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Lateral soft tissue release with distal chevron metatarsal osteotomy in moderate and severe hallux valgus

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The purpose of this study was to evaluate the radiographic outcomes of distal chevron metatarsal osteotomy associated with lateral joint capsule split as only lateral soft tissue release in patients with symptomatic moderate and severe hallux valgus (HV) deformity.
Ninety patients (103 feet) at our institution between January 2014 and December 2019 were included in the present retrospective study.
Each patient was evaluated preoperatively and at final follow-up by means of weight bearing radiographs lateral and dorsoplantar views. We analyzed hallux valgus angle (HVA), first-second intermetatarsal angle (IMA) and medial sesamoid position (MSP).
The mean follow-up time was 21.8 months (range 6-69.4).
The mean of the HVA improved, from 36.6 to 24.3º, the IMA from 13.05 to 9.93º and the MSP from 2 to 1.
Our study demonstrates that the deformity recurrence rate after surgery is 69.9%. Radiologic HV recurrence was defined by a final HVA equal or more than 20 degrees at final follow-up.
Level of Evidence, IV.

Keywords: Hallux valgus, osteotomy, distal, joint capsule release, tenotomy.

INTRODUCTION

Hallux valgus (HV) is one of the most common deformities of the forefoot. It is a complex progressive triplane deformity, characterized by a medial displacement of the first metatarsal head in relation to the sesamoids and a lateral deviation of the great toe. It is associated with pain, functional disability, and problems in shoe wear[1].

Mann and Coughlin classified HV into three types according to the HVA and the IMA: mild (HV <20º, IMA <11º), moderate (HVA 20-40º, IMA 11-16º) and severe (HVA >40º, IMA >16º)[2].

The HV treatment is continuously evolving, and not one single treatment can be recommended. Most corrective procedures for HV deformity use a combinationof osteotomy and soft tissue procedure with overall good to excellent clinical results[3-6] (Fig. 1). Distal chevron osteotomy is widely accepted for correction of HV7-10. There are concerns with avascular necrosis (AVN) as the plantar cut of the osteotomy exits close to the plantar nutrient vessels, particularly when combined with a lateral soft tissue release.

Lateral soft tissue release is regarded as a key step in the treatment of HV. The purpose is to release the contracted lateral structures, to relocate and rebalance the first metatarsal head onto the sesamoid ligament complex.

A recent study demonstrated the superiority of the combined osteotomies with a soft tissue release[4]. Controversy remains regarding which exact anatomicalstructures (Fig. 2) need to be released in combination with metatarsal osteotomies for adequate surgical correction.

A thorough knowledge of the local anatomy is paramount for performing the procedure[11]. The following lateral structures possibly are involved: the lateral metatarsophalangeal (MTP) capsule with the lateral collateral ligament (LCL), lateral metatarsal-sesamoid ligament (suspensory ligament) (LSML),

Fig. 1 — Dorsoplantar and lateral radiographs of a 66 years-old female who underwent distal soft tissue procedure and distal chevron osteotomy through one medial incision for a severe hallux valgus deformity: preoperatively (a and b) and 2 years postoperatively (c and d).

deep transverse metatarsal ligament (DTML) and adductor hallucis tendon (oblique and transverse portions) (AHT).

We perform lateral joint capsule split as only lateral soft tissue release in all patients.

The purpose of this study was to evaluate radiological outcomes of a distal chevron metatarsal osteotomy with lateral soft tissue release that included only lateral joint capsule split for correction of moderate and severe HV.

MATERIALS AND METHODS

Study design

This study protocol was approved by the local ethics committee (23/304).

A total of 90 patients (103 feet) with symptomatic, unilateral moderate or severe HV who underwent distal chevron metatarsal osteotomy associated with lateral joint capsule split as only lateral soft tissue release at University Hospital October 12 between January 2014 and December 2019 were included in this descriptive, observational and retrospective study.

The inclusion criteria were as follows:

1) HV patients with HVA equal or more 20º,
2) age at surgery older 18 years,
3) failed previous of nonoperative management and
4) post-operation follow-up time being more than 6 months.

