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Hardware Failure Rates in Intramedullary Foot Fixation for Midfoot Charcot Correction

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Purpose

- The goal was to evaluate the failure rate of intramedullary foot fixation (IMFF) when utilized in midfoot Charcot reconstruction.

Methodology & Hypothesis

- After obtaining institutional-review-board approval, a retrospective medical record review was conducted to identify all feet that had IMFF for midfoot Charcot reconstruction between March 2004 and August 2011.
- Medical records of 86 patients (97 feet) who had midfoot Charcot correction were reviewed.
- Inclusion criteria:
  - Midfoot Charcot neuropathy that required surgical correction (rockerbottom type)
  - Pedal instability of the midfoot ("Bayonet")[1,2] (Figure 1)
  - Ulceration or at risk for ulceration
  - Treatment with IMFF
- Exclusion criteria:
  - Midfoot Charcot treated with external fixation.
  - Midfoot Charcot treated with internal fixation other than IMFF.

Figure 1. "Bayonet" Charcot deformity of the midfoot with forefoot superimposed dorsally on hindfoot.

- Of the 86 patients, 42 patients (52 feet) met the inclusion criteria. Feet were then categorized based on type of surgery and fixation.
- Data were analyzed to determine the rate and causes of implant removal.
- The authors hypothesized that infection would be the most common cause of hardware removal.

Literature Review

- IMFF has been referred to in the literature as beaming and axial screw fixation for correction of midfoot Charcot deformity.[1]
- Sammarco[1] followed 22 patients who underwent a similar IMFF technique and found that 36% experienced hardware failure.
- Grant et al.[3] evaluated IMFF with subtalar joint arthroereisis in 70 patients and found only 6% experienced hardware failure.
- Eschler et al. in 2015[4] tried to simulate a "superconstruct" by fixating both the medial and lateral columns to increase stability thereby reducing the risk of complications. They evaluated 21 patients over four years and found that despite increasing stability, complication and reoperation rates remained high. Their study demonstrated implant failure in 46% of patients, implant breakage in 33%, implant loosening in 10%, and nonunion in 5% of patients. Ultimately, 23% required a more proximal amputation.[4]

Results

- Reconstructions consisted of:
  - IMFF: 65.4% (34/52) (Table 1)
  - Two-stage reconstruction: 19.2% (10/52)
    - Two-stage reconstruction consisted of gradual correction with hexapod assisted external fixation followed by definitive fusion of the medial and lateral columns with IMFF.
  - Combination of IMFF and external fixation: 15.4% (8/52)
- Implant removals were required in a total of 25 feet:
  - IMFF: 64% (16/25)
  - Combination of IMFF and external fixation: 20% (5/25)
  - Two-stage reconstruction: 16% (4/25)
- Twenty-five (48.1%) of 52 feet required hardware removal at an average of 18 months after correction (Table 2). The most common cause of removal was implant-related infection (56.0%; 14 of 25 feet).
- Other complications occurred but did not result in implant removal, such as re-ulceration, nonunion, delayed union, amputation, development of contralateral foot Charcot arthropathy, and death.

Table 1. Method of fixation for midfoot Charcot reconstruction (n = 52 feet).

Type of Fixation	Number of Feet (%)
Intramedullary fixation	34 (65.4%)
Intramedullary fixation with external fixation	8 (15.4%)
Intramedullary fixation maintained following removal of external fixation	10 (19.2%)

Table 2. Primary cause of IMFF hardware removal at an average of 18 months (n = 25 feet).

Cause of Removal	Number of Feet (%)
Implant-related infection	14 (56.0%)
Hardware breakage	5 (20.0%)
Recurrence of adjacent joint Charcot arthropathy	4 (16.0%)
Implant loosening	2 (8.0%)

Analysis & Discussion

- Overall complication rates reported in the literature are greater than 30%.[4]
- In our retrospective study of 52 feet, intramedullary fixation was removed secondary to implant-related infection or broken/loose hardware in 21 (40.4%) of 52 cases.
- Since no singular fixation method is without complications, the risks and benefits must be weighed with any intervention.
- IMFF has been shown to have short-term positive outcomes for midfoot Charcot joint correction.[2] Careful patient selection is critical in achieving a successful outcome for this very challenging population.
- Based on our long-term findings, IMFF:
  - Should be used with caution when there are open wounds or suspected superficial or deep infection.
  - Can be augmented with external fixation to protect internal fixation.
  - Should be performed with caution in patients who are unable to remain non-weight bearing for extended periods.

References

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