guide the sawing (Figure 2). Intramedullary nail was retrieved for academic analysis (Figure 4)

Figure 2: Lateral and A-P radiograph of proximal and distal portion of tibia showing three proximal screws and two distal screws



Figure 3: Proximal end of the intramedullary nail and the three multidirectional interlocking screws anterior view and Superior view



Figure 4: Intramedullary nail *in situ*

3. Discussion

Cadavers are used for practicing surgical skills and developing new surgical techniques [4]. Teaching clinical anatomy is a challenge with the occurrence of myriad ailment and surgical procedures. A chance discovery of surgical appliances in a cadaver must be utilized for study of related clinical anatomy of the region as the authors have experienced.[5]

In the present case of intramedullary nail in tibia, one must know the entry point of tibia, procedure of nailing, size and bend of medullary canal, reaming and its effect on endosteal vessels, blood supply of tibia. The anatomical knowledge of entry point of intramedullary nail in tibia is essential. It is important to enter the medullary canal at the right point so that the nail is introduced in line with the axis of tibia in both coronal and sagittal plane. The surface of entry of tibial nail is above the tibial tubercle on the anterior surface of the proximal tibia. First, there is the risk of damage to the posterior surface of proximal tibia if the point is too low and the angle of nail (Herzog bend) is too large. Second, there is a chance of unrecognized articular penetration if the entry point is too high and if the nail is driven in vertically. There are reports of unrecognized intra articular penetration during tibial nailing.[6]

In Caucasians, the classically described entry point for tibial intramedullary alignment system lies 5mm anterior to the midpoint of the anteroposterior dimension of tibial plateau in the sagittal plane and at the midpoint of mediolateral dimension of the tibial plateau in the coronal plane.[7] However, in Korean, the entry point for tibial intramedullary alignment system is anterolateral to the classically described entry point. This is because of difference in the relationship of tibial intramedullary canal axis to the tibial plateau, or cut surface of tibia in maneuver of tibial arthroplasty.[8]

A number of tibial diaphyseal fractures are impossible to nail because the intramedullary canal is too narrow in which the smallest reamer could not be passed down the intramedullary canal. If unreamed nail is used failure rate high. Again if marrow is extremely narrow reaming produces excessive heat. If a reamed nail is used, the surgeon should use a 10- or 11-mm nail, and if the canal is too narrow 9mm can be used.[9] Nailing is contraindicated in adults with very small medullary canals of less than 7mm.[10] Extremely narrow medullary canal was observed in 13.3% and an excessive anterior bowing along in the tibial shaft in 11.1% and an axial lateral rotation in the middle third of intramedullary canal being on average \pm SD 32.35 ± 16.25^0 (range 10-75⁰).[11]

In fracture management of tibia, reaming of medullary canal before insertion of intramedullary nail might be choice for some orthopedic surgeon. Use of unreamed intramedullary nailing in tibial shafts as favoured procedure had been reported as this method preserve the endosteal blood supply better and disturb the soft tissue minimally [12]. Hence, knowledge of blood supply of tibia needs to be well versed. Nutrient artery of tibia arises from the posterior tibial artery and enters through the posterolateral cortex of bone at the origin of soleus muscle, just below the oblique line of tibia posteriorly. The nutrient artery provides afferent supply to all areas of endosteal surface and inner two third of diaphyseal cortex. The periosteal vessels are derived from the main vessels of the limb and run transversely to the long axis of bone. With fracture, the nutrient vessels are disrupted and as periosteal vessels run transversely to the long axis of bone, blood supply to periosteum is maintained on both sides of fracture line, thus allowing adequate vascularity for periosteal callus. After a fracture, these periosteal vessels penetrate the cortex and thereby help to reestablish the endosteal circulation right upto the fracture site. In a resting bone, the periosteal vessels plays minimal role in nutrition of the cortex [13][14].

Anterior knee pain is the most common complication after tibial nailing. Injury to the infrapatellar branch of saphenous nerve is assumed to be possible cause of anterior knee pain.[15] Other complications of intramedullary nailing includes irritation of patellar tendon which is an important anatomical structure related in close proximity to point of entry of nail. This tendon is at risk while reaming or introducing the nail and must be protected during the procedure. Postoperatively patellar irritation and joint complication are reported.[16]

Retrieved nail was examined for academic interest. Interlocking nails are either made of stainless steel or of titanium. The present case is of titanium make. Surgeons of our Institute use nail made up of stainless steel only, hence, discovery of this nail turned out to be a boon for the postgraduate trainees in orthopedics. Titanium is a better alloy than steel for implant. Titanium is lighter, modulus of elasticity is nearer to bone but costlier than steel, which is heavier, stiffer and less costly. Secondly, it was observed that bone was united with the nail in situ. There was no bending in the nail and the interlocking screws are in near normal condition. There was no deformity in the bone.

Such observation of rare clinical case in cadaver contributes to the advancement of the knowledge of clinical anatomy for researchers and clinician alike.

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