Patients were excluded if one of these conditions was present:

1) radiographic evidence of substantial degenerative arthritis of the first metatarsophalangeal joint (MTP),
2) rheumatoid arthritis affecting the foot,
3) foot infection, neuromuscular disease, or peripheral vascular disease,
4) previous hallux surgery, or
5) incomplete radiographs preoperatively and at the final follow-up (Fig. 3).

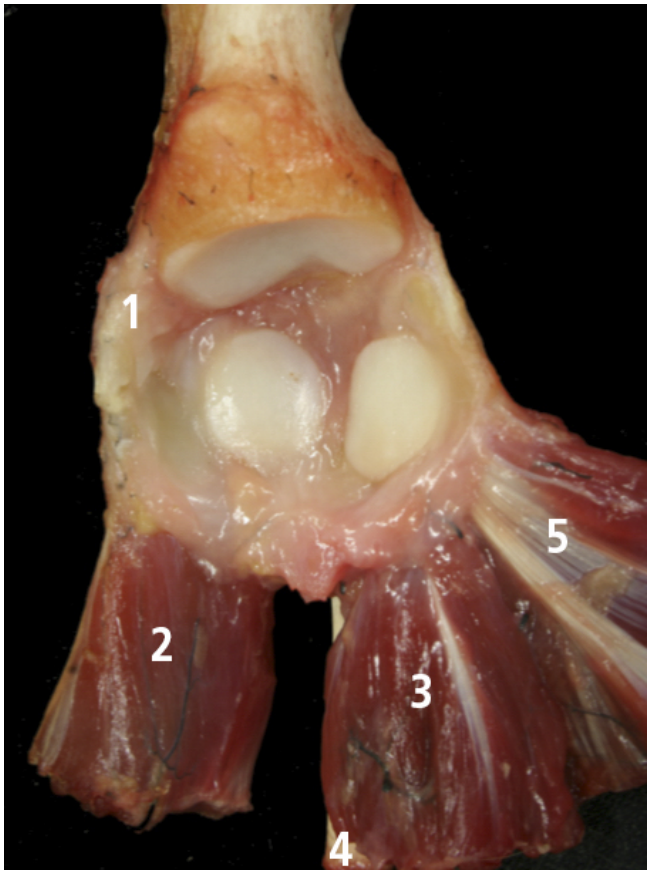

Fig. 2 — Dorsal view of a anatomial diseccion of the left first metatarsophalangeal joint. The first metatarsal has been removed. (1) Adductor hallucis tendon (cut). (2) Lateral head of flexor hallucis brevis muscle. (3) Medial head of flexor hallucis brevis muscle. (4) Flexor hallucis longus tendon. (5) Abductor hallucis muscle. (Courtesy of Professor X. Martín, University Barcelona, Spain.

Operative technique

A tourniquet was used in all patients. A straight incision of approximately 4 to 5 cm was made on the medial surface of the first metatarsophalangeal (MTP) joint.

A longitudinal midline capsulotomy was performed in line with the skin incision.

A medial exostosis resection was undertaken to the sagittal sulcus with a saw.

Osteotomy centered at the head was subsequently made. The dorsal cut was directed perpendicular to the second metatarsal in the axial plane. The length of the plantar cut could be adjusted according to the IMA angle (traditional chevron or more horizontal, extended plantar limb). The plantar cut was also directed slightly plantar in the medial to lateral direction. For large distal metatarsal articular angle (DMAA) the procedure included the removal of a medially-based wedge from the capital fragment.

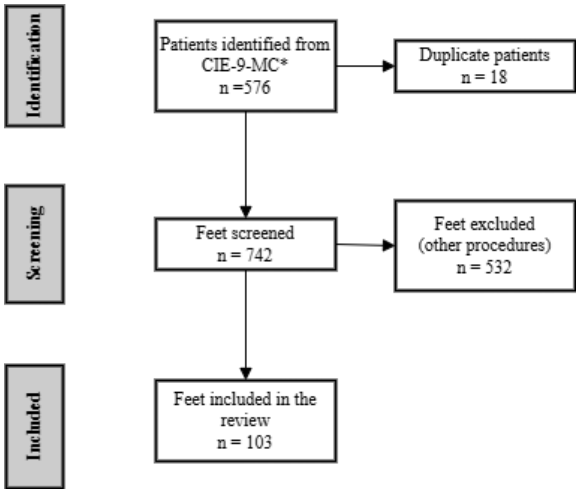

*Fig. 3 — Flowchart depicting study enrolment process. * HV underwent surgical treatment at University Hospital October 12 between January 2014 and December 2019.*

Regarding the lateral soft release, it was always performed after the osteotomy and included lateral joint capsule (Fig. 4) split longitudinal direction.

