



Proximal First Metatarsal Osteotomy and Mc Bride Procedure in Hallux Valgus: 5-years results of 25 cases

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ABSTRACT

More than 130 operations have been described for the treatment of hallux valgus. However, no evidence that any of these methods of treatment are superior to the others has been described, excepting studies in the long term. The aim of this study was to analyse a series of patients who had undergone Proximal osteotomy of first metatarsal and Mc Bride procedure and had been followed up for 5 years. In This prospective study During a 6 years period, (2005-2010), 25 feet in 24 cases with hallux valgus underwent Proximal first metatarsal osteotomy and McBride procedure, With a mean follow-up of $3/5 \pm 1/5$ years. The cases were evaluated by American Orthopaedics Foot & Ankle Society HalluxMetatarsophalangeal-interphalangeal scale (AOFAS/HMI). Pre and post hallux valgus angle (HVA), intermetatarsal angle (1-2IMA), and the correlation between the angles and patient satisfaction were statistically evaluated. The mean angular corrections for hallux valgus (HVA), and intermetatarsal angle (IMA) were 28 and 10/6 degrees respectively. 13 Patients reported good to excellent results, while in 11 cases dissatisfaction were reported. Proximal first metatarsal osteotomy and Mc Bride procedure for hallux valgus is an acceptable procedure in Patients with hallux valgus deformity correction. Pain and first MTP joint contractures are two main side effects.

Keywords: Hallux Valgus, Osteotomy, Orthopedic Procedures, Joint Capsule Release, Treatment Outcome

INTRODUCTION

Hallux valgus deformity is one of the most common foot problems seen today by foot and ankle specialists. Hallux valgus is a deformity at the first MTP joint with abduction and valgus rotation of the great toe combined with a medi-ally prominent first metatarsal head. The indication for surgery is pain which is not adequately controlled by non-operative means. The pain may be over the bunion itself or in the second metatarsophalangeal joint as a result of insufficiency of the first ray [1]. Also, moderate to severe cases with concurrent degenerative arthritis of the first metatarsophalangeal joint [2], first intermetatarsal angle of more than 12 degrees or hallux valgus angle exceeding 30° can indicate surgical correction [3].

More than 130 operations have been described for the treatment of hallux valgus. The plethora of techniques indicates that no single operation is perfect, and none will address all cases. Treatment which is poorly planned or executed leads to high levels of patient dissatisfaction. [4]. Operation techniques in mild to moderate cases, if indicated, are Micheal, McBride and Chevron [5]. In moderate to severe cases, more complex and combined osteotomies like MT osteotomy in two or three levels, Ludloff osteotomy, or Scarf's are used, depending on patient's condition, and surgeon's proficiency [6].

Of outcome Measures which can determine surgical success against failure, are patients' satisfaction after surgery, especially in those with limitations in wearing shoes. Satisfaction with the cosmetic results can greatly affect the quality of life of patients, especially in females, since the gender ratio in occurrence of hallux valgus is 9 females to 4 males [7].

Pain is the most important variable to both patients and surgeons [4] Preoperative pain level is different in patients, grading from mild or moderate to severe pain. In some patients the pain is totally gone after surgery [8], while in others it may have been reduced to different levels [9].

Preoperative HVA is the main radiological predictor in correction of hallux valgus. Intermetatarsal angle is another factor which is corrected during surgery, and measuring this angle can determine surgical success to some extents.

Flexion and extension ability of first metatarsal should be evaluated in patients' follow up, as it shows the post-operative functionality of first metatarsal and can partly assess the surgical success. More important than that is that it confirms any joint stiffness which is considered a post-operation complication in this surgery.

Common postoperative complications in reconstructive procedures are over and under-correction.

Overcorrection or hallux valgus may also occur for a number of reasons such as overplication of the medial capsul, excessive medial eminence resection, lack of sufficient lateral capsular tissue reformation to stabilize the lateral joint and overcorrection of the osteotomy.

Mal-union of the osteotomy site is another complication. Shortened MT is usually associated with transfer metatarsalgia, usually affects the second metatarsal, but can affect lateral heads. Several authors have suggested that dorsiflexion malunion is less likely to occur with proximal osteotomies done from the medial aspect of the metatarsal when compared to those performed via the dorsal aspect. To limit the chance of dorsiflexion malunion, the saw must be directly in line with the longitudinal axis of the metatarsal; there is a tendency for the leg [and first metatarsal to externally rotate, thus causing the saw to be externally rotated relative to the metatarsal. The osteotomy is performed by moving the saw in a medial to lateral direction [10]. Other risk factors for a malunion include walking too early.

Delayed union is less common complication [$<1\%$ risk] that in case of development, the application of a below-knee walking cast for 6 weeks enables an expeditious healing of osteotomy site [11].

Foremost among the complications of reconstructive procedures are recurrences, sometimes as a result of insufficient lateral release, lack of reduction of sesamoid, insufficient correction of soft tissue, inadequate osteotomy correction, inadequate medial capsular plication or inadequate correction of pronation. Complete correction is the best insurance against recurrence deformity.

