

## Acta Ortopédica Mexicana

Volumen **19**  
Volume

Supl. **1**  
Suppl.

Mayo-Junio **2005**  
May-June

*Artículo:*

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## Functional, esthetic and radiographic results of treatment of *hallux valgus* with minimally invasive surgery

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**SUMMARY.** *Introduction.* The condition known as *hallux valgus* is a foot deformity involving the first ray, and is characterized by the lateral displacement of the great toe. *Objective.* To assess the effectiveness of minimally invasive surgery to treat *hallux valgus*. *Design.* Retrospective, cross-sectional, descriptive, observational study. *Location:* “Lomas Verdes” Trauma and Orthopedics Hospital of the Mexican Social Security Institute, in Naucalpan de Juárez, State of Mexico. *Material and methods.* Fifteen patients with diagnosed *hallux valgus* were evaluated. Eleven patients were classified as having grade II and 4 as grade I disease. Patients were assessed over the period between August 1, 2002 and October 31, 2003. Information was collected from patient charts. The single-variance frequency analysis was then performed. Also, the central trend and dispersion measurements were obtained for the standard population variables using the SPSS, Version 11, for the dependent variable. *Results.* The surgical technique for the percutaneous approach of *hallux valgus* is a very effective choice, with reports of 86.58% excellent results and 13.48% good results in the short and medium terms. Complications included displacement of one fragment in one patient (6.66%), and residual edema in 6 patients (39.96%). *Discussion.* Percutaneous treatment of bones and soft tissues is possible and leads to good results, which represent a considerable improvement over traditional techniques. *Conclusions.:* Percutaneous techniques to surgically treat *hallux valgus*, when properly performed, allow for

**RESUMEN.** *Introducción.* El proceso patológico conocido como *hallux valgus* es una deformidad de los pies que afecta al primer rayo, caracterizada por la desviación lateral del primer dedo. *Objetivo.* Evaluar la eficacia del tratamiento quirúrgico del *hallux valgus* con cirugía mínima invasiva. *Diseño.* Estudio retrospectivo, transversal, descriptivo y observacional. *Ubicación.* Hospital de Traumatología y Ortopedia “Lomas Verdes” del Instituto Mexicano del Seguro Social, Naucalpan de Juárez Estado de México. *Material y métodos.* Se revisaron a 15 pacientes con el diagnóstico de *hallux valgus* grado II en 11 pacientes y grado I en 4 pacientes en el periodo comprendido entre el 1 de agosto del 2002 al 31 de octubre del 2003. Se recabó la información consignada en la hoja de recolección de datos y posteriormente se realizó el análisis univariado de frecuencias así como medidas de tendencia central y de dispersión para las variables demográficas obligadas, mediante el paquete estadístico SPSS versión 11 para la variable dependiente. *Resultados.* La técnica quirúrgica para el tratamiento quirúrgico del *hallux valgus* por vía percutánea es una alternativa de tratamiento muy eficaz, teniendo el 86.58% de excelentes resultados y el 13.48% de buenos resultados a corto y mediano plazo. Y como complicaciones observamos el desplazamiento de uno de los fragmentos en 1 paciente (6.66%). Y edema residual en 6 pacientes (39.96). *Discusión.* Podemos realizar procedimientos a nivel óseo y de tejidos blandos con técnicas percutáneas obteniendo buenos resultados que mejoran considerablemente en al-

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excellent to good results according to the guidelines set by the Research Committee of the American Orthopaedic Foot and Ankle Society to assess patients with *hallux valgus*.

**Key words:** *hallux valgus*, surgical procedure.

unos aspectos a las técnicas tradicionales. **Conclusiones:** Las técnicas percutáneas para el tratamiento quirúrgico del *hallux valgus* correctamente practicadas, permiten obtener excelentes a buenos resultados, de acuerdo a los lineamientos para la evaluación de los pacientes con *hallux valgus* de la Research Committee of American Orthopaedic Foot & Ankle Society.

