CHAPTER **37**

POSTOPERATIVE HALLUX VARUS

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The first known case of hallux varus dates back to a 3.75 million year old fossil from the Pliocene age in Africa.[1] Although this may imply that hallux varus is not exclusive to surgery, most cases are reported as a postoperative complication associated with the surgical correction of hallux abducto valgus.[2-6] In looking for the most accurate estimate of hallux varus as a complication of hallux abducto valgus surgery, an extensive review of the literature is presented. This article is the most comprehensive literature review to date regarding the occurrence rate of hallux varus by procedure.

ANATOMY

Four intrinsic muscles insert directly onto the base of the proximal phalanx. The extensor hallucis brevis inserts dorsally, the flexor hallucis brevis plantarly, abductor hallucis medially, and the common tendon of the oblique and transverse head of the adductor hallucis tendon combine with the lateral head of the flexor hallucis brevis to insert plantar laterally. These 4 muscles are important for stabilizing the great toe into a neutral position, with no more than 15° of lateral deviation allotted.[2,6,7] Finally 2 extrinsic muscles, the extensor hallucis longus dorsally and the flexor hallucis longus plantarly, course over the metatarsophalangeal joint to insert distally on the distal phalanx. As the hallux drifts medially, the pull of these muscles can bow string and enhance the medial deviation of the hallux.

ETIOLOGIC FACTORS

Many etiologic factors in the development of hallux varus have been presented throughout the literature. It is believed that there is no one specific factor that acts alone in the advancement of this deformity and as stated by Banks and Ruch, usually several parameters have to be violated before the first metatarsophalangeal joint assumes an aberrant position.[8] The most common theory is that interruption of the conjoined adductor tendon with subsequent overpowering of the medial muscles of the first metatarsophalangeal eventually leads to hallux varus.[9,10] The following list shows etiologic factors that are believed to have a possible role in the progression of a deviated hallux secondary to surgery: excessive plantar-lateral release/fibular sesamoidectomy; "staking" the first metatarsal head; excessive medial capsulorraphy/medial capsule tightening; overcorrection osteotomy; excessively long first metatarsal; rounded first metatarsal head; elasticity of joint capsule; and postoperative bandaging.

LITERATURE REVIEW

Metatarsocuneiform procedures.

Also know as the Lapidus, this procedure has been indicated in patients with a hypermobile first ray, degenerative changes of the first metatarsocuneiform joint, and severe metatarsus primus varus (Table 1). Overall there was a 5.3% rate of hallux varus out of 453 lapidus procedures with 24 reported cases between 1980 and 2004. In 1990 Mauldin reported a hallux varus rate of 15.7% after performing a metatarsocuneiform stabilization procedure along with a modified McBride on 51 feet. It was concluded that an over-zealous lateral release was the underlying factor. In response to the encountered complications, the authors began to repair the adductor tendon in an attempt to prevent a dynamic varus from appearing postoperatively.[11] McInne in 2001 reported a 12.5% hallux varus rate (4 cases) out of 32 lapidus osteotomies with a total lateral release.[12] In 2003 Lombardi reported 2 hallux varus deformities after performing 20 lapidus osteotomies with an additional Reverdin-Laird osteotomies and lateral release.[13] The remaining studies depicted a low percentage of hallux varus ranging between 0 and 4%.

Proximal osteotomies with soft tissue procedure.

One of the main advantages for using a proximal osteotomy is the ability to correct a larger intermetatarsal angle. However, it was gathered from eighteen various studies between 1992 and 2001 that there was an overall hallux varus rate of 10.6% (Table 2). This procedure

