



Short Term Observations on Distal Chevron Osteotomy Without Lateral Soft Tissue Release in Mild to Moderate Hallux Valgus Deformity: A Prospective Study

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Abstract

Background: The purpose of this study was to observe short term results of distal chevron osteotomy in mild to moderate hallux valgus deformity with respect to deformity correction, radiographic and functional outcomes and record of complications.

Methods: The study was a prospective study and consisted of a total of 35 cases who were admitted in the Bone and Joint Surgery Hospital from September 2017 to March 2020. All the patients were treated by distal chevron osteotomy.

Results: In our study, the average value of hallux angle preoperative was 32° (range, 24°-40°) and at final follow-up it was 14° (range, 8°-31°). The average reduction was 18°. The average intermetatarsal angle showed mean reduction of 2.7° at the final follow-up. Average range of motion of the first metatarsophalangeal joint preoperative and at final follow-up showed small reduction of 5 degrees. The average preoperative AOFAS score was 49, which improved by 35 points to 84 at the final follow-up. 11.4% of the patients in the study group recurrence.

Conclusions: Based on our experience with distal chevron osteotomy, we found the procedure easy to perform with good procedural outcomes. However, the patient or the parents should be counselled before the procedure of possible complications, particularly recurrence.

Keywords: Hallux valgus; Distal chevron osteotomy; AOFAS score; Recurrence

Introduction

Hallux valgus is a very common deformity of the foot in which there is valgus angulation at the first metatarsophalangeal joint. Hallux valgus defined by Stamm et al. as a complex progressive deformity affecting the fore foot in which lateral deviation of great toe is the obvious feature. The complex may involve one or more of the following conditions; rotation of the hallux; overriding/underriding of second toe; metatarsus primus varus and bunion formation of first metatarsal head [1].

The deformity bothers the patient because of the following reasons which include pain over bunion, difficulty in shoe wear, cosmetic concern and metatarsalgia. Because of the pain and difficulty in shoe wear, it adversely affects the quality of life and results in restriction of the daily activities of the patients.

Hallux valgus is reported to be the most common pathological condition affecting the great toe, its prevalence increases with advancing age [2-6]. The global prevalence reaches up to 23% in those aged between 18 to 65 year and to 35% in the population over 65 years. With a prevalence of 30% in females compared 13% in males, it is apparent that females are more likely to develop hallux valgus [7].

Various etiological factors have been implicated for causing hallux valgus that include: heredity, shoes with a narrow toe-box, females sex, pronation of foot, excessive first ray length, excessive rounding of the first metatarsal head, pronation of the first metatarsal, secondary to amputation of second toe, rheumatoid arthritis, neurogenic imbalance of foot, etc.

Although various conservative treatment modalities have been mentioned for Hallux valgus but Cholemy, et al. stated that no form of

conservative treatment is effective in this condition, and sooner or later one has to operate [8]. Surgery is required in this condition because of pain over bunion, difficulty in shoe wearing and for cosmetic reason. Numerous surgical procedures are listed in the literature for correction of this deformity that include bunionectomy, arthroplasties, tendon transfer procedures, osteotomies, arthrodesis, cuneiform procedures and combined procedures.

The selected procedure for correcting hallux valgus needs to be easy to perform and with minimum complications. The distal chevron osteotomy is a well-known and widely accepted intervention for the treatment of mild to moderate deformities [9]. This technique was first described in 1962, in which a V-shaped cut is made in the first metatarsal after which the distal fragment is displaced laterally [10]. The technique is popular because of its simplicity and low invasiveness, leading to excellent procedural outcomes [11,12].

Normal value of various parameters related to hallux valgus deformity is given below:

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Hallux valgus angle: $\leq 15^\circ$ (Hardy & Clapham) [13]

Inter metatarsal angle: $\leq 9^\circ$.

Range of Metatarsophalangeal joint movement [14]

Neutral position (slight extension): +16

Active dorsiflexion: 51°

Additional passive: 23°

Active planter flexion: 23°

The IMA is formed by the longitudinal bisection of the shafts of the first and second metatarsal. The HVA is formed by the intersection of a line drawn through the long axis of the first metatarsal and the long axis of the proximal phalanx [15]. Table 1 shows the different grades of hallux valgus [16].

