The Chessboard Technique
A New Freehand Aiming Method for Rapid Distal Locking of Tibial Nails

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Abstract
Distal locking is considered a difficult stage of the endomedullary tibial nailing procedure. A new rapid, simple, and inexpensive freehand aiming technique is presented that uses a galvanized metal grid. The grid is positioned to overlay the skin of the medial cutaneous face of the tibia, giving to the underlying bone under fluoroscopy a pattern that resembles a chessboard. The squares of the grid permit a rapid and accurate localization of the corresponding distal holes of the endomedullary nail, requiring only a single fluoroscopy image, which can be important relative to radiation exposure.

The positioning of distal screws during locking endomedullary nailing is a difficult and time-consuming procedure that entails risk for the surgeon from exposure to radiation. Despite the availability of a fixed aiming device for distal locking mounted on the nail introducing arm, aiming is altered by nail deformation during its insertion into the diaphysis channel. To get around this problem, alternative techniques have been put forward, some of which involve using a fixed tool and others, when they are carried out, use a freehand method. A new rapid, simple, inexpensive, and very low-radiation freehand aiming method for distal interlocking of tibial nails is presented herein.

Surgical Technique
This new freehand technique makes use of a galvanized metal grid (available in any hardware store), the final dimension of which is 2.5 cm x 5 cm (namely five squares by ten squares). The advantage of the grid is in providing a chessboard pattern, where the side of each square is 5 mm (i.e., the diameter of the entry hole for the static screw) and a cross diameter for the dynamic screw hole (where the longitudinal diameter is 10 mm, i.e., equivalent to two squares). The grid is applied to the skin on the medial cutaneous face of the distal tibia, above the tip of the medial malleolus, by means of disposable adhesive sterile strips attached to its edges (Fig. 1).

Under fluoroscopic monitoring with an image intensifier positioned vertical to the leg to be operated on in the lateral decubitus position (or horizontal in case of neutral decubitus position of the leg), the grid easily permits localization with a single fluoroscopy image of both locking screw holes of the endomedullary nail (Fig. 2). The desired square is identified by starting to count from the inferior edge of the metal grid, beginning from the row in which both the static and dynamic holes are located. The incision is made thus in the skin corresponding to the selected square (Fig. 3A) with a No. 11 scalpel blade, introducing the drill thread and carrying out the trepanation orthogonal to the tibial crest (the essential step of the procedure) through the metal square (Fig. 3B). For the introduction of the screw, which has a head larger than the square, the grid has to be turned laterally through 180°. This is done by simply removing one of the two adhesive sterile strips. At this time, the cutaneous incision is slightly enlarged (Fig. 3C) in order to permit the introduction of the screw (Fig. 3D).

Discussion
This new technique was successfully carried out for the distal locking of tibial nails in eight tibial diaphyseal fractures. Both distal locking holes were detected with a single fluoroscopy image; therefore, the total amount of radiation received by the surgeon for the distal locking was only about 0.5 seconds. Operative time needed to find the desired hole

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using the metal grid until placement of the distal screw was about 50 seconds.

When compared to other aiming devices, there are several advantages to using such a system, including: 1. only a single fluoroscopy image is needed to find both of the locking screw holes, and the device is not held in place by the hand of the surgeon, making the technique "surgeon-friendly" in terms of radiation exposure; 2. the remaining adhesive sterile strip allows for the corrective repositioning of the device, if and when necessary; 3. the galvanized grid has a negligible cost and can be washed, sterilized, and reused; 4. the incision required for screw incision is minimal; and 5. the two-dimensional nature of the grid means that the drill, as well as the screw, does not follow an incorrectly directed
path set by traditional arm-mounted devices. This latter situation may arise using three-dimensional tubular aiming devices, where neurovascular damage may be at risk.

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