Table 1

REPORTED HALLUX VARUS AFTER METATARSOCUNEIFORM PROCEDURES

Procedure	%	# Feet	Author (ref)	Year
Lapidus & lateral release[1,2,3]	15.7	8/51	Mauldin[11]	1990
Lapidus & lateral release[6]	12.5	4/32	McInne[12]	2001
Lapidus & Reverdin-Laird, lateral release[1,2,3]	10.0	2/20	Lombardi[13]	2003
Lapidus & lateral release[NS]	4.3	2/47	Catanzariti[14]	1999
Lapidus & lateral release[1,2,3]	5.8	3/51	Faber[15]	2004
Lapidus & lateral release[1]	2.5	3/119	Butson[16]	1980
Lapidus & lateral release3	2.5	1/40	Sangeorza[17]	1989
Lapidus & lateral release[1,3]	1.5	1/67	Myerson[18]	1992
Lapidus & lateral release[1,3]	0.0	0/26	Coetzee[19]	2003
TOTAL	**5.3**	**24/453**		

lateral release[1] = adductor tenotomy; lateral release[2] = deep transverse intermetatarsal ligament; lateral release[3] = capsulotomy / release of lateral capsule; lateral release[4] = fibular metatarsosesamoid ligament; lateral release[5] = adductor transfer after adductor tenotomy; lateral release[6] = total release; lateral release[NS] = not specified.

Table 2

REPORTED HALLUX VARUS AFTER PROXIMAL OSTEOTOMIES WITH LATERAL RELEASE

Procedure	%	# Feet	Author(ref)	Year
Closing Base Wedge & lateral release[1]	26.6	16/60	Trnka[20]	1999
Closing Base Wedge & lateral release[5]	18.0	9/50	Zembsch[21]	2000
Closing Base Wedge & lateral release[1]	17.4	19/109	Trnka[22]	1997
Proximal Chevron & lateral release[1,3]	12.0	5/43	Easley[9]	1996
Proximal Crescentic & lateral release[5]	12.0	3/25	Markbreiter[23]	1997
Proximal Crescentic & lateral release[1,2,3]	12.0	13/109	Mann[24]	1992
Proximal Crescentic & lateral release[1,2,3]	10.7	3/28	Dreeben[25]	1996
Proximal Crescentic & lateral release[1,2,5]	10.0	4/46	Thordarson[26]	1996
Proximal Crescentic & lateral release[1,3]	10.0	4/41	Easley[9]	1996
Proximal Crescentic & lateral release[2,3,5]	9.0	8/86	Zettl[27]	2000
Proximal Crescentic & lateral release[1,2]	7.1	1/14	Okuda[28]	2001
Proximal Chevron & lateral release[1]	6.3	2/32	Borton[29]	1994
Proximal Chevron & lateral release[2,3,5]	5.4	2/37	Veri[30]	2001
Proximal Crescentic & distal closing wedge & akin	4.6	1/21	Coughlin[31]	1999
Proximal Chevron & lateral release[5]	4.0	1/25	Markbreiter[23]	1997
Proximal Crescentic & lateral release[6]	3.4	1/29	Fox[32]	1999
Proximal Chevron & lateral release[1,3]	1.4	1/72	Sammarco[33]	1998
Proximal Chevron & lateral release[1,3]	0.0	0/51	Sammarco[34]	1993
TOTAL	**5.3**	**24/453**		

lateral release[1] = adductor tenotomy; lateral release[2] = deep transverse intermetatarsal ligament; lateral release[3] = capsulotomy / release of lateral capsule; lateral release[4] = fibular metatarsosesamoid ligament; lateral release[5] = adductor transfer after adductor tenotomy; lateral release[6] = total release; lateral release[NS] = not specified.

demonstrated the highest rate of hallux varus complication in the literature.

Interestingly it should be noted that Trnka has reported cases of a varus complication in multiple studies.[20-22,35-37] Trnka's articles from 1999 and 1997 reviewed patients that had undergone a closing base wedge osteotomy in conjunction with an adductor tenotomy.[20,35] All of the patients included in the 2 studies underwent the surgeries between 1974 and 1985, thus raising some question as to whether there was overlap among the reported data. Excessive medial eminence resection was thought to be an underlying cause in 10 of the cases and it was specifically noted that excessive medial capsulorraphy was the cause in 8 cases. The last varus complication developed secondary to a Keller-Brandes procedure that was included in one of the patients to relieve hallux rigidus symptoms. It was also noted in the article when reviewing hallux abducto valgus surgery results; one should define every hallux abducto valgus angle less than 0° as a hallux varus. It could be for this reason why Trnka has consistently reported higher occurrences of hallux varus regardless if it was symptomatic or not to the patient. Trnka concluded that only hallux varus deformities with higher degrees (16°-24°) were clinically troublesome and those to a lesser degree do not have any clinical relevance.

