OPERATIVE TREATMENT OF ADOLESCENT HALLUX VALGUS

Alexandar Gerchev, Simona Tserovska, Georgi P. Georgiev*

Received on November 17, 2019
Presented by D. Damianov, Member of BAS, on November 26, 2019

Abstract

The hallux valgus deformity in pediatric patients is a common pathology with no definitive criteria for surgical treatment. The purpose of this study is to present mid-term postoperative results after surgical treatment of this foot deformity.

The study included 43 operated feet in 29 patients, with an average age of 14.31 years. Scarf osteotomy was performed in 23 patients, combined with an Akin osteotomy in 14 of the cases; Chevron osteotomy was performed in seven patients, five patients were treated with the mini tightrope technique, two with the Ludloff osteotomy, and six patients with lateral hemiepiphyseodesis of the first metatarsal. We evaluated the change in angular radiographic parameters and the American Orthopaedic Foot & Ankle Society scale for data analysis.

The mean follow-up of the study was 48 ± 33.2 months. The mean preoperative hallux valgus angle showed an average improvement of 30.19° to 12.79° (p < 0.001). Loss of correction of the HVA angle of 20.46° was noted at the time of final follow up (p > 0.05). Favourable correction of the intermetatarsal angle was achieved with improvement of 11.44° preoperatively to 7.35° postoperatively. Significant progression was found for the American Orthopedic Foot & Ankle Society score from 57 points (42–85) before surgery to 80 points (54–100) after surgery. The recurrence rate 6 months after surgery is 30.95% (13 cases). Relapse of the deformity after Scarf osteotomy was observed in nine cases; after mini tight rope technique in three cases, and in one case after Chevron osteotomy.

DOI:10.7546/CRABS.2022.03.14
In conclusion we state that the most important factor influencing the outcomes of treatment and postoperative recurrence rate is skeletal maturity. Surgical treatment should be indicated after growth plate fusion. Conservative treatment via orthotic devices is recommended until that time.

Key words: hallux valgus, adolescent, bunion, foot, operative treatment

Introduction. Adolescent hallux valgus (AHV) deformity is defined as a varus deviation of the first ray metatarsal and valgus deviation of the first proximal phalanx in skeletally immature patients. Incidence appearance reaches up to 36% in children and adolescents \[1^{1-3}\]. Different predisposing factors like family history, female gender, joint laxity, flat foot deformity, longer first metatarsal bone, metatarsus primus varus and tight shoes were discussed \[4,5\]. AHV surgical treatment is still controversial. Over 130 surgical procedures were described for treatment of this deformity in adults \[6-8\]. Contradictorily operative treatment in pediatric patients does not present with satisfactory results.

Indications for surgery include hallux valgus angle (HVA) greater than \(25^\circ\), intermetatarsal angle (IMA) greater than \(12^\circ\) and painful feet with American Orthopaedic Foot & Ankle Society (AOFAS) score less than 60 points. Extensive literature review revealed heterogeneity in the surgical techniques used to correct the pediatric deformity. However, all procedures include the following components: soft tissue alignment, metatarsal osteotomy (proximal or distal), and attention to increased distal metaphyseal articular angle. The results of treatment of AHV are most often presented in single series and are associated with a high rate of recurrence after surgery \[9,10\].

The aim of this study is to present the results after surgical treatment of hallux valgus in children. This is the first study in Bulgarian orthopedic surgery and one of the few for pediatric patients worldwide.

Material and methods. Between 2006 and 2019 (13 years), 43 feet (29 patients) were operated at the Department of Pediatric orthopedics of the University Hospital “Boycho Boychev” in Sofia. In 14 of the cases (48.27%) the pathology was bilateral. The average age at the time of operation was \(14.31 \pm 2.65\) years (10 years – 17 years). Patients were divided into two groups upon age: the first group aged 8–15 years (15 patients) with 23 operated feet, and the second group aged 15–18 years (18 operated feet). Theoretical closure of the growth plate of the first metatarsal at this age was the division criteria. Preoperative radiographs revealed the presence of a growth plate in 48.27% of the children, predominantly in females (93.75%). The right feet are affected in 51.21% of the patients. In 13 patients (44.82%), AHV deformity was associated with pes planus.