In case of infection development, the approach to correction depends on the extent of the bone involvement. If the infection involves the MP joint, arthroplasty or arthrodesis ultimately needs to be performed. As the saying goes, the best way to treat a complication is to avoid one to begin with, and this applies in particular to correction of hallux valgus, for which many treatment approaches carry an increased risk of failure [12].

It has become traditional to classify the severity of the deformity using radiological criteria in order to help formulate an algorithm for surgical treatment: mild [HVA up to 19° , IMA up to 13°]; moderate [HVA 20° to 40° , IMA 14° to 20°]; severe [HVA $> 40^\circ$, IMA $> 20^\circ$]. [4]

In recent years, a number of new osteotomies have been described. Determining which to use can be difficult. Since no comprehensive study regarding outcomes of surgically treated hallux valgus has been conducted in Iran, this study aims to evaluate the outcomes of proximal first MT osteotomy and with McBride procedure, in Patients treated for hallux valgus deformity.

Patients and Methods:

This prospective study was designed and conducted to evaluate the outcomes of proximal first MT osteotomy and with McBride procedure, in Patients treated for hallux valgus deformity in a 5-years period.

During 2009 to 2014, 36 feet of 35 patients with hallux valgus deformity were treated by proximal MT osteotomy and McBride procedure, for deformity correction.

The study was approved by local ethics committee and has been performed in accordance with the ethical standards of the 1964 Declaration of Helsinki. All patients signed their informed consent forms prior to inclusion in the study.

Inclusion criteria comprised patients aged 18 years or more, moderate to severe hallux valgus (namely of that of HVA $> 20^\circ$ and IMA $> 14^\circ$) who admitted for proximal osteotomy for hallux valgus deformity correction.

Exclusion criteria included non-surgical treatments for hallux valgus, failure to follow-up after surgery and indications of other osteotomy techniques.

A McBride procedure was performed on 36 feet of 35 patients with hallux valgus deformity. Patients were evaluated preoperatively, early postoperatively, and late postoperatively by means of subjective evaluation and clinical and radiological findings.

a) Radiographic assessment:

In all patients, forefoot, hindfoot and midfoot were evaluated in walking, standing and supine positions and their relation was assessed as well. Weight-bearing anteroposterior (AP) and lateral radiographs of the foot were taken to help assess the deformity and assist in post-operative evaluation. Also, axial sesamoid radiography was taken in order to evaluate post-op sesamoid sublocation angle. The position of the medial (tibial) sesamoid in relation to a line drawn through the mid-longitudinal axis of the first metatarsal determines sesamoid position. Traditionally there have been seven stations. Recently, a more simplified version using four stations has been developed (table 1). Stations 0 and 1 are considered to be within normal limits (13).

The hallux valgus angle (HVA) and intermetatarsal angle (IMA) were measured before and after surgery.

Correction or over-correction rate as hallux varus was evaluated using first metatarsophalangeal deviation angle after osteotomy.

b) Clinical evaluation:

Both before and after surgery, Patients were asked to score their pain in standing position using visual analog score (VAS) representing 10 maximum pain and 0 no pain.

Patients' satisfaction, scaled into excellent, mild and dissatisfaction was similarly asked and recorded.

Any inflammation and discharge were noticed in incision site in order to assess post-op infection.

Metatarsophalangeal extension and flexion was clinically observed.

Hallux metatarsophalangeal-interphalangeal scores (HMP-IP) based on The American Orthopaedic Foot and Ankle Society's (AOFAS's) recommendations were scored.

c) Data Analysis:

Statistical analysis was performed using SPSS (v.16). To explain the descriptive data we used mean, median, mode and distribution parameter of standard deviation. Correlation between patients' satisfaction and percentage of hallux valgus angle correction was assessed by chi-square test. Independent-samples *t*-test was used for comparisons of mean preoperative, and postoperative values of HVA, and 1-2. IMA.

RESULTS

In this study we compared clinical assessments (first metatarsal flexion and extension) before and after surgery, together with patients' satisfaction (Pain intensity, function and cosmetics points).

From 35 patients recruited in the study, 11 cases lost follow up and therefore were excluded. On this series, final evaluation was conducted on 25 feet of 24 patients.

19 cases were male (79.2%), and 5 (21.8%) were female.

1 patient (4%) underwent bilateral (in two stages), and 23 (98%) had unilateral surgery; in 13 patients left feet (56%) and 10 patients right feet (33%) were treated.

Mean follow-up time was 3.5 years \pm 1.5, (range 2-5 years). Mean patient age at late postoperative follow-up was 41 \pm 14 years (range 24-53 years).

Mean Hallux valgus angle, and Mean intermetatarsal angles showed statistically significant difference before and after surgery, which are demonstrated in table 1.

Pain intensity was decreased in 19 (79.2%) patients though in the 5 remaining cases, it showed no change.

In axial sesamoid radiography, current sesamoid station to the anatomical site; and in apical/lateral view, internal sesamoid to metatarsal head was graded, using AOFAS grading scale. In the current study, post-operative patients' AOFAS score was 88, but since there were no pre-operative subluxation graphy it was not comparable to pre-operative score.

