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# Limb Length Restoration through Novel Limb Salvage Procedure on Medial Column via Ipsilateral Fibular Strut Autograft: Technique Guide

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## Abstract

In this paper, we describe a novel medial column reconstruction using an ipsilateral fibular strut autograft in a patient with Charcot-related midfoot collapse following excision of nonviable medial cuneiform bone. The harvested fibula was segmented into three struts and reconstituted into a single column using a railroaded Kirschner wire configuration, preserving a central canal for intramedullary screw fixation. This construct was incorporated into medial column arthrodesis with adjunctive hindfoot arthrodesis and ankle syndesmotic stabilization. In our case, we discovered ipsilateral fibular strut autografting provides a biologically favorable and mechanically stable option for medial column length restoration in complex limb salvage cases. This technique offers osteogenic potential, enhanced structural support, and precise restoration of medial column length, and may serve as a reliable alternative to allograft in select patients.

## Keywords

Fibula, Autograft, Strut, Medial Column, Reconstruction

## 1. Introduction

Medial column fusion involves arthrodesis of one or more joints of the medial ray in the foot, including the talonavicular, naviculocuneiform, and first tarsometatarsal joints [1]. Indications include pain, instability, and progressive deformity,

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most commonly seen in acquired flatfoot deformity, midfoot arthritis, severe hallux valgus, and neuropathic conditions such as Charcot neuroarthropathy [2]. The presence of a large osseous defect adds procedural complexity, as failure to restore medial column length may result in metatarsalgia. In these cases, surgical treatment options are limited to amputation versus complex reconstruction [3]. Reconstruction frequently requires structural bone grafting to restore length and fill the osseous void, most commonly utilizing allograft. The literature on medial column lengthening using allograft is limited. Roukis *et al.* reported the use of a fibular strut allograft for medial column lengthening [4]. Some foot and ankle surgeons have compensated for the osseous defect through global shortening of the foot as part of limb salvage procedure.

In 2025, our team utilized ipsilateral fibular struts autograft to fill the osseous void and restore lower extremity length following excision of nonviable talus, achieving successful clinical outcome [5]. This technique was subsequently adapted for medial column reconstruction. Unlike allograft, autograft possesses osteogenic, osteoconductive and osteo-inductive properties. In addition, our construct using three fibular struts within single column is designed to provide enhanced structural stability. To date, autograft use for medial column length restoration and osseous defect reconstruction has been rarely described, including in technique guide.

## 2. Technique Guide

A 53-year-old male with diabetes and peripheral neuropathy presented with a plantar ulcer probing to bone and severe Charcot-related midfoot dislocation at the tarsometatarsal level. He underwent urgent reduction with external fixation, excision of the medial cuneiform with bone biopsy, and tendo-Achilles lengthening, followed by six weeks of oral linezolid for suspected osteomyelitis.

Following completion of six weeks of oral antibiotics, definitive reconstruction proceeded in the following sequence: removal of external fixator, double arthrodesis of the subtalar and calcaneus-cuboid joints, ankle syndesmotic stabilization and subsequent medial column arthrodesis using an ipsilateral fibular strut autograft. The details below describe medial column arthrodesis technique using an ipsilateral fibular strut autograft. The patient is placed in a supine position on the operative table. General anesthesia is induced followed by popliteal and saphenous nerve block and tranexamic acid. The extremity was prepped in standard sterile fashion.

1) Following debridement of all nonviable and fibrotic bone on first metatarsal-navicular articulation back to healthy bleeding bone, the osseous defect on medial column was measured and found to be 2.5 cm. Remaining medial column joints, including talus-navicular articulation, were then prepped by removing residual cartilage and performing subchondral drilling with 2.0 mm drill bit to prepare the joint surfaces for fusion.
2) Attention was directed to a 15 cm longitudinal lateral incision over the fib-

ula. A fibular graft was harvested 5 cm proximal to the fibular tip and extended 10 cm proximally, yielding a total graft length of 10 cm while preserving the periosteum. Since the osseous void was estimated at 2.5 cm intraoperatively using a sterile ruler, a total of approximately 7.5 cm of fibular graft was required to reconstruct medial column with three strut segments. Occasionally, 1 - 2 cm of excess graft was morselized and repurposed as supplemental autograft to support fusion.

3) The ankle syndesmosis was stabilized using a 1/3 tubular plate and four 3.5 mm fully threaded cannulated screws. All screws engaged the tibial far cortex to create super construct. Syndesmotic stabilization was required specifically because the harvest site compromised ankle stability.
4) The harvested fibula was fashioned into three equal strut segments to fill the medial column defect and restore limb length.
5) A 2.0 mm drill bit was used to create two transverse holes in each segment. Two 1.7 mm stainless steel Kirschner wires were passed through the holes in a railroad configuration, and the segments were then aligned and compressed into a single column (Figure 1).
6) The wires were twisted to secure the construct, leaving a central canal to accommodate a 7.0 mm screw for intramedullary fixation (Figures 2-4).
7) Single column with fibular strut graft was placed on medial column and fixated with 7.0 mm screw (Figures 5-7), and medial column was stressed and no motion appreciated.