The metatarsal head was displaced according to the deformity and the width of the first metatarsal. The osteotomy was secured with one or two cannulated screws sized between 2.5 and 3.0 mm, depending on the length of the osteotomy, from the dorsal shaft to the plantar metatarsal head. The adequacy of correction was checked by simulating weight bearing on a flat surface and X-ray fluoroscopy. Intraoperative confirmation that the first metatarsal head is repositioned over the sesamoids is necessary. Then, any medial bone protrusion was removed. An additional Akin osteotomy (closed-wedge osteotomy of theproximal phalanx) was performed in cases where the reduction of HVA was deemed insufficient or increased proximal to distal phalangeal articular angle (PDPAA). Finally, medial capsular plication was performed to restore the corrected alignment of the first metatarsophalangeal joint.

Postoperative care

The bandage was adjusted weekly by the surgeons in order to maintain the correction. Weight bearing with a hard-sole orthopedic shoe was permitted as tolerated the day after surgery. After 6 weeks, full weight bearing and sports shoe were permitted. We recommend a toe spacer for at least 3 months postoperatively to decrease the tension on the medial side.

Radiographic assessment

Three orthopaedic surgeons measured all radiographic parameters.

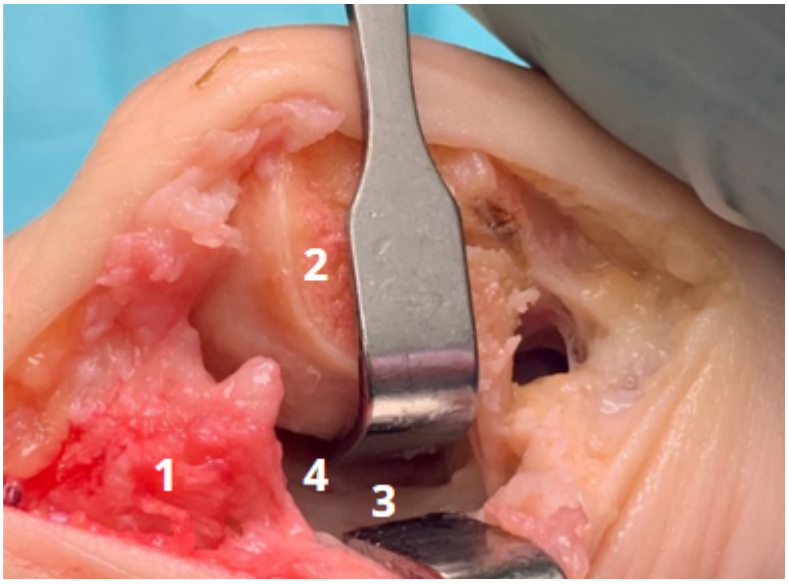

Fig. 4 — Medial transarticular approach. (1) Phalanx, (2) Metatarsal head. (3) Sesamoids. (4) Lateral joint capsule.

The HVA, the IMA and the MSP were analysed with weight bearing foot dorsoplantar plain radiographs preoperatively and at final follow-up visit.

To define the longitudinal axis of the first metatarsal a line is draw from the centre of the head through the centre of the base, as described by Miller in 197412.

MSP was determined according method documented by Smith et al.13. This method relate the position of the medial sesamoid to the longitudinal axis of the first metatarsal and was classified as grade 0, 1, 2 or 3.

Radiologic HV recurrence was defined by a final HVA equal or more than 20 degrees at final follow-up.

Statistical analysis

Descriptive statistics was done for continuous variables in terms of means and standard deviations. Qualitative variables were presented in terms of absolute frequencies and proportions. Comparisons of quantitative variables for different levels of a qualitative variable were made by applying a t test.

Statistical computations were done using R12 version 4.1.3.

RESULTS

Only 5 (4.8%) of those patients were men, while 98 (95.2%) were women. The mean age of the patients at the time of surgery was 62.1 years (range 22-88).