14 patients (58.3%) reported excellent satisfaction, 7(29.2%) patients reported mild satisfaction while 3(12.5%) patients were dissatisfied from the results. Patients satisfaction and HVA correction were correlated, although not statistically significant ($p=0.371$)

In our study, 5 patients (20.8%) reported joint stiffness and 7 patients (25%) developed malunion. No post-op infection in surgical site, over-correction, osteonecrosis or metatarsal arthritis was developed.

DISCUSSION

Despite the large number of techniques described for hallux valgus correction, there has been much controversy regarding the best procedure to use, especially for severe deformities [13]. More than 130 operations have been described for the treatment of hallux valgus; the plethora of techniques indicates that no single operation will address all cases [1].

In 1923, Silver defined the "distal soft tissue procedure" [DSTP] as excision of the medial prominence, release of the adductor tendon and the lateral capsule, and plication of the medial capsule [14]. In 1928, McBride modified Silver's method and proposed excision of the lateral sesamoid, release of the adductor tendon, and resuturing of the tendon to the head of the first metatarsal order to correct the metatarsal varus deformity [15-17].

Many studies regarding the efficacy of the McBride procedure have been conducted [15-20]. In one study, the authors achieved a decrease of HVA to less than 16° in 59% of feet treated by a modified McBride procedure, and in 76% when proximal crescentic osteotomy was added [10]. They strongly advocated the combination of these two procedures when HVA correction of more than 20° is necessary and when the 1-2 IMA is greater than 15 [18]. Our results showed HVA values less than 16° in 36.1% of cases.

Patient satisfaction was reported between 70.6% and 93% in previous studies [19-24]. Mean satisfaction was found to be 92%. The criteria for satisfaction were alleviation of pain [achieved in 74% of cases], decrease in deformity [18%], and decrease in bunion size [8%]. Causes of dissatisfaction were pain in the 1.MTP joint and the shape of the great toe, equally. The authors concluded that, in mild and intermediate cases of hallux valgus deformity, the McBride procedure yields satisfactory results, but in severe cases, it may not be sufficient [18]. As our findings shows, 88% of patients achieved mild to moderate self-reported level of satisfaction.

Hallux varus complication following surgery is most frequently observed after use of the McBride procedure. Although in previous studies hallux varus complication ratios of 2/39 [16], 6/72 [20], 3/39 [21], and 13/109 [25] were reported, we encountered none in 25 cases. Other complications such as joint stiffness and mal-union were seen in 20.8% and 25% of the cases respectively.

Although osteotomies are more effective when using radiological criteria to measure the deformity, the McBride procedure is claimed to be more effective in alleviating pain [26].

Findings from the current study revealed satisfactory Results of McBride procedure and proximal first metatarsal osteotomy. Low rate of post-operative complications along with high level of pain elimination makes this approach an efficient procedure for hallux valgus deformity correction.

Mcbride osteotomy has great vantages against other techniques: First, metatarsal length does not change after surgery. Second, all 3 parts of hallux valgus deformity [first metatarsal varus, increase in angle degree of valgus and internal bulging of metatarsal head] are all dealt with.

In a retrospective review of 70 consecutive patients treated operatively for moderate and severe hallux valgus malalignment, Johnson reported 21.54, 9.25 and 6.6 degrees of reduction in HVA, IMA and DMAA respectively, During 27 months of follow up. There was statistically significant difference between pre and post operation angle values. Our results also fall almost in the same range.

In Another study, correlation between first metatarsal length and hallux valgus, 110 cases along with 110 controls were evaluated. In 77% of the cases, first metatarsal was higher or equal to second metatarsal [which is called zero

plus first metatarsal], while in control group only 28% were evidenced for so.as a result there were significant correlation between first metatarsal length and hallux valgus, which is not evaluated in the current study except for first metatarsal angle.

A point of interests during post operation evaluations was patient's complaints of lack of sensation,

This can be a point of evaluation for further studies.

Almost half of the patients complained about coldness and numbness of first and medial metatarsophalangeal which is not addressed in previous studies and can be a new issue for research.

Table 1: Sesamoid position criteria

Station	Criterion
0	sesamoid completely medial to mid-axial line
1	sesamoid less than 50% overlapping the line
2	sesamoid greater than 50% overlapping the line
3	sesamoid completely lateral to the line

Table 2: Pre and post operation angles

N=25	Pre-operation	Post- operation	P-value
HVA	35 (3.6)	7.1 (2.6)	P<0.001
1-2 IMA	15.2	4.6	P=0.037

CONCLUSION

Rate of success in surgery for hallux valgus deformity correction highly depends on right selection of the patients. If correctly selected, high rates of success can be expected, although few patients may develop poor results after surgery. To determine predictor factors of surgical success, clinical trials (randomized in higher levels of evidence) are needed to be conducted. Besides, validated rating scales are needed for rating and reporting the results. Based on these results, we recommend proximal first metatarsal osteotomy and McBride procedure as an acceptable form of correction for moderate to severe hallux valgus.

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