TECHNOLOGY UPDATE : PINLESS EXTERNAL FIXATOR

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Abstract

Pinless fixator is an outstanding system designed for external fixation without invading the medullary canal in polytrauma patients. The pinless external fixation allows immediate stabilization and reduction of compound tibial fractures with or without skin loss. This is an ideal tool for emergency stabilization of tibial fractures in a peripheral setup because the application technique is easy to learn by general surgeons. This device can be applied quickly even under local anaesthesia, average application time being 20 minutes in our setup. It does not transfix the bone and therefore avoids the contamination of the medullary canal and thus does not preclude the use of any further treatment methods eg. repeated wound debridement, soft tissue coverage and internal fixation of the fracture. Transportation to referral centre can be done after application of the external fixator if considered necessary in patients with multiple injuries.

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KEY WORDS :Compound fracture tibia; External fixation; Pinless fixator; Polytrauma.

Introduction

The pinless external fixator is an ideal treatment alternative to conventional external fixation in polytrauma patients with open fracture of tibia and fibula [1]. After resuscitation of the patient, the first priority in the management of an open fracture is to prevent infection and stabilization of the fracture by internal or external fixation [2]. The external pinless fixator is designed to be attached by clamps anchored in the cortex without invading the medullary canal. Thus it prevents the problem of pin loosening, pin tract infection and possible neurovascular injury during pin insertion in contrast to conventional external fixators [3]. The pinless fixator can be applied quickly in the operation theatre or emergency room.

Surgical anatomy

The tibia is the most common long bone to be injured because of its very location. The lower end of the tibia is smaller than the upper end. Because one third of its surface is subcutaneous throughout most of its length, open fractures of the shaft of tibia are amongst the most common long bone injuries presenting for treatment. Furthermore blood supply to tibia is more precarious than that of bones enclosed by heavy muscles. The presence of hinge joints at the knee and ankle allows no adjustment or rotational deformity after fracture, and thus special care is necessary during reduction to correct such deformity.

Pinless Fixator Set assembled is shown in Fig - 1.

All the contents are placed in a safe pack for pinless fixator set with upper tray and bottom tray and can be easily autoclaved. The pinless clips are available in three sizes to accommodate anatomic variation of tibia.

Surgical Technique

The application of the pinless fixator is done in three main steps :

1. Application of clips
2. Assembling the frame

Fig. 1 : Pinless external fixator set instruments

Fig. 1a : Pinless external fixator assembled and applied on patient

Fig. 2 : Application of asymmetric clip (diagrammatic)

3. Reduction and fixation

Application of symmetric clip

The procedure can be done under local, spinal or general anaesthesia. After cleaning and draping the lower extremity, two 1 cm incisions are made just below the tibial tubercle on each side of upper third of tibia. Tips of the trocar are inserted in the cortical bone, with the rocking motion of the handle along the axis of the clip in a 45 degree arc. Once the clip is secured in the bone, maintain grip on the handle and fully tighten hinge nut first manually, then with combination wrench. Similarly place the small clip on the lower third of the tibia 3 cm above the medial malleolus.

Application of asymmetric clip

Place the asymmetric clips in the diaphyseal area 3 cm from fracture site in upper and lower fragment. Avoid penetration of the tibialis anterior, gastrocnemius and soleus muscles. Skin incision of 1 cm is given and soft tissues retracted so that posteromedial tibial crest is exposed and is directly palpable. Single tip is placed first between the gastrocnemius and bone

Fig. 3 : X-ray of leg showing pinless fixator and healed fracture

just posterior to posteromedial crest. Clip is closed so that the forked tip passes through an anterior incision and sits on the anterior tibial crest (Fig - 2).

Assembling the frame

The fixation posts are placed loosely, each fixation post rotates 360 degree which permits fracture reduction after frame assembly. Assemble one clamp onto each fixation post so that all the rod vices are aligned. Now the carbon fibre rod 11 mm diameter of adequate length depending on the length of tibia is inserted through the clamps.

Reduction and Fixation

The fixation posts and the clamps are loosened and initial reduction of the fracture is performed. Now perform final reduction and firmly tighten all the nuts with the combination wrench. If nailing is required later on, take into account the entry point of the nail while positioning the carbon fibre rod.

A pilot study has been carried out at 172 Military Hospital of using pinless fixator in patients of multiple trauma with compound fracture of both bones of lower leg from Jan 98 to Feb 2000. 3 patients of fracture midshaft shaft tibia and fibula were treated by application of pinless fixator. Age group of 25-55 year, all males. A serving soldier was admitted with head injury with compound fracture shaft tibia and fibula. The pinless fixator was applied after wound debridement under spinal anaesthesia and fracture stabilised. The wound healed well after daily dressings. The fracture has united clinically and radiologically and the patient has been followed up in OPD under sheltered appointment (Fig - 3). In another patient, a retired NCO, a case of road traffic accident with multi-

Fig. 4: Calcaneal traction by symmetric large clip in fracture shaft femur

ple injuries, pinless fixator was applied under general anaesthesia after fasciotomy as patient developed acute compartment syndrome. This patient was transferred to referral hospital for further management. The procedure was done under local anaesthesia in one of the elderly patients, as anaesthesiologist was away. Reduction was confirmed by check X-ray. The fixator was kept for the duration of six weeks and active movements of the knee and ankle joint encouraged. Fracture united clinically and radiologically after 12 weeks.

Indications for external pinless fixator application are as under -

1. Tibial fractures with severe soft tissue injury.
2. Tibial fractures in polytrauma patients.
3. Internally fixed tibial fractures requiring external neutralization or additional stabilization.
4. Intraoperative reduction / distraction during intramedullary nailing.
5. Lower limb traction eg. calcaneal / tibial traction (Fig-4).

Pinless fixator system is expensive and can be applied only on two patients at a time. It is designed for nonweight bearing interim stabilization of open fractures of tibial shaft and may require internal fixation at a later date once the wound is healed. In contrast to

conventional external fixators, the pinless clips penetrate only the outer cortex to a maximum depth of 3 mm, hence the chances of pin tract infection are eliminated. Animal and cadaver studies by Stene [4] and Remiger [5] revealed that pinless fixator is strong enough for temporary fracture fixation of ten tibial shaft fractures, eight of which were open fractures.

To sum up, the pinless fixator is an ideal tool designed for emergency stabilization of compound fractures of tibia and fibula in polytrauma patients. The wound is easily approachable for dressing and specialized surgical treatment. Transportation to referral centre is possible for further management in polytrauma patients. Application technique is easy to learn by general surgeons and can be applied quickly in ICU or emergency room under local anaesthesia in a peripheral setup. The pinless fixator can be applied as an additional, minimally invasive external locked system to increase the stability of intramedullary nail fixation in patients with highly unstable tibial shaft fractures [6,7].

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