Excluding the data from Trnka's studies, the overall percentage rate of hallux varus for a proximal osteotomy drops from 10.6% down to 7.4%, which only covers the proximal chevron and proximal crescentic osteotomies. Easley conducted a study that compared the results of these 2 procedures.[9] At a minimum followup of 12 months, Easley observed hallux varus in 12% (5/43) of the proximal chevron and 10% (4/41) in the proximal crescentic osteotomies. In conjunction with the proximal osteotomies, was a lateral release consisting of an adductor tenotomy and a lateral capsulotomy. Of the patients with the deformity, there were no complaints of pain or shoe modifications necessary. Furthermore only one patient in each group was disappointed with the cosmetic appearance of the great toe. Overall, Easley was still in favor of the proximal chevron osteotomy because he found there to be a statistically significant shorter healing time as well as less shortening of the metatarsal. He also concluded that postoperatively the tibial sesamoid was shifted more medial in the proximal chevron osteotomy and therefore aided in restoring the normal biomechanics of the first metatarsophalangeal joint.[9]

MidShaft Osteotomy Procedures.

These procedures attempt to utilize the advantages of both proximal and distal metatarsal osteotomies in that they can correct higher intermetatarsal angles while at the same time allowing an early return to postoperative mobilization (Table 3). Midshaft osteotomies or "compromise" osteotomies include the Mau, Ludloff, Scarf-Meyer Z-osteotomy, Vogler offset V-osteotomy, and the Kalish osteotomy.[40] A total of 4.1% of 755 cases reported, resulted in a varus deformity (31 feet). Although Schoen reported a 20% complication rate of hallux varus (10/56), he also stated that there were no patient concerns regarding the appearance of the foot on the long term study. Similar to the study by Trnka, this report also considered any hallux adductus measurement less than 0° as a hallux varus deformity. Seven out of the ten cases of hallux varus were no greater than 5° in varus

Table 3

REPORTED HALLUX VARUS AFTER MIDSHAFT OSTEOTOMY PROCEDURES

Procedure	%	# Feet	Author (ref)	Year
Scarf & lateral release[1,3,4]	20.0	10/56	Schoen[38]	1996
Mau & lateral release[6]/ sesamoidectomy	9.1	2/22	Bar-David[39]	1998
Kalish & adductor transfer in IM° less than 15°	8.0	5/64	Downey[40]	1994
Scarf & lateral release[4]	6.6	5/76	Weil[41]	2000
Scarf & lateral release[1,3,4]	3.0	2/66	Zygmunt[37]	1989
Kalish & adductor transfer in IM° greater than 15°	1.5	3/200	Downey[40]	1994
Kalish & lateral release[4,5]	1.5	4/256	Kalish[42]	1994
Chevron osteotomy with a long plantar arm	0.0	0/15	Donnelly[43]	1994
TOTAL	**4.1**	**31/755**		

lateral release[1] = adductor tenotomy; lateral release[2] = deep transverse intermetatarsal ligament; lateral release[3] = capsulotomy / release of lateral capsule; lateral release[4] = fibular metatarsosesamoid ligament; lateral release[5] = adductor transfer after adductor tenotomy; lateral release[6] = total release; lateral release[NS] = not specified.

alignment and it was concluded that small amounts of adductus are accepted by patients.[38]

Kalish found that the rate of hallux varus secondary to the Kalish osteotomy was directly related to the intermetatarsal angle and concomitant adductor hallucis tendon transfer. It is advocated to transfer the adductor tendon only in intermetatarsal angles greater than 15° while transecting the adductor tendon without transfer in intermetatarsal angles less than 15°.[40] Hallux varus was found to be the most common complication for the Kalish osteotomy.

