

A Retrospective Analysis Of Adolescent Hallux Abducto Valgus

Jane Pontious, D.P.M.

Kieran T. Maban, D.P.M.

Steven R. Carter, D.P.M.

INTRODUCTION

Adolescent hallux valgus is a unique condition and its surgical history is noted to have a high rate of recurrence as has been previously documented in the literature. The authors will discuss the important etiologic factors of this deformity, and describe in detail in the surgical procedures that can best address the critical components of the deformity.

Many important differences can be identified between the adolescent and adult hallux abducto valgus deformities. In the adolescent bunion, there are usually fewer degenerative changes around the first metatarsophalangeal joint, however true joint adaptation is more common. The most important distinction between the adolescent and adult hallux abducto valgus deformity is the strength of the mechanical and genetic forces that are influencing this deformity at such an early age. It is important to appropriately address and control these deforming mechanical and genetic factors in an attempt to reduce the high rate of recurrence in this deformity.

INCIDENCE

Many authors have identified the fact that hallux abducto valgus in the adolescent population is quite common and can range from 22-36%. Adolescent hallux abducto valgus is more common in females who comprise 75-92% of the patients who present with this deformity. Adolescent hallux abducto valgus has been described as occurring five times more frequently among the black population than in the white population.

The typical adolescent with hallux abducto valgus presents between 11-14 years of age. There is often a positive family history for the deformity as well as a 75% bilateral occurrence.

ETIOLOGY

Any proximal deforming force producing compensation in the foot by excessive pronation of the subtalar joint can result in instability of the first ray and promote the development of an adolescent hallux valgus deformity. Although there are many different theories concerning the etiology of hallux abducto valgus in adolescents, it is generally agreed that there are certain structural abnormalities that result in dynamic muscle imbalance and biomechanical dysfunction. The important structural abnormalities include: metatarsus adductus (compensated or uncompensated), pes valgo planus, metatarsus primus adductus, short or long first metatarsal, rearfoot equinus, as well as the orientation of the first metatarsocuneiform joint.

The shape of the metatarsocuneiform joint has been demonstrated to affect the stability of the first ray. A horizontal setting is more likely to resist adduction of the first metatarsal. An oblique orientation of the first metatarsal cuneiform joint may result in instability of the first ray and has been associated with an increase in intermetatarsal angle.

Neuromuscular disease, ligamentous laxity, and shoe wear have been cited as other causative factors. Obviously, the deformity is very complex and its etiology is multifactorial.

EVALUATION OF THE DEFORMITY

Adolescent hallux abducto valgus can range in deformity from a simple bump to a severely progressive deformity with associated metatarsus adductus and more proximal deforming influences. Evaluation begins with a thorough patient and family history. Common complaints include bump pain, inability to wear shoes comfortably and an

unpleasant cosmetic appearance which is psychologically disturbing to the child.

Biomechanical, orthopedic, and neurologic evaluations should be conducted to determine which etiological factors are contributing to the deformity. These evaluations should include examination of the foot and ankle as well as a more proximal exam to see whether limb length deformities, genu varum, genu valgum, or any other tarsal abnormality of the lower extremity is present. The examiner should also pay particular attention to the presence of compensated metatarsus adductus, collapsing pes valgo planus, or other conditions which can produce excessive pronation. Passive range of motion at the first metatarsophalangeal joint in the deformed and corrected position is evaluated, as well as the degree of rigidity of the deformity. The joint is evaluated to determine whether the sesamoid apparatus is "tracking" or "trackbound," since this finding is commonly associated with an increase in the proximal articular set angle more commonly seen in the adolescent deformity.

Standard weight bearing radiographs are taken in the angle and base of gait with attention directed toward the intermetatarsal angle (IMA), hallux abductus angle (HAA), hallux abductus interphalangeal angle (HAIA), metatarsus adductus angle (MAA), proximal articular set angle (PASA), distal articular set angle (DASA), sesamoid position (SP), as well as the length of the first metatarsal. A weight bearing DP projection with the subtalar joint placed in a neutral position may be performed to help unmask metatarsus adductus.

An accurate determination of the intermetatarsal angle in the presence of metadductus is evaluated by using the formula as described by Yu and DiNapoli: $IMA + (MAA - 15) = \text{true IMA}$.

The status of the first metatarsal's growth plate is evaluated. In most cases, a single growth plate is located in the proximal metatarsal base, but occasionally a distal first metatarsal physis can also be present. Although it is difficult to assess accurately by radiographs alone, the effective proximal articular set angle deviation of the first metatarsal should be examined.