**Palabras clave:** *hallux valgus*, procedimiento quirúrgico.

## Introduction

The condition known as *hallux valgus* is a foot deformity involving the first ray. It is characterized by lateral displacement of the great toe producing a much more complex picture than a simple esthetic deformity. Defined by Viladot as “first-ray insufficiency syndrome,” this condition has major consequences on the dynamics, statics, esthetics, and function of the foot.

Classically, the initial description of this deformity was attributed to Laforest (1782), surgeon of King Louis XVI. However, Schnepf mentions previous descriptions by Legran (1731) in his paper “La toilette des pieds” and by Rouselot (1769) in “L’art de soigner les pieds”. Heuter first called this deformity *hallux valgus* in 1871. Later, Morton and Reverdin proposed to treat it surgically in 1876 and 1881.

The incidence of this deformity is very high, especially in women aged 40 to 60 years, as evidenced by Coughlin and Thompson, who associated the deformity to footwear and reported a higher prevalence among females versus males.

A better understanding of the deformity, a good assessment of its progression based on knowledge of its natural history, and properly addressing its causes, allows to provide a treatment that is highly likely to succeed in the medium and long range.<sup>1</sup>

We believe the percutaneous technique promises at least the same results as traditional techniques.

The purpose of this study is to assess the effectiveness of minimally invasive surgery to treat *hallux valgus* by evaluating the functional, esthetic and radiographic results.

## Material and methods

This is a retrospective, cross-sectional, descriptive, observational study of the patients with *hallux valgus* who were operated at the “Lomas Verdes” Trauma and Orthopedics Hospital of the Mexican Social Security Institute, during the period between August 1, 2002 and October 31, 2003. Fifteen patients of both genders who met the criterion of >12 months postoperative follow-up were included. They had all undergone minimally invasive surgery. Their ages

ranged between 16 and 80 years. According to the investigator, their health was good based on their medical history and physical examination. They had a symptomatic deformity, good metatarsophalangeal mobility, a congruent or displaced joint, mild axial rotation of the great toe, a metatarsophalangeal angle >15°, an interphalangeal angle >15°, a distal metatarsal angle >6°, an intermetatarsal angle >8° and <15° (Figures 1 and 2). The surgical procedure was performed in 13 female patients (86.8%) and 2 males (13.2%). There was only one patient (6.6%) in the 21 to 30 year-old age group and 14 patients (93.4%) were 21 to 74 years old. Age-group distribution was obtained from the data collection form. Of the 15 patients in the series, 11 (73.26%) had bilateral disease and 4 patients (26.74%) had unilateral disease. We treated 26 feet, 14 (53.76%) right feet and 12 (46.24%) left feet.

The clinical, esthetic, and radiographic postoperative variables were measured in the immediate postoperative period and at postoperative weeks 1, 2, 4, 5, 6, 7, and 8. These variables were also measured at 6 months and finally at 12 months after surgery.

Supplies used were those required to perform the surgical procedure, such as gauze, iodine, OR scrubs, gloves. The materials used after the surgery included gauze, micropore tape, tube-packed gauze, Coban-type tape, interdigital separators, and post-surgical shoe.

The equipment used consisted of the specific instrumentation for percutaneous foot surgery, divided into three sections: a) basic instrumentation: Beaver 64 and Beaver 64 MIS scalpels, hemostasis clamps, needle holder, scissors, dissection clamps, DPR gouge; b) power-driven instrumentation with lateral reamers, fine and gross reamers; c) X-ray control instrumentation, image intensifier included.

