Procedure Selection for Hallux Valgus Deformity with Underlying Metatarsus Adductus: Can Combined Deformity Be Corrected with Isolated Lapidus Fusion?

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STATEMENT OF PURPOSE

The presence of metatarsus adductus (MA) in the setting of hallux valgus (HV) surgery can pose a challenging problem for surgeons. Many surgical options for HV involve correction of the intermetatarsal angle (IMA), however patients with MA typically do not have a significant increase in IMA, making bunion correction incomplete and prone to recurrence. This review demonstrates surgical outcomes in consecutive patients undergoing Lapidus fusion for hallux valgus with underlying MA to evaluate if Lapidus fusion is able to improve MA.

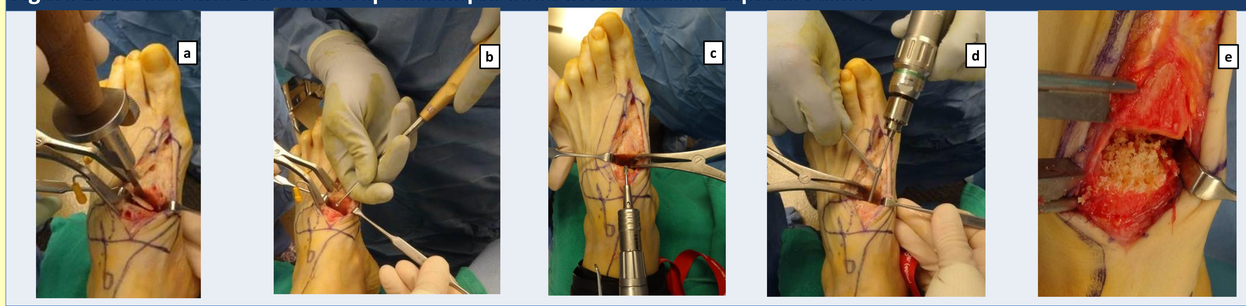
LITERATURE REVIEW

MA has been thought to be a possible risk factor for the development of HV. There is also concern for higher risk of recurrence following bunion surgery in these patients, making procedure selection challenging. La Reaux et al. reported a 35% prevalence of MA in HV patients, stating that patients with MA are 3.5x more likely to develop HV [1]. Loh et al. reported similar prevalence with 33% of HV patients having MA. They also reported on functional outcomes following bunion surgery and did not find MA to predispose patients to poorer functional outcome [2]. Aiyer et al. reported a prevalence of 29.4% in HV patients [3]. Aiyer also reported a recurrence rate of 29.6% in patients with MA undergoing bunion surgery compared to a 15% recurrence rate in those without MA [4]. While there are various procedures that can address HV in MA patients, to our knowledge there has yet to be a study that demonstrates the degree of correction in MA achieved by Lapidus fusion.

METHODOLOGY

A level 4 retrospective study of consecutive cases was performed from December 2015 to December 2017. Cases were identified through Current Procedural Terminology (CPT) codes for 1st tarsometatarsal joint (TMTJ) fusion. 103 patients who underwent 1st TMTJ fusion were identified. All procedures were performed by one surgeon (TJB). Inclusion criteria for this study consisted of patients who underwent Lapidus fusion for correction of HV deformity who had MA based on Engel's angle preoperatively and who had weight bearing (WB) radiographs preoperatively and 10 weeks postop. Patients who underwent fusion for DJD, patients who had adjunctive procedures to the second metatarsal such as fusion or osteotomy as well as patients with multiple midfoot fusions were excluded. A patient was considered to have MA if their Engel's angle was ≥ 24˚. The IMA was also assessed preoperatively and at 10 weeks postop. Patients were excluded if they had Lapidus fusion for other conditions, or if documentation, imaging or follow up was incomplete. The mean degree of MA correction obtained was calculated using the preop and 10 week postop AP WB xrays. Statistical significance was set at $p \leq 0.5$ for correction of MA and IMA. We hypothesized that Lapidus fusion would improve the degree of MA in patients with HV deformity.

Figure 1. Curette and Bur Joint Prep Technique Used in All Cases of Lapidus Fusion

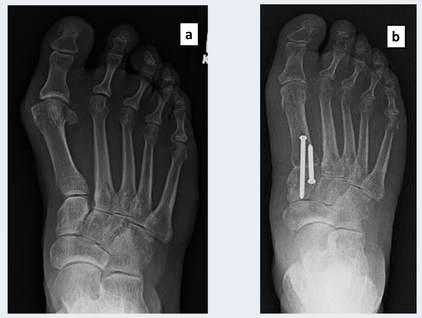


(a) Initial joint prep is performed with a flexible osteotome. (b) This is followed by curettage to remove remaining cartilage. (c) Next, a rotary bur is used to remove the calcified cartilage layer. (d) Lastly, the subchondral bone is fenestrated with a 2.0 mm drill. (e) Use of the drill instead of a K-wire allows for autograft to be drawn out into the fusion site.

