CASE REPORT

Nonunion of Medial Malleolus Fracture: Tension Band Wiring is an Effective Option Even in Failed Surgeries

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ABSTRACT

Nonunions of medial malleolus (MM) are a relatively rare entity, especially after previous surgical stabilization. These are routinely managed with compression screws and autografts. Usage of tension band wiring (TBW) is very common in acute MM fractures; however, its usefulness in nonunion scenarios has been sporadically reported. We treated a 7-year-old MM nonunion with TBW, which united well after 5 months of follow-up. We present this technique highlighting its critical steps and additionally review previous cases that were treated similarly with good outcomes.

Keywords: Autograft, Medial malleolus, Neglected ankle, Nonunion, Tension band, Tension band wiring.

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BACKGROUND

Nonunions in medial malleolus (MM) fractures are a rare though disabling scenario, with variable reports citing an incidence from 5 to 30%, with long-term complications related to the ankle joint.^{1,2} This problem has become even rarer with the advent of routine operative management with anatomical reduction and fixation.^{3,4} Surgery is indicated for symptomatic nonunions causing significant pain, inflammation, and instability.^{1,5}

The most cited surgical technique involves screw fixation with bone substitutes.^{1,3} In our practice, we prefer tension band wiring with autograft for atrophic nonunion of the MM, since it is a biomechanically stronger construct with more stiffness, and provides better compression.⁶ Additionally, the compression screw can damage the inlaid graft, and in fractures where the distal fragment is very small, the use of screw becomes impractical. We highlight the critical steps of this surgery performed by the principal author (DDT) in a 7-year-old case of nonunion and have added a literature review of similar surgeries from the literature.

PREOPERATIVE ASSESSMENT

Standard plain radiographs and computed tomography (CT) scans are taken to assess the fracture type and gap. MRI may be used to evaluate associated ligament injuries and the existence of any infection. Blood investigations like ESR, leukocyte counts, and C-reactive proteins help in diagnosing infection as a cause of nonunion.

CASE DESCRIPTION

The patient suffered the injury about 7 years prior to presentation and was treated with TBW for right MM fracture (Fig. 1). 1 year after the index surgery, the wires were removed because of their prominence causing discomfort to the patient. After 5 years the patient revisited the outpatient department, due to pain, where X-rays and MRI were labeled "normal," and the patient was informed that he had no significant problem (Figs 2 and 3). He carried on with reasonable function but with some discomfort in the ankle for another 2 years, after which due to persistent symptoms, plain radiographs, and CT scans were repeated; these demonstrated nonunion of the MM, which was now 7 years old (Figs 4 to 6).

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Surgery was planned for this case, and despite a failure of previous TBW, the same procedure with the addition of autograft was contemplated.

SURGICAL TECHNIQUE

Anesthesia

Regional spinal-epidural anesthesia was used.

Figs 1A and B: Postoperative plain radiographs after the index surgery

Fig. 2: X-rays at 5 years of follow-up

Fig. 3: Inconspicuous MRI at 5 years of follow-up

Fig. 4: X-ray at 7 years of follow-up showing the nonunion

Fig. 5: Plain CT scan showing gap nonunion

Fig. 6: Plain CT scan showing gap nonunion

Position of the Patient

The surgery was done in supine position with the affected limb in 45–60° of flexion at the knee and the hip abducted and externally rotated, forming a figure of “4” position. Alternatively, surgery can be done in an ipsilateral lateral decubitus with the side to be operated at the bottom. The normal leg can be flexed at the knee to facilitate the

intraoperative C-arm imaging. A small radiolucent sandbag or bolster can be placed underneath the ankle as per the surgeon’s preference.

Incision

The standard medial approach was used, centered at the MM, and the incision was anteriorly curved distally.

Critical Steps

The fragment was identified, and the fracture site exposed (Figs 7 to 9). The fracture site was cleared of debris, including periosteal remnants, fibrous tissue, etc. The fracture ends were freshened with a high-speed burr until punctate bleeding was observed (Fig. 10). This creates a gap that is eventually filled with an inlay tricortical autograft from the iliac crest (Fig. 11). Weber’s reduction clamp was used to reduce the fracture with the inlay graft, which was smoothed with the burr, and 2–3 K wires of 2–2.5 mm were inserted into this bone-graft-bone assembly (Fig. 12). A 3.5 mm partially threaded cancellous screw was inserted at the metaphysis parallel to the plafond. Tension band wiring with 18 French stainless steel wire was done using the standard method with the proximal loop of the “8” turned around the cancellous screw head, which was then tightened to hold the wire (Fig. 13).