Clinical and radiographic methods were used to evaluate the deformation – HVA and IMA. They are also used as an objective indicator of the effectiveness of the correction and its subsequent dynamics. We used the AOFAS classification scale to account the clinical results. It is a scoring system, with a maximum
score of 100 points, divided into 3 groups according to pain, function and joint congruence.

Scarf osteotomy was performed in 23 of the cases. In 14 of them an Akin osteotomy was additionally done. We treated seven patients with Chevron osteotomy, five with the mini tightrope technique, two with the Ludloff osteotomy, and six cases with hemiepiphysiodesis of the first metatarsal bone. The preferred operating technique depends on the severity of deformity, the age of the patients and evidence of literature data.

Statistical methods (one sample t-test, analysis of variance etc.) were used for data evaluation.

Results. The mean clinical and radiological follow up was 48 ± 33.2 months (min 10 months and max 9 years and 8 months). In 71% of cases, the last follow up was at skeletal maturity.

The mean preoperative HVA is 30.19° (49.6°–17.5°). Immediately after surgery, a statistically significant improvement of 12.79° (2.6°–40.1°) (p < 0.001) was reported. The average correction loss at the final follow up was 20.46° (6.8°–38.2°) (p > 0.05). The mean improvement was 9.73° (Table 1).

<table>
<thead>
<tr>
<th>Patients</th>
<th>Average results preoperative</th>
<th>Average results intraoperative</th>
<th>Average results postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVA</td>
<td>30.19°</td>
<td>12.79°</td>
<td>20.46°</td>
</tr>
<tr>
<td>IMA</td>
<td>11.44°</td>
<td>7.35°</td>
<td>7.35°</td>
</tr>
<tr>
<td>AOFAS score</td>
<td>57</td>
<td>–</td>
<td>80</td>
</tr>
</tbody>
</table>

Satisfactory radiographic improvement of the IMA was achieved. From a mean preoperative value of 11.44° (5°–20.8°), we established significant intraoperative improvement to 7.35° (2.5°–11.5°), (p < 0.001), and at the last follow up the mean IMA angle was 7.35° (2°–11.1°).

The preoperative AOFAS score for the whole series was 57 points (42–85). Twenty-six patients with 37 surgically corrected feet deformities had preoperative complaints of mild pain during weight baring with an average AOFAS score of 51 points (42–70). In three of the cases with 6 operated feet, no significant clinical symptoms were reported before surgery and their AOFAS score was 73 points (58–85). In these patients we performed hemiepiphysiodesis of the first ray.

Postoperatively, the average AOFAS score for the whole series was 80 points (72–100). Eight patients with 13 operated feet had persistent complaints and recurrence of the deformity. Their AOFAS score was 68 points (54–100). Four patients with 5 operated hallux valgus deformities had a recurrence of the deformity without subjective complaints, with an AOFAS score of 82 points (63–100). Sixteen patients with 19 operated feet were asymptomatic with an AOFAS score.
Fig. 1. a) Preoperative radiograph with HVA 32.5° and IMA 11.5°; b) Postoperative radiograph after mini tightrope technique with HVA 3° and IMA 5.1°; c) Roentgenography of the first recurrence after 4 months with HVA 30.1° and IMA 11.2°; d) Postoperative radiograph after second mini tightrope technique with HVA 5.2° and IMA 5.6°; e) Roentgenography of the second recurrence after 24 months with HVA 38.2° and IMA 14°; f) Postoperative radiograph after Lapidus osteotomy with HVA 20.6° and IMA 6.6°
of 94 points (72–100). Two of the patients were included in both groups due to complaints from the one and missing from the other.