DISTAL OSTEOTOMY WITH LATERAL RELEASE.

The distal chevron procedure, described by Austin in 1981, has been written on in great detail and is one of the most common distal metatarsal procedures performed today (Table 4). As shown in Table 5, the occurrence of hallux varus secondary to this procedure has relatively been low in comparison with other first metatarsal osteotomies. Austin does not clearly define the number of postoperative varus cases that he observed and only stated in passing that there were a "few" cases.[50] Interestingly, Austin's original technique consisted of the V shaped osteotomy along with an adductor tenotomy. According to the techniques reported by the other surgeons in this group, it appears that as additional structures are incorporated in the lateral releases, the number of varus cases substantially increased.

Distal Osteotomy without Lateral Release.

With the exception of the study by Loretz, there were few hallux varus complications secondary to a lone distal procedure. Loretz's hallux varus deformities ranged from an adducted hallux, to a more complicated triplane deformity. Of the patients with the varus complication, the postoperative hallux abductus angle ranged from -17 to -1. Five of the patients were categorized as a transverse deformity and only one patient had a lack of toe purchase. The final case was not identified within the study as to the severity of the deformity, however, it was noted that the patient went on to have the adducted toe surgically corrected.[55] Only 2 other studies in this group of osteotomies demonstrated any varus complications while nine other studies expressed no complications. As stated by Sanders in her comprehensive review of hallux varus, "the distal osteotomies as a group seem to be entirely spared the complication of hallux varus."[65]

First Metatasophalangeal Joint Implant.

There has not been a great deal of literature written on the first metatarsophalangeal implants with hallux varus as a complication (Table 6). Commonly reported

Table 4

REPORTED HALLUX VARUS AFTER DISTAL OSTEOTOMY LATERAL RELEASE

Procedure	%	# Feet	Author (ref)	Year
Distal Chevron / McBride / DSTP with Met Osteotomy	10.0	6/60	Coughlin[44]	1995
Distal Chevron & lateral release[6]	8.7	2/23	Pochatko[45]	1994
Distal Chevron & extensive lateral release[2,3,5]	8.5	8/94	Trnka[36]	1997
Distal Chevron & lateral release[3]	5.8	7/121	Hetherington[46]	1993
Distal Chevron & lateral release[1]	4.8	3/62	Trnka[35]	1997
Distal Chevron & lateral release[1,3]	2.6	1/38	Stienstra[44]	2002
Distal Chevron & lateral release[1,3]	2.0	1/58	Peterson[47]	1994
Distal Chevron & lateral release[4]	1.6	1/64	Schneider[48]	2002
Distal Chevron & lateral release[1,4]/ sesamoidectomy	1.0	1/100	Feit[49]	1997
Distal Chevron & lateral release[1]	—	Few/300	Austin[50]	1981
Tricorrectional & lateral release[4]	0.0	0/121	Selner[51]	1999
Distal Chevron & lateral release[6]/ sesamoidectomy	0.0	0/13	Oloff[52]	1998
Distal Chevron & lateral release[3]	0.0	0/76	Horne[53]	1984
Reverdin-Laird & lateral release[5]	0.0	0/24	Beck[54]	1974
TOTAL	3.5	30/854*		

lateral release[1] = adductor tenotomy; lateral release[2] = deep transverse intermetatarsal ligament; lateral release[3] = capsulotomy / release of lateral capsule; lateral release[4] = fibular metatarsosesamoid ligament; lateral release[5] = adductor transfer after adductor tenotomy; lateral release[6] = total release; lateral release[NS] = not specified.
*total does not include 300 cases from Austin