Figs 7A and B: Intraoperative identification and clamping of the fragment

Fig. 8: Intraoperative identification and clamping of the fragment

Fig. 9: Photograph showing the actual gap at the nonunion site

Fig. 10: Photograph showing usage of high-speed burr to freshen the fracture ends

Figs 11A and B: Photograph depicting inlay bone grafting and its smoothing with burr

Figs 12A and B: Photograph depicting inlay bone grafting and its smoothing with burr

Figs 13A and B: Postoperative X-ray

Fig. 14: X-rays showing complete union at 5 months follow-up

Figs 15A to C: Photographs showing healed scar excellent function at the ankle joint

Postoperative Care

The ankle was immobilized in a below-knee slab for 4 weeks, followed by gradual ankle range of motion (ROM) exercises. Patient was kept non-weight-bearing for 4 weeks, and then partial weight bearing in a protective boot until the union occurred by 5 months (Fig. 14). With an adequate rehabilitation protocol, we were able to achieve good functional outcomes in our patients (Fig. 15).

DISCUSSION

Conventionally, compression screws have been described as the treatment of choice for nonunions of the MM. Madhu et al. successfully operated three cases with screws and graft that united well at 4 months.³ Similarly, Khurana et al. operated one case with compression screw and iliac crest aspirate and reported good outcome.⁴ However, the disadvantages in terms of chances of graft breakage with a screw, along with difficulty in purchase when the fragment is small, makes TBW an effective alternative.

Nonunion of MM after prior fixation is extremely rare.^{1,4} A PubMed search on 26.7.2019 with keywords; non[All Fields] AND union[All Fields] AND medial[All Fields] AND malleolus[All Fields] yielded only 21 hits out of which only two studies reported on these fractures treated with TBW.

Kanakakis et al. reported 100% rates of union in seven patients with pseudoarthrosis of the MM, treated with TBW.⁷ The average period between injury and surgery for these cases was 5 months. None of these patients were previously operated. On a functional score evaluated on the basis of pain, walk, stability, and radiographic findings of arthritis, six of these cases had excellent outcomes. One remaining case also had a good outcome.

John et al. reported a neglected case of 6 months old MM fracture treated by TBW and inlay autograft, similar to our technique, that showed no signs of osteoarthritis at 3 years of follow-up¹ (Table 1). The authors concluded that TBW may be a better option when compared to screw fixation as it requires a simple technique, is cheaper, can provide controlled compression with the tension band principle, protects the graft from damage and can be utilized even if the bone quality is poor that could lead to suboptimal hold of the screw.¹

The important point from both these cases is that neither of them was operated as a fresh fracture, however, in the present case, the index surgery with TBW failed and had a delayed diagnosis of nonunion after 7 years. This adds to the novelty of the present case. The conventional method employed for such a failure is a compression screw, and the old adage that if one procedure fails,

Table 1: Review of literature for tension band wiring usage in nonunion of medial malleolus

<i>Author</i>	<i>Year</i>	<i>No. of cases</i>	<i>Surgical technique</i>	<i>Follow-up</i>	<i>Outcome</i>
John et al. ¹	2017	1	TBW + iliac crest inlay graft	3 years	No secondary osteoarthritis, ROM (DF 15° and PF 45°)
Kanakis et al. ⁷	1990	7	TBW (grafts usage not specified)	3.5 years (mean)	Six patients had excellent outcomes; one patient had good outcome
Tanna et al. (present case)	2019	1	TBW + iliac crest inlay graft	6 months	United at 5 months

TBW, tension band wiring; ROM, range of motion; DF, dorsiflexion; PF, plantar flexion

then it should not be repeated for the same fracture is universally utilized. However, the time-tested procedure of TBW is easy, cost-effective, and can be used for small fragments also.

CONCLUSION

Tension band wiring is an effective surgical technique for nonunions of MM even after previous surgery. It is easy to use, and most of the surgeons are well acquainted with the technique; it protects the inlaid graft and can even be used in fractures with comminution and in osteoporotic bones.

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