Aims and Objectives of the Study

To observe the results of distal chevron osteotomy in hallux valgus in respect of

Correction of deformity.

Normalization of radiographic angles.

Functional outcomes especially range of motion and relief of pain.

Record of complications.

Materials and Methods

This study was carried out in the Postgraduate Department of Orthopedics, Hospital for Bone and Joint Surgery, Government Medical College Srinagar. The study was a prospective study and consisted of a total of 35 cases who were admitted in the Bone and Joint Surgery Hospital from September 2017 to March 2020. All the patients were treated by distal chevron osteotomy. Approval to carry out the study was obtained from Institutional ethical committee. Informed consent was taken from each patient for their inclusion in the study.

Inclusion criteria were patients age 18-60 years, all sexes, patients with hallux valgus deformity with pain or difficulty in shoe wear, hallux valgus angle 200 to 400 and intermetatarsal angle 100 to 160. Patients with previous surgery of the first ray, compromised neurovascular status of the foot i.e, diabetic neuropathy or peripheral vascular disease and patients with hallux valgus secondary to neuromuscular disorder, metabolic disorder or trauma were excluded from the study. From all the patients, a detailed history with reference to pain, difficulty in shoe wear, loss of function, foot and ankle related quality of life was taken.

Detailed clinical examination was done. AOFAS score was calculated both preoperatively and at final follow up of 1 year. The following radiographs were taken preoperative: dorsoplantar (anteroposterior) weight bearing x-ray views, weight bearing lateral view and sesamoid view.

All cases were evaluated using The American Orthopaedic Foot and Ankle Society Score (AOFAS) [17]. Hallux Metatarsophalangeal-Interphalangeal Scale is given Table 2.

Operative technique

An informed consent was taken from the patients. All the patients received a dose of prophylactic antibiotic (cefuroxime 50mg/kg body wt.) within 1 hour of surgery before tourniquet application. The procedure was done under spinal or general anesthesia. A thigh tourniquet was used. The patient was placed supine on the operating table so that the entire foot to be operated upon is accessible. The foot was washed with savlon and then painted with 10% betadine solution and draped. A medial incision, approximately 5 to 6 cm in length was made over the medial aspect of the metatarsophalangeal (MTP) joint, extending from the base of the proximal phalanx to just proximal to the metatarsal head. As the capsule was identified, a straight incision was made down to the bone in line with the skin incision. The capsule was stripped from medial aspect and dorsal and plantar capsular flaps were retracted and medial eminence of the metatarsal head was osteotomized with the oscillating saw. A "V" shaped osteotomy was made across the head of the first metatarsal, parallel to the bottom of the foot with its apex at the center of the metatarsal head, as observed from the medial side, and was often the center of the oval that was left after removal of the medial eminence. The osteotomy subtended an angle of 50-60 degrees. Once the osteotomy was completed, the distal fragment was displaced laterally, approximately 3 to 4 mm, but the amount of displacement was decided on basis of the degree of deformity and it was also made sure that the displacement was not greater than 50% of the width of the metatarsal head. The osteotomy was then impacted and fixed with a 2.7mm cortical screw. The screw was driven from dorsal to plantar across the osteotomy site to hold the fragments in position. The remaining overhanging portion of the bone that was left behind after lateral displacement of the metatarsal head was resected and remaining sharp edges were smoothed off with a rongeur. The great toe was then brought into alignment with the metatarsal and the medial capsular redundancy was corrected by removal of 1-3-mm slice of capsule from the plantar lip of the medial capsular incision, and the capsule was tightly closed with interrupted 2-0 braided absorbable suture. The tourniquet was then released, and hemostasis was achieved. The skin was then closed, and a bulky dressing applied.

Grades	Angle	
Mild	Hallux valgus angle	$<20^\circ$
	Inter metatarsal angle	$\leq 11^\circ$
	Subluxation of lateral sesamoid as on APX-ray	$<50\%$
Moderate	Hallux Valgus angle	$20-40^\circ$
	Intermetatarsal angle	$12^\circ-16^\circ$
	Subluxation of lateral sesamoid	$50^\circ-75\%$
Severe	Hallux Valgus angle	$>40^\circ$
	Intermetatarsal angle	$>16^\circ$
	Subluxation of lateral sesamoid	$>75\%$

Table 1: Grades of hallux valgus.