The procedure followed in all patients was: 1) Bunionectomy of the great toe;<sup>2,3</sup> 2) Reverdin-Isham oblique distal osteotomy of the great toe with an internal wedge;<sup>2</sup> 3) tenotomy of the abductor muscle at its attachment on the first phalanx;<sup>4,6</sup> 4) inferolateral capsulotomy of the metatarsophalangeal joint of the first metatarsal;<sup>4,6</sup> 5) Akin osteotomy of the proximal phalangeal base of the great toe with an internal wedge.<sup>7</sup>

Table 1. Nonparametric descriptive statistical testing.					
	N	Mean	Typical deviation	Min	Max
Preoperative metatarsophalangeal angle	15	2.7333	.45774	2.00	3.00
Postoperative metatarsophalangeal angle	15	1.0000	.00000	1.00	1.00

Results were obtained from a survey answered by all 15 patients included in the study and the pre and postoperative X-ray evaluation. This information was gathered in data collection sheets approved by the Research Committee of the American Orthopaedic Foot and Ankle Society.<sup>8</sup> Based on this evaluation sheet, the parameters to rate the results as excellent, good or poor were applied. Then the single-variance frequency analysis was performed in addition to the central trend and dispersion measurements for the standard demographic variables using the SPSS, Version 11, for the dependent variable.

### Results

The data that showed a significant difference and had a statistical value are shown below. The radiographic evaluation included a comparative statistical analysis of the preoperative versus postoperative data. The *hallux valgus* angle was measured and a nonparametric statistical test was used (Table 1). Thirteen patients (86.58%) had excellent results (Figures 3, 4, and 5) and 2 patients (13.48%) had good results. Four patients (26.74%) had a 15 to 20° *hallux valgus* and 11 patients (73.26%) had a 21 to 40° *hallux valgus*. The deformity was corrected in all 15 patients (100%) with <15° angles. Twelve patients (79.92%) had a 6 to 14° distal metatarsal angle while 3 patients had a distal metatarsal angle >14°. The distal metatarsal angle was corrected in all 15 patients, with 14 patients (93.34%) having angles <6° and one patient (6.66%) with an angle <14°, for a mean 8° correction. Time to osteotomy healing was 6 weeks in 9 patients (59.94%) and 8 weeks in 6 patients (40.06%). Fragment displacement occurred in one patient (6.66%) with no final significant repercussions. Regarding the medial sesamoid displacement in the dorsoplantar view, 7 patients (53.28%) had no displacement, while 8 patients (53.28%) had mild displacement but no dislocation of the sesamoid. No arthrotic changes were seen at the metatarsophalangeal level of the great toe in 3 patients (19.98%); 10 patients (66.6%) had a decreased joint space, classified as grade I arthrosis, and 2 patients (13.42%) had sclerosis of the joint surfaces (grade II arthrosis). A flat cuneometatarsal joint surface was seen in 5 patients (33.4%) and a concave joint in 10 patients (66.6%). The clinical evaluation showed 10 patients (66.6%) with excellent results and 5 patients (33.4%) with good results. All 15 patients (100%) had medial exostosis with tenderness at this level that resolved postoperatively in all of them (100%). Six patients (39.96%) had residual edema that resolved at 4 months. Patient evaluation data showed 9 patients (59.94%) with excellent results and 6 patients



Figure 1. Fifty-seven year-old female patient diagnosed with bilateral *hallux valgus*, treated with minimally invasive surgery. Preoperative clinical picture



Figure 2. Preoperative X-ray.



Figure 3. Postoperative clinical picture.



Figure 4. Postoperative X-ray.

(40.06%) with good results. All 15 patients (100%) started walking and did light work within a 1–6 week period. Furthermore, patients resumed their activities of daily living within 6 weeks to 3 months. Patients were able to wear normal shoes. Thirteen patients (86.58%) were satisfied and achieved total control of the discomfort they had prior to surgery. Two patients (13.48%) were partly satisfied due to a mild discomfort that subsided at 4 months. Regarding the final esthetic aspect of their toe, all 15 patients (100%) reported excellent results on deformity correction and medial exostosis. As to the mobility of the great toe, 11 patients (73.26%) reported full mobility with no discomfort, and 4 patients (26.74%) had some stiffness but no discomfort. As regards the recovery period of after surgery, 9 patients (59.94%) reported a shorter recovery than expected, and 6 patients (40.06%) said recovery was as expected. No poor results were reported in any evaluation.