The mean follow-up was 21.8 months (range 6-69.4). Out of the 103 cases of HV, 73 (70.87%) and 30 (29.13%) were classified as moderate and severe, respectively.

The HVA decreased by a mean of 12.3º, from a preoperative mean of 36.6º (range 21-65) to a mean of 24.3º (range 6-55) at the final follow-up visit ($p<0.001$).

The IMA decreased by a mean of 3.12º, from a preoperative mean of 13.05º (range 5-22) to a mean of 9.93º (range 2-18) at the final follow-up visit ($p<0.001$).

The MSP decreased from a preoperative mean of 2 to a mean of 1 at the final follow-up visit ($p<0.001$).

Fifty-eight (56.3%) feet had Akin osteotomy.

Recurrence was reported in 71 cases (69.9%) over a mean follow-up period of 21.8 months.

DISCUSSION

We perform lateral joint capsule split as only lateral soft tissue release in all patients. Various authors assume different combinations of anatomical structures under the expression lateral release.

The release of the lateral metatarsal-sesamoid ligament (suspensory ligament) (LSML) after incision of the lateral articular capsule and the lateral collateral ligament (LCL) is the key to a successful lateral release[3,15]. According Schneider, the ligament between the lateral part of the lateral sesamoid and the plantar plate of the second MTP joint (PTML) should be avoided, since the transection can result in increased first-second intermetatarsal angle (IMA) and medial displacement of the sesamoids15. A meta-analysis demonstrates a beneficial effect of sectioning the LSML along with the lateral capsule in all cases

of HV deformity, to add an adductor hallucis tendon (oblique and transverse portions) (AHT) transection only if the correction is not fully achieved and a third release via PTML transection only when the transection of the LSML and the AHT do not full correct HV deformity[16].

Del Vecchio et al show that an AHT release may be sufficient to correct valgus deformity, mainly in the presence of incongruent MTP joints, in a cadaveric study[17]. Gong et al conclude that the modified distal chevron together with release of lateral capsule and AHT achieve significant improvement for moderate to severe HV deformity[18].

For the lateral soft tissue release, options include: the traditional open dorsal approach in the first intermetatarsal space, the medial approach[18-20] and minimally invasive surger[14, 22-24].

At present study, a medial transarticular approach was used in every patient. Hartenbach et al.[25] conclude that open dorsal and medial transarticular approaches for the lateral release combined with the scarf osteotomy led to equal outcomes.

Similar results were achieved by Ahn et al.[26] and Park et al.[27] who compared the transarticular lateral release vs the interdigital lateral release combined with a distal chevron osteotomy. The decision for single or double incision depends mainly on the personal preference of the surgeon.

Our study demonstrates that the deformity recurrence rate after surgery is 69.9%over a mean follow-up period of 21.8 months.

The recurrence rate in our study population was higher than in the literature[28].

When performing a distal chevron osteotomy with lateral soft tissue release should be considered: careful anatomical dissection, avoidance of excessive stripping of the joint capsule and periosteum, great care should be taken with the use of the saw when performing the osteotomy cuts, the plantar limb cut should be positioned well proximal to the capsular attachment and a separate intermetatarsal incision for the lateral release should be avoided.

Among other factors (osteototomies, medial capsular plication), insufficient lateral soft tissue release could contribute to undercorrection or increased risk ofrecurrence of deformity. This situation could be the result of an improperpreoperative planning. The use of weightbearing computed tomography may behelpful to assess the preoperative forefoot alignment with HV deformity and guide the appropriate treatment strategy[29].

The present study has several limitations. First limitation, it is a retrospective study, which led a risk of bias due to the lack of standardizacion in methodology.

Second limitation, it is a non-comparative study. Third limitation, this study is a radiographic analysis only.

CONCLUSION

Our study demonstrates that the recurrence rate after moderate and severe HV surgery is 69.9%. The question is whether these outcomes resulted from poor execution of the procedures or a failure in the preoperative classification of the deformities.

Among other factors, lateral soft tissue release, osteotomies and medial capsular plication contribute to correction of HV deformity. Regarding the lateral soft tissue release, future comparative clinical trials are necessary to standardize release of the lateral soft tissue and to determine what should be sectioned according to the severity of the deformity to get the best correction with the least risk of recurrence.

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