Scale	Score
Pain (40 points)	
None	40
Mild, occasional	30
Moderate, daily	20
Severe, almost always present	0
Function (45 points)	
Activity limitation	
No limitation	10
No limitation of daily activities, limitation of recreational activities	7
Limited daily and recreational activities	4
Severe limitation of daily and recreational activities	0
Footwear requirements	
Fashionable, no inserts	10
Comfort footwear, shoe insert	5
Modified shoe or brace	0
MTPJ range of motion (plantar+dorsiflexion)	
Normal or mild restriction (75 degree or more)	10
Moderate restriction (35-74 degree)	5
Severe restriction (Less than 30 degree)	0
IPJ range of motion (plantarflexion)	
No restriction	5
Severe restriction (Less than 10 degree)	0
MTBJ-IPJ Stability (all planes)	
Stable	5
Definitely unstable or able to dislocate	0
Callus related to hallux MTPJ-IPJ	
No or asymptomatic callus	5
Callus, symptomatic	0
Alignment (15 points)	
Good, hallux well aligned	15
Fair, hallux malalignment, no symptoms	8
Poor, symptomatic malalignment	0
Final Grading	
90-100	Excellent
80-89	Good
70-79	Fair
<70	Poor

Table 2: Hallux metatarsophalangeal-interphalangeal scale.

Patients were mobilized on the first postoperative day on crutches. Oral antibiotics were continued for 5 days. On 3rd postoperative day, a boot cast was applied. Touch down weight bearing was allowed for 6 weeks and cast was removed at 6 weeks. The patients were followed at 2 weeks, 6 weeks, 12 weeks, and 6 months and 1 year. Final follow-up was done at 1 year and radiological and clinical assessment was done (Figure 1).

Results

Our study consisted of total of 35 patients. The age of the patients involved in the study ranged from 16-48 years, with mean age of 25.4 years. 28 (80%) patients were females and 7 (20%) were males. Left foot was affected in 50%, right in 30% and 20% had bilateral involvement. 30% of the patients in the study had positive family history. In our study, the average value of hallux angle preoperative was 32° (range, 24°-40°) and at final follow-up it was 14° (range, 8°-31°). The aver-

age reduction was 18°. The average intermetatarsal angle of the cases included in our study was 13.5°, which decreased by 2.7° to 10.80 at the final follow-up. Average range of motion of the first metatarsophalangeal joint preoperative and at final follow-up showed small reduction of 5 degrees. In our study, the average preoperative AOFAS score was 49, which improved by 35 points to 84 at the final follow-up. 11.4% of the patients in the study group had undercorrection. Undercorrection, also designated as recurrence, was defined as a postoperative HVA greater than 20 degrees with less than 10 degrees of angular correction [18]. One patient developed superficial wound infection. 8.6% of the patients had symptomatic hardware at final follow-up. There was no case of non-union, avascular necrosis or hallux varus deformity at the final follow-up of 1 year (Figure 2). Patient characteristics are mentioned in Table 3. Radiological parameters and R.O.M are given in Table 4, AOFAS scores (Table 5) and Complications Figure 3.



Figure 1: Showing important steps of the operative technique.



Figure 2: Clinical pictures of one of the patients preoperative (left) and at final follow up (right).