The following complications were found in our series: displacement of osteotomy fragment in one patient (6.66%) with no impact on the end result.

Right foot



Preoperative hallux valgus      Postoperative hallux valgus

Left foot



Preoperative hallux valgus      Postoperative hallux valgus

Figure 5. Pre and postoperative plantoscopy.

Six patients (39.96%) had residual edema that resolved at 4 months.

### Discussion

Percutaneous techniques may be used to approach the bone and soft tissues and get better results, in some aspects, than those with traditional techniques.<sup>9,10</sup> The time to osteotomy healing with percutaneous techniques may be considered as totally physiological, and in this series it was even shorter than with traditional techniques. This may be due to two basic reasons: a) the tiny injury of vessels and surrounding soft tissues caused by the percutaneous technique; and b) the bone detritus (“bone mush”) in the osteotomy focus resulting from the use of cutting burrs and

reaming the exostosis may behave as a true bone graft that stimulates osteotomy healing.

There has been a constant dilemma in foot surgery between fixation and non-fixation of osteotomies in the surgical treatment of *hallux valgus*. It is generally believed that fixation assures a good result by maintaining the desired corrections through osteosynthesis. Except for the AO compression techniques,<sup>11</sup> not used as a standard technique in foot surgery, the other fixation methods (Kirschner nails, metal pins, steel sutures, and so forth) will only prevent large displacements, and not small position changes, which generally occur with osteotomies performed with no fixation. The opposite is true, that is, using stabilization methods would cause problems particular to osteosynthesis materials (migration, percutaneous infection, etc.)

We highlight the fact that osteotomy healing is the same with and without fixation, provided that: 1) there is no soft tissue overlapping; 2) there is no major fragment diastasis; and 3) no iatrogenic injuries occurred during tissue vascularization. Percutaneous surgery allows sparing the joint capsule, ligament attachments, and muscle and tendon insertions. We advocate fragment stabilization without diastasis or soft tissue overlapping, which minimizes injuries during vascularization.

Selecting the osteotomy site by keeping the capsule-ligament element intact, in addition to an external dressing used as a metatarsal cerclage, provides enough stability to encourage healing. No modalities of synthesis were used in this series to fixate osteotomies and our results are better than those reported by Wu<sup>4</sup> with the Chevron osteotomy.

We therefore agree with Austin and Leventen<sup>12</sup> in that no osteosynthesis techniques are necessary for osteotomy fragments.

The first dilemma was deciding the ideal spot for the osteotomy. We agree with Mann<sup>13</sup> and Coughlin,<sup>14</sup> who highlight the importance of correcting the distal metatarsal angle of the great toe. We advocate distal osteotomy<sup>15-18</sup> with removal of an internal wedge. This is the only way to directly prevent relapses. The correction of the metatarsophalangeal angle by performing distal osteotomies on the metatarsal of the great toe is limited, about 10 to 25°, according to Blum's series.<sup>18</sup> Accordingly Wu, Kitaoka and other authors<sup>4,5,19</sup> recommend combining the lateral capsule release and the abductor muscle detachment at the phalangeal level, thus getting corrections far better than 25°. Other authors like Shereff<sup>20</sup> noticed an increased avascular necrosis rate of the metatarsal head after distal osteotomies and soft tissue release. No cases of avascular necrosis of the metatarsal head were reported in this series despite the percutaneous release.

Regardless of the shortening due to wedge removal, percutaneous techniques result in a 2-millimeter additional shortening caused by the cutting line of rotational burrs. We have therefore obtained a mean 4-millimeter shortening. When shortening exceeds 10 millimeters, metatarsal pain increases significantly, as a large number of authors, such as Miller,<sup>21</sup> have reported.

The absence of infection is attributed to compliance with aseptic techniques, in addition to the power device used throughout the surgical procedure. Secondary alterations in great toe sensitivity have not been a problem in terms of the severity or the number of cases in our series.

Further studies to assess the long-term results and a comparative study of both techniques are needed.

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