CONSERVATIVE TREATMENT

Conservative treatment of adolescent hallux abducto valgus should be directed towards those patients with a mild deformity which is flexible in nature and of a biomechanical origin. In this scenario, orthotic devices can help prevent the progression of the deformity. Other modalities such as toe spacers and conforming shoe gear can also be effective. However, if the patient is symptomatic and the deformity progressive, long-term conservative treatment is discouraged. Surgical correction should be considered in these cases since prevention of further adaptive changes that can potentially result in a non-functional joint is essential.

SURGICAL CONSIDERATIONS

The status and location of the first metatarsal's physal plate, the age of the patient, as well as any ancillary surgical procedures are important considerations in determining when to perform the corrective surgery. Indications for surgical correction of adolescent hallux abducto valgus include pain, cosmetic considerations, difficulty in acquiring comfortable shoes, and a progressive or rigid deformity. The goals of the surgical correction should include relief of pain, prevention of the progression of the deformity, cosmetic considerations, and restoration of a normally functioning first metatarsophalangeal joint.

Timing of the operation in relation to the patient's age is also an important factor. If the deformity is mild and static in nature, the surgery can be delayed until bone growth is complete. If the deformity is painful and rapidly progressive, surgical correction should not be delayed for a significant period of time.

Surgical techniques used to repair the adolescent hallux abducto valgus can be divided into capsule-tendon balance procedures, distal first metatarsal osteotomies, proximal first metatarsal osteotomies, and a miscellaneous group. It is sometimes necessary to perform ancillary surgical procedures such as tendoachillis lengthening, metatarsus adductus correction, or flat foot repair in conjunction with the repair of the hallux abducto valgus.

The reasons for failure and patient dissatisfaction can include recurrence of the deformity, poor

cosmetic appearance associated with scar formation, residual pain, and hallux limitus. The high rate of recurrence associated with the repair of adolescent hallux abducto valgus deserves attention. The literature reports a recurrence rate from 20-52%. Patients who obtain adequate reduction of their intermetatarsal angle are reported to be more satisfied in the long term with the results of their surgery.

MATERIALS AND METHODS

From 1985 through 1992, 63 feet and a total of 54 patients under the age of 21 with hallux abducto valgus deformities were operated on through the Foot and Ankle Institute at the Pennsylvania College of Podiatric Medicine. The medical record of each patient was reviewed to identify the following: age of presentation, race, sex, chief complaint, age of symptom onset, family history, suspected etiology, surgical procedures performed, and postoperative complications. A retrospective radiographic analysis was conducted on those patients. These analyses contained a complete set of weight bearing AP, oblique and lateral foot x-rays in the angle and base of gait, with a follow-up of at least eight weeks from the date of surgery.

DISCUSSION

After review of the medical records of 54 patients, it was found that 63 feet underwent surgical intervention for correction of adolescent hallux abducto valgus. The racial distribution in the study was heavily weighted toward the non-white races with 59% black, 29% white, 11% Hispanic, and 2% Asian. The gender characteristics of this study, 68.5% female, generally agree with other reported findings.

The most significant finding of the study was a very high prevalence of abnormal metatarsus adductus in patients with adolescent hallux abducto valgus. Although metatarsus adductus has been reported in the literature as being associated with adolescent hallux abducto valgus, the authors' findings contrast significantly with many other authors in that approximately three-fourths of the 65 radiographs that were reviewed were abnormal for metadductus. The clinical significance of this finding is profound. It is the authors' contention that under-recognized metatarsus adductus is one of the factors that heavily contributes to the high

recurrence rate of this deformity. When surgical decisions are made between base and capital osteotomies without an appreciation for the underlying metatarsus adductus, it is likely that the true "intermetatarsal angle" will not be appreciated. This factor could lead to an under-utilization of the base osteotomies and an over-utilization of the capital osteotomies.

A statistically significant relationship between increased metatarsus adductus angle and increased hallux abductus and proximal articular set angles has been documented in the literature. Yu and DiNapoli have postulated that the proximal articular set angle and hallux abductus angles both increase with an increasing metatarsus adductus angle. Griffiths and Palladino have also confirmed this relationship. It is the authors' experience that preoperative measurements do not accurately reflect the true increase in the PASA as demonstrated by intraoperative evaluation.