Table 5

REPORTED HALLUX VARUS AFTER DISTAL OSTEOTOMY WITHOUT LATERAL RELEASE

Procedure	%	# Feet	Author (ref)	Year
Reverdin-Laird	10.1	7/69	Loretz[55]	1993
Wilson	4.8	2/42	Klosok[56]	1993
Hohmann	2.0	1/50	Faber[13]	2004
Distal Chevron	0.0	0/95	Viehe[57]	2003
Distal Chevron	0.0	0/23	Mann[58]	1997
Wilson	0.0	0/32	Pouliart[50]	1996
Mitchell	0.0	0/204	Blum[60]	1994
Distal Chevron	0.0	0/45	Klosok[56]	1993
Wilson	0.0	0/100	Schemitsch[61]	1989
Distal Chevron	0.0	0/225	Hattrup[62]	1985
Mitchell	0.0	0/96	Merkel[63]	1983
Mitchell	0.0	0/72	Glynn[64]	1980
TOTAL	**1.0**	**10/1053**		

Table 6

REPORTED HALLUX VARUS AFTER FIRST METATASOPHALANGEAL JOINT IMPLANT

Procedure	%	# Feet	Author (ref)	Year
MTPJ Implant	9.3	4/43	Fuhrmann[66]	2003
Closing Base Wedge & total implant	3.2	1/31	Seiberg[67]	1994
TOTAL	**6.8**	**5/74**		

complications included infections, metatarsalgia involving the lesser digits, cock-up hallux or abnormal rotations of the hallux with lack of toe purchase. Nevertheless, these observations were of no use to this study. With the study by Seiberg,[67] the total implant was 1 of only 3 implants used in their study. As explained in their paper, the patient previously had bunion surgery in which a great deal of degenerative changes affected the joint, ultimately leading to the joint implant. Due to a lack of patient compliance, the hallux varus developed secondary to implant failure. Fuhrmann's study was the only other study involving implants that noted hallux varus as a true complication.[66]

Phalangeal Procedures.

Like first metatarsophalangeal joint implants, there has been little regarding hallux varus and procedures distal to the joint (Table 7). This is not surprising as there are very few procedures described for correcting bunions based on solely altering the proximal phalanx of the great toe. The occurrence of hallux varus was fairly consistent among the reported data, however, it should also be noted that of the four studies listed, each procedure devised for hallux abducto valgus correction was different from the next.

Soft-Tissue Procedures.

The surgical procedure originally described by McBride emphasized the importance of releasing the lateral contractures of the first interspace to restore the normal alignment of the great toe (Table 8). "The conjoined tendon of the base of the outer aspect of the first phalanx is released from its attachment and transplanted into the head of the first metatarsal. The external sesamoid is removed if it is eroded, abnormal in shape, or displaced. The bursa and prominence on the medial aspect of the head of the metatarsal are then removed and an ideal yet conservative correction is obtained."[72]

Table 7

REPORTED HALLUX VARUS AFTER PHALANGEAL PROCEDURES

Procedure	%	# Feet	Author (ref)	Year
Oblique Proximal Phalangeal Osteotomy	5.6	2/36	Cohen[68]	2003
Keller & lateral release[3]	5.4	2/37	Zembsch[21]	2000
Keller & sesamoidectomy	2.0	1/50	Donley[69]	2002
Keller & lateral release[4]	2.0	2/97	Schneider[47]	2002
TOTAL	**3.2**	**7/220**		

Table 8

REPORTED HALLUX VARUS AFTER SOFT-TISSUE PROCEDURES

Procedure	%	# Feet	Author (ref)	Year
Modified McBride (DuVries) & sesamoidectomy	25.0	3/12	Beck[70]	1971
McBride & sesamoidectomy	13.0	18/139	Hansen[71]	1974
Modified McBride	11.0	11/100	Mann[72]	1981
Modified McBride	8.3	6/72	Mann[24]	1991
McBride & sesamoidectomy	5.3	2/39	McBride[73]	1935
McBride & sesamoidectomy	1.6	18/1100	Janis[74]	1975
McBride & sesamoidectomy	1.1	10/878	Feinstein[3]	1980
McBride & sesamoidectomy	1.0	3/300	Hawkins[5]	1971
McBride & sesamoidectomy	Case	7/7	Miller[6]	1975
TOTAL	**2.7**	**71/2640**		