Figure 2. Manipulation of the Entire Tarsometatarsal Joint Complex

(a) Midfoot manipulation technique is shown here with stabilization of the rearfoot with one hand while compressing the IMA and abducting the entire forefoot out of adductus as indicated (green arrow). (b,c) Preoperative manipulation can be performed to assess flexibility of midfoot deformity. Note reduction of metatarsus adductus. (d) The hand used to manipulate the forefoot needs to remain out of the way when placing temporary fixation. A resident assistant is helpful when performing this step as a minimum of 3 hands are needed.

Figure 3. Fixation Construct for Lapidus



(a) Preop AP x-ray with significant HV deformity and underlying MA. (b) 10 week postop x-ray of Lapidus fusion involving our standard 3.5 crossing solid screw fixation. Note significant reduction of IMA and MA.

PROCEDURE

Lapidus arthrodesis was performed using a standard dorsomedial approach. Joint prep was performed using the same technique, involving removal of articular cartilage using a flexible osteotome followed by curettage. The subchondral plates were thinned and contoured with a rotary bur to expose bleeding bone. The joint surfaces were then fenestrated with a 2.0 mm drill. Allograft produced by the drill was replanted into the fusion site to promote healing **(Figure 1)**. Intentional lateral manipulation of the entire TMTJ complex was performed in an attempt to optimize 1st ray alignment **(Figure 2)**. Our standard approach to Lapidus arthrodesis for correction of HV also involves reconstruction of the medial collateral ligament using 2-0 braided composite suture and bone tunnel anchoring system. Postoperative recovery involved non-weight bearing in a surgical shoe for 6 weeks followed by progressive weight bearing in a removable cast boot for 4 weeks.

Table 1. Summary of Results (N = 52 Feet)

Gender (M: F)	5:47
Mean Age (years)	54.1 (range 23-73)
Laterality (R:L)	21:31
Mean Preop Engel's Angle	28.7˚ (range 24-42)
Mean 10 Week Postop Engel's Angle	22.1˚ (range 10-30)
Mean Improvement Engel's Angle Preop to 10 Weeks Postop	**6.6˚ +/- 0.61 (p< .00001)**
Mean Preop IMA	14.3˚ (range 10-28)
Mean 10 Week Postop IMA	6.3˚ (range 1-10)
Mean Improvement IMA from Preop to 10 Weeks Postop	**8.0˚ +/- 1.48 (p< .00001)**
Mean Preop HAA	30.8˚ (range 8 – 51)
Mean 10 week PostOp HAA	13.6˚ (range 2 – 29)
Mean Improvement HAA from Preop to 10 Weeks Postop	**17.2˚ +/- 1.19 (p<0.01)**

RESULTS

There were 75 patients who underwent Lapidus fusion for HV between December 2015 to December 2017. 52/75 (69.3%) patients met criteria for MA based on an Engel's angle ≥ 24˚. This included 5 males and 47 females. Of the MA patients, the average preoperative IMA was 14.3˚ (range 10-28) and the average postoperative IMA was 6.3˚ (range 1-10). The average preoperative Engel's angle was 28.7˚ (range 24-42). The average postoperative Engel's angle was 22.1˚ (range 10-30) with mean improvement in MA of 6.6˚. 30/52 (57.6%) patients had a normal Engel's angle 10 weeks postop. Additionally, the average preoperative HAA was 30.8˚ (range 8-51). The average postoperative HAA was 13.6˚ (range 2-29), which resulted in an average correction of 17.2˚. Improvement in both Engel's angle, IMA, and HAA were found to be statistically significant .

ANALYSIS & DISCUSSION

This retrospective study was undertaken to assess the radiographic correction of MA achieved with Lapidus fusion. The prevalence of MA in patients undergoing HV surgery was found to be 69.3% in this study. This is a higher prevalence than what has been previously reported. Limitations of this study include the relatively small number of patients, although all were consecutive which decreases exclusion bias. All procedures were performed by a single surgeon, which could be seen as a benefit because this removes the inter-surgeon variability with patient selection and procedure technique. We also had a relatively short follow-up period of 10 weeks. In conclusion, the present study of consecutive patients supports a high prevalence of MA in patients undergoing HV surgery. Lapidus fusion was shown to improve the degree of MA which should be considered when selecting the ideal HV procedure in this patient population.

REFERENCES

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