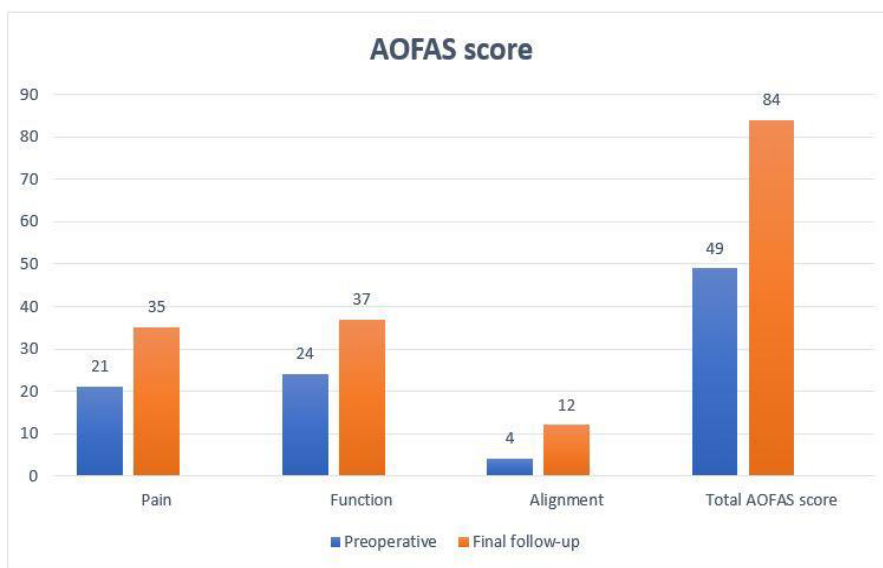


Figure 3: AOFAS score.

Total no. of patients	n=30
Age group	16-48 years
Sex distribution	80% females
	20% males
Feet involved	50% left
	30% right
	20% bilateral
Positive Family history	30% patients

Table 3: Patient characteristics.

Parameter	Mean preoperative value	Final follow-up	Mean change
Hallux valgus angle (°)	32 (24-40)	14 (8-31)	18
Intermetatarsal angle (°)	13.5 (10-16)	10.8 (8-15)	2.7
Range of motion of 1st MTP joint (°)	82	77	5

Table 4: Radiological parameters and R.O.M.

Complications	No. of cases	Percentage
Recurrence	4	11.40%
Infection	1	2.80%
Symptomatic hardware	3	8.60%

Table 5: Complications.

Discussion

Various nonoperative methods have been described for the management of hallux valgus. Nonoperative methods like modification of footwear and orthotics have been seen useful only in the treatment of mild deformities, but for management of moderate to severe deformities nonoperative methods have no role. Chevron osteotomy was described by Corless, et al. [19], in 1976, as a modification of the Mitchell procedure for correction of hallux valgus associated with mild to moderate deformity. Distal metatarsal osteotomies can effectively correct mild to moderate deformities and chevron osteotomy has become widely accepted [20,21]. But before going for operative treatment, the patient should always be explained the complications associated particularly risk of recurrence.

Our study was a prospective study and consisted of a total of 35 cases who underwent distal chevron osteotomy for mild to moderate hallux valgus deformity. The aim of this study was to observe the results of distal chevron osteotomy in hallux valgus deformity with respect to deformity correction, radiographic and functional outcomes, and record of complications.

The mean age in study group was 25.4 years, with range of 16-48 years. Majority of the patients were females. Left side involvement was predominant. 30% of patients had positive family history. 20% of patients had bilateral foot involvement. Majority of the patients had pain over bunion and difficulty in shoe wear as presenting complain.

The hallux valgus angle reduced from 32 degrees preoperative to 14 degrees at final follow-up, with average reduction of 18 degrees and the result was comparable to these studies of Lee, et al. [12] and Lee, et al [22]. The intermetatarsal angle had average correction of 2.7 degrees in the study group and the studies published by Lee, et al. [22] and Resch, et al. [23] showed similar results. AOFAS Score was used for functional assessment, the AOFAS score of 49 (final grading=poor) preoperative improved to final follow-up score of 84 (final grading=good). The results were comparable to the published studies Lee KB et al. and Schneider, et al. [24].

The range of motion of first metatarsophalangeal joint decreased by 5 degrees at final follow-up, without any functional limitations. 11.4% of the patients in the study group had under correction. One patient developed superficial wound infection; the organism isolated was pseudomonas that was treated with antibiotics according to sensitivity report. 8.6% of the patients had symptomatic hardware at final follow-up, that was managed with removal of the screw under local anesthesia.

Conclusion

The distal chevron osteotomy is a well-known intervention for the treatment of mild to moderate hallux valgus. Based on our experience with distal chevron osteotomy, we found the procedure easy to perform with minimal complications. Because of its simplicity, low invasiveness of the technique and good procedural outcomes of this procedure, we safely recommend it in the treatment of mild to moderate hallux valgus. However, the patient and the parents should be counselled before the procedure of possible complications particularly of recurrence. We are using a word of caution because of small sample size of our study.

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