The recurrence rate reported at 6 months after surgery is high – 30.95% (13 cases). There were relapses are after Scarf osteotomy (9 cases), mini tightrope technique (3 cases) (Fig. 1) and one case after Chevron osteotomy.

**Discussion.** The purpose of surgical treatment of the AHV deformity is to relieve pain, restore joint function, prevent progression of deformity and improve cosmetic appearance. Stimulating the potential long-term remodelling for correction of the deformity is ineffective in AHV. According to literature analysis the recurrence rate after surgery varies between 30% and 60%. Poor results are associated with inadequate correction of the deformity, excessive shortening of the first metatarsal, inadequate fixation, non-union and recurrence of the pathology. Nowadays, the percentage of poor results is around 25%. Roddy et al. [11] reported recurrence rate of the deformation of 22.9% using a percutaneous correction technique. Harb et al. [10] reported 20% recurrence rate using the same operative method in 28 patients [7]. However, in their study, the overall incidence of recurrence was 42.3%. According to them, the high percentage of recurrence is attributed to the presence of an open growth plate of the first metatarsal bone. In our series presence of growth plate is found in 20 cases before the operation. In 9 of these patients, we report recurrence of the deformity corresponding to the preoperative one. Finally, in our study, the recurrence rate is 30.95% (13 cases).

The study focused on the Scarf osteotomy presents statistically significant improvements in clinical and radiographic results. Biomechanical studies of cadavers support these clinical findings and show that Scarf osteotomy is more stable than distal-based osteotomies at physiological load [6]. In the study of Harb et al. [10] the Scarf osteotomy in 17 of the 19 cases was combined with an Akin osteotomy. The reasons for this are individual surgeon preferences, or the inability of the Scarf osteotomy for correction of rotational deformity. John et al. [12] reported only one case of recurrence in 19 feet after Scarf osteotomy. The mean age of their series, however, is higher – 14.43 ± 1.59 years, with only three cases of active first metatarsal physe.

In our study the Scarf osteotomy was performed in 21 of the cases which include 48% of the total number of the operated feet; in 14 of them it was combined with an Akin osteotomy of the proximal phalanx. In 6 patients (28.6%) we report recurrence of the deformity 6 months after surgery.

A relatively new technique for treatment of AHV is the hemiepiphysiodesis of the first metatarsal. Farrar et al. [13] reported excellent results after treatment in 12 children with this method. AOFAS score and radiographic parameters improved significantly, and no postoperative complications were observed. In our study, with an average follow-up of 6 months, we have no progression of the deformity. The radiographic criteria are also improving: the HVA decreases by 2.3° and the IMA angle by 1.8°. However, the short follow-up period does not allow us
to make statistically reliable conclusions. According to our study the technique presents with favorable results, because of the low complications rate. It is a suitable treatment option for patients with active growth plate.

The incidence of postoperative complications such as infection, postoperative pain, and hypersensitivity are relatively rare. In the largest published series of Harb \cite{10}, including 201 operated pediatric feet, only 2% of the cases presented with infection. In 11.9% of the cases significant postoperative pain was established and hypersensitivity was observed in 4.5% of feet. In their study, the overall revision rate is 4% because of dislocation of the first metatarsal phalangeal joint, metatarsalgia, development of regional pain syndrome and cosmetic dissatisfaction.

In our study the reported complications are: one case of avascular necrosis (2.3%) of the metatarsal head occurring in the first year after surgery, four cases (9.3%) with hypersensitivity and one case of intraoperative fracture of the first metatarsal bone (2.3%). In one of the cases recurrence of deformation occurred on the sixth postoperative month.

**Conclusion.** Nowadays, surgical treatment of AHV is an unsolved problem in pediatric orthopedic society. Although many surgical techniques have been described, there is still no widely accepted technique, open or minimally invasive, for treatment of AHV. After processing our data and comparisons with those published in the literature, we assume that fusion of the growth plate of the first metatarsal bone is a crucial factor for better postoperative results. Therefore, we recommend surgery after skeletal maturity, and conservative orthotic therapy until this happens.

**REFERENCES**