The authors also believe that there is probably an even greater discrepancy among recorded values for proximal articular set angle in adolescent hallux abducto valgus patients than in the adult population. The radiographic angle can be measured by the "step-off" created in the cartilage by adaptation. However, in adolescents, this "step off" is not apparent because there is less time for atrophy of the under-utilized cartilage to occur. This simply adds more weight to the conclusion that the PASA has a significant importance in the correction of adolescent hallux abducto valgus, particularly in the proportion of patients who also have an abnormally increased metatarsus adductus angle.

TREATMENT

The timing of surgery in the adolescent with hallux abducto valgus is somewhat controversial. The authors' criterion (for determining whether or not to delay surgery until after osseous maturity) is based on a combination of the severity of deformity, degree of symptoms, and controllability of the deforming forces. These patients are classified into two distinct types of adolescent hallux abducto valgus. The first group, Type I, are those patients with one or more of the following characteristics: early onset, familial history, significant metatarsus adductus, or more severe deforming forces (equinus, flatfoot, etc.). The second group, Type II, is comprised of patients with a moderate

degree of deformity (IMA, HAA), rectus foot type, controllable deforming forces, late onset, and with less progression of the deformity.

In reviewing their experience with these patients, the authors have identified several factors that are important to evaluate and treat in adolescents with hallux abducto valgus deformity. First, the high incidence of metatarsus adductus emphasizes the need to critically evaluate this factor in all patients. In conjunction with the high incidence of metatarsus adductus, adaptation of the metatarsal head (high PASA) is an important aspect of this deformity and should be evaluated intraoperatively. Furthermore, there are two discrete groups of patients with adolescent hallux abducto valgus deformity, and the treatment differs significantly between the two groups. Those patients with a Type I deformity should be treated more aggressively with base wedge type osteotomies, whereas a Type II deformity may benefit adequately from a capital osteotomy. In this study, the closing base wedge osteotomy was found to provide superior correction of the intermetatarsal angle.

SUMMARY

Important etiologic factors associated with adolescent hallux abducto valgus deformities, as well as the surgical procedures that are available to address the deformity, have been reviewed. In this study, the authors found a high incidence of metatarsus adductus (75.4%) in patients with adolescent hallux abducto valgus. This factor is often under-recognized and as a result, the deformity may not be treated as aggressively as needed. This often leads to a high recurrence of the deformity. Another factor which contributes to the high recurrence rate would be an elevated proximal articular set angle, which has been previously correlated to a high metatarsus adductus angle. Therefore, intraoperative assessment and correction of this deformity is necessary to prevent recurrence.

BIBLIOGRAPHY

- Cole S: Foot inspection of the school child. *J Am Pod Assoc* 49:466, 1959.
- Craigmile DA: Incidence, origin, and prevention of certain foot defects. *Dr Med J* 2:749, 1953.
- Griffiths TA, Palladino SJ: Metatarsus adductus and selected radiographic measurements of the first ray in normal feet. *J Am Pod Assoc* 82:616, 1992.
- Mahan KT: Juvenile and adolescent hallux valgus. In McGlamry ED (ed) *Reconstructive Surgery of the Foot and Leg - Update 1987* Podiatry Institute Publishing Co. Tucker, GA, 198 p. 72.
- Mahan KT, Jacko J: Juvenile hallux valgus with compensated metatarsus adductus. *J Am Pod Med Assoc* 81:525, 1991.
- Palladino SJ: Preoperative evaluation of the bunion patient: Etiology, biomechanics, clinical and radiographic assessment. In Gerbert J (ed) *Textbook of Bunion Surgery*, 2nd Ed. Futura Publishing, Mt. Kisco, NY, 1991, p. 1-51.
- Palladino SJ, Towfigh A: Intra-evaluator variability in the measurement of proximal articular set angle. *J Foot Surg* 31:120, 1992.
- Ruch JA, Bernbach M, DiNapoli DR, et al: Juvenile Hallux Abducto Valgus. In McGlamry ED (ed) *Comprehensive Textbook of Foot Surgery* Williams & Wilkins, Baltimore, 1987, p. 227.
- Yu GV, DiNapoli DR: Surgical management of hallux abducto valgus with concomitant metatarsus adductus. In McGlamry ED (ed) *Reconstructive Surgery of the Foot and Leg - Update 1989* Podiatry Institute Publishing Co. Tucker, GA, 1989, p. 262.
- Yu GV, Landers PA, Lo KG, Shook JE: Juvenile and adolescent hallux abducto valgus deformity. In DeValentine SJ (ed) *Foot and Ankle Disorders in Children* Churchill Livingstone, New York, 1992.