Although the percentage of hallux varus ranged between 1% and 25%, Table 8 shows that there was an overall complication rate of 2.7% for soft tissue procedures. Other than the paper by Beck, who gave very little discussion regarding his high rate of varus complication, Hansen, Mann, and Janis all had different opinions regarding the reason for the deformity. Hansen stated that due to injuring the lateral head of the flexor hallucis brevis, the medial head gained a mechanical advantage as an abductor, and subsequently initiated the varus alignment.[71] Mann credited his varus complications to "an over eagerness to correct a severely deformed foot and that a hallux varus was rarely a complication of a mild-to-moderate hallux valgus deformity."[72] Finally, Janis, whose study encompassed over 1,100 McBride type corrections, found only 18 cases of hallux varus as a complication. He attributed the complication to the length of the first metatarsal, stating that the chances of a hallux varus were increased when the first metatarsal head was rounded as well as longer than the second metatarsal.[74]

MATERIALS AND METHODS

A review of the literature was performed by manually inspecting the table of contents, online search engines, and inspecting the reference section from previous articles written. This study includes articles up to 2004. The journals extensively evaluated for this study included the following: Clinics in Podiatric Medicine and Surgery of North America, Clinical Orthopedics and Related Research, Foot and Ankle Clinics, Foot and Ankle International, Journal of the American Podiatric Medical Association, Journal of Bone and Joint Surgery, and the Journal of Foot and Ankle Surgery.

The data from reported cases of hallux varus were broken down into 8 separate tables based upon the type of surgical procedure performed. The surgical procedures included metatarsocuneiform procedures, proximal osteotomies with a soft tissue procedure, midshaft osteotomies, distal osteotomies with a lateral release, distal osteotomies without a lateral release, first metatarsophalangeal joint implants, phalangeal procedures, and

soft-tissue procedures. Only articles that specifically admitted to looking for hallux varus as a postoperative complication were considered as reliable estimates and were included for analysis in this study. After compiling these data into the appropriate groupings, the percentage of the reported cases was calculated. Lastly, chi-square analysis was utilized to evaluate if data differed significantly. The following null hypothesis was formulated: (H1) If the incidence of hallux varus deformity as a complication from hallux abducto valgus correction is stratified across the types of surgical procedures then there will be no significant difference. The resulting proportions (ie, observed frequencies) of hallux varus complications by procedure were summarized. Contingency tables were formed such that the pooled data is shown in Table 9.

RESULTS

Through chi-square analysis, it was found that there was a significant difference in complication rates of hallux varus when stratified across various surgical procedures (Table 10). From this analysis the null hypothesis was rejected.

DISCUSSION

After reviewing the literature, it is still difficult to conclude what degree of deformity warrants the title of hallux varus. By definition, hallux varus may range from a simple transverse plane hallux adductus to a triplane deformity consisting of a medially deviated hallux in a varus rotation with a non purchasing contracted hallux.[8] In addition, some researchers define hallux varus if the hallux abducto valgus angle is less than 0° on a dorsoplantar radiograph.[22,75] Yu discussed the relevance of first identifying all of the deformities involved, observing the patient both weightbearing and non-weightbearing. After an accurate assessment of the first metatarsophalangeal joint, Yu defined a hallux varus as a term used to describe only the transverse plane medial deviation of the great toe in respect to the first ray. He reserved the title of hallux malleus to describe the flexure contraction at the distal phalangeal joint and concomitant extension contracture at the first metatarsophalangeal joint. When both deformities exist simultaneously, this should be referred to as an iatrogenic hallux varus with concomitant hallux malleus deformity.[76]

With these definitions in mind, a majority of documented cases are incidental findings in that most patients have no difficulty with footwear and are asymptomatic with the deformity.[77] As stated by Granberry, this condition may be more common than reported in the literature due to the benign nature of symptoms and Mann concluded that an 8° hallux varus deformity is of little or no clinical significance.[72,78] This raises the question should the postoperative diagnosis rely solely on radiographic views, or on the clinical appearance and patient's satisfaction?