**Figure 1.** Clinical image of three equal strut fibular segment in railroad configuration.

**Figure 2.** Schematic drawing created to illustrate the construct prior to twisting the Kirschner wire.

**Figure 3.** Schematic drawing of single column with fibular strut autograft.

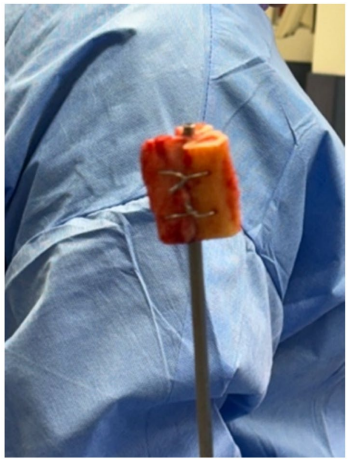

**Figure 4.** Clinical image of single column with fibular strut autograft.

**Figure 5.** Final radiograph image of final construct, AP Ankle.

**Figure 6.** Final radiograph image of final construct, DP Foot.


**Figure 7.** Final radiograph image of final construct, Lateral Foot.

Patient will typically use a night splint to maintain the ankle at 90˚ post-operatively. The patient will remain non-weightbearing for 7 weeks, followed by a non-contrast CT scan of the operative limb to assess fusion, including bony ingrowth into the medullary canal (**Figure 8**). If fusion is progressing appropriately, the patient will begin weightbearing as tolerated in a Charcot Restraint Orthotic Walker (CROW) boot for 2 weeks, with weekly serial radiographs to monitor for hardware complications. If pain-free, the patient will transition to supportive footwear. Impact activities will be restricted for 3 months post-fusion assessment. We do not routinely order physical therapy, but it is sometimes needed for gait training when the patient begins ambulating.

This patient is currently at 16-weeks follow-up. Due to a post-operative wound complication, non-weightbearing status was extended to 14 weeks. At 15 weeks post-operatively, non-contrast CT demonstrated progressive bony ingrowth into

the medullary canal (Figure 8). The medial column fibular strut graft site is now clinically and radiographically fused. The patient has now initiated protected ambulation in a CROW boot.

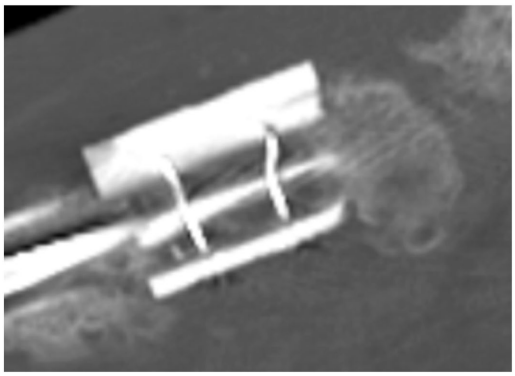

**Figure 8.** Non-contrast CT demonstrating intramedullary trabecular bone ingrowth into the medullary canal, supporting solid fusion.

## 3. Discussion

In this surgical technique, we describe medial column arthrodesis using an ipsilateral fibular strut autograft combined with ankle syndesmosis stabilization. The major reconstructive challenge was the large osseous defect following removal of a nonviable medial cuneiform, which resulted in a markedly shortened medial column. It is paramount to confirm infection clearance with negative culture results prior to proceeding with definitive reconstruction. Literature on medial column lengthening is sparse. Roukis *et al.* described the use of a single fibular allograft strut [4]; however, allograft provides only osteoconductive and osteo-inductive properties, and a single strut offers limited structural stability. In contrast, our ipsilateral fibular strut autograft offers additional osteogenic potential and is cost-effective, and when configured as multiple struts within single column, offers superior structural stability and an optimal scaffold for arthrodesis site. Donor-site morbidity is a common concern with autograft harvesting. Potential complications at the fibular harvest site include superficial peroneal nerve injury or entrapment. Despite the need for larger studies, Chun *et al.* reported no donor-site pain following large segment fibular autograft harvest in a pilot study [6].

In terms of surgical pearls, segmenting the fibular autograft into three struts and reconstituting it into a single column using a railroaded Kirschner wire technique allowed both precise contouring of the graft to the defect and optimal cortical contact across the arthrodesis surfaces. Maintaining the central canal allowed for insertion of a 7.0 mm intramedullary screw for biomechanical support. This construct, further supported by thorough preparation of the arthrodesis interfaces including subchondral drilling, provided a stable foundation for achieving union and restoring medial column length. Additional stabilization of the ankle syndesmosis using a plate-and-screw super-construct reinforced overall limb alignment and enhanced rigidity.

This case demonstrates that ipsilateral fibular strut autografting combined with ankle syndesmotic stabilization can effectively address large medial column osseous defects while restoring length of medial column. This technique leverages the biological and mechanical benefits of autologous bone, enables precise reconstruction of limb length, and integrates well with modern super-construct principles for diabetic limb salvage. Although long-term outcomes and larger comparative studies are necessary, early results suggest that this approach may provide a reliable and safe solution for medial column lengthening.

## Acknowledgements

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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