Table 9

TOTAL REPORTED HALLUX VARUS COMPLICATION BY PROCEDURE*

Procedure	1	2	3	4	5	6	7	8	Total
Hallux Varus	24	93	31	30	10	5	7	71	271
No Complication	429	785	724	824	1043	69	213	2569	6656
Total	453	878	755	854	1053	74	220	2640	6927
Percentage	5.3	10.6	4.1	3.5	1.0	6.8	3.2	2.7	3.9

*1 = Metatarsocuneiform Procedures; 2 = Proximal Osteotomies with Lateral Release; 3 = MidShaft Osteotomy Procedures; 4 = Distal Osteotomy with Lateral Release; 5 = Distal Osteotomy without Lateral Release; 6 = First Metatasophalangeal Joint Implant; 7 = Phalangeal Procedures; 8 =Soft-Tissue Procedures.

Table 10

TOTAL REPORTED HALLUX VARUS EXPECTED FREQUENCIES

Data Set	Table	X^2	df	Critical Value X^2	P Value	Statistical Significance	Hypothesis
1	9	143.965	7	14.0671	<0.0001	Yes	Reject H1

There is a difference in the incidence of hallux varus deformity as a complication from hallux abducto valgus correction when stratified across various surgical procedures. Through chi-square analysis, the hypothesis was rejected. The data from reported cases of hallux varus was broken down into 8 separate tables based upon the type of surgical procedure. After compiling these data into the appropriate groupings, the percentage of the reported cases was calculated. Proximal osteotomies with some form of lateral release ultimately resulted in having the highest varus complication rate at 10.6%. Distal osteotomies that did not include any type of lateral release had the lowest occurrence rate at 1.0%.

It is the author's opinion that a great deal of published literature lack true representation of the occurrence rate of hallux varus secondary to a lack of patient complaints. This makes it difficult to evaluate and develop the most accurate estimate of hallux varus. In a majority of the literature reviewed, the authors found that hallux varus complications were commonly either mentioned in just a single sentence or in a brief statement regarding the occurrence rate for that procedure with little follow up or possible explanation. In some instances, data from formulated tables expressing postoperative negative intermetatarsal angles had no mention of hallux varus anywhere within the articles.[79,80] This possibly could result from the common presentation of patients who are asymptomatic with the deformity, regardless; this data was not included in the current study. Only articles that specifically admitted to looking for hallux varus as a post-operative complication were considered as reliable estimates and were included for analysis in this study. Unfortunately, a majority of articles reviewed had no mention of whether hallux varus was openly looked for, which does have an affect on the overall incidence of this complication. Obviously if all of the articles involving surgical correction of hallux abducto valgus could have been used in this study, the occurrence rate of hallux varus as a postoperative complication could have been more accurately assessed.

The conclusions obtained in this paper are considered to be the "best case scenario" as far as the occurrence rate of hallux varus deformity. The data collected to formulate these opinions were derived from clinicians considered at the top of the podiatric and orthopedic fields of medicine with their complication rates considered as the preeminent standards. Since the literature is a source of continual education that consistently shapes our practice and acknowledging the reviewed articles as our most reliable source, it can only be hypothesized that hallux varus is occurring more commonly in the typical podiatric and orthopedic office.

A great deal of literature has been published regarding hallux varus as a post operative complication of hallux abducto valgus surgery. This article involved a comprehensive evaluation of the literature and specifically analyzed the results from a variety of long term follow up studies. It was found that proximal metatarsal osteotomies in conjunction with some form of distal soft tissue release were the most likely of procedures to acquire a hallux varus deformity.

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