

# Percutaneous surgery of allux valgus: risks and limitation in our experience

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**Abstract.** *Aim of the study:* The Reverdin-Isham percutaneous osteotomy is indicated in the treatment of mild to moderate hallux valgus. The aim of this study is to evaluate the technique itself after a relevant experience. *Methods:* From January 2010 to January 2012 we have done 213 percutaneous osteotomy. The patients were evaluated clinically and with imaging after a minimum 5 months and a maximum 2 years follow up. For the clinical evaluation it was used the American Orthopaedic Foot and Ankle Society score. *Results:* The mean postoperative clinical score was 90 points in front of the mean 45 preoperative points. The technique was well accepted by the patients because of the minimal invasivity, the poor post operative pain and the immediate functional recovery even with poor radiological results. These imaging results pose doubts on the length of the clinical results and pose the necessity of particular technical choices and strict indication limits. *Conclusion:* The results we have obtained with the Reverdin-Isham percutaneous osteotomy have confirmed that this procedure is a valid alternative to other open techniques. However this is a not simple technique, requires the respect of the indications, a steep and long learning curve and the necessity of a greater follow up. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** hallux valgus, percutaneous surgery, Reverdin-Isham

## Introduction

The hallux valgus is a very common foot, often disabling and characterized by the existence of many operative and non-operative treatments (1-3).

Surgical correction involves many techniques (more than 100) that are often conceptually very different. The surgical option is therefore not unique and the variety of those proposed is dictated by the multiplicity of causal factors (4-6) and the surgeon's personal preference.

This extreme variety of technique, conceptually different and some very invasive, reveals that there is not yet an ideal solution for this deformity, with secure results and without long term recurrence.

For this reason our position has also been to prefer the less invasive possible techniques.

Over the past 15 years, we have often used the Bosch minimally invasive technique with good results, but also with complications related mainly to the presence of the percutaneous K-wire and problems resulting from infection. In one case there was also a severe skin ulcers with total exposure of the wire, due to lack of accurate nursing (Fig. 1).

In the search for minimally invasive techniques, we started using the percutaneous technique since January 2010.

Percutaneous hallux valgus surgery is a surgical technique born in the United States in the nineties thanks to Stephan Isham founder of the Academy of



**Figure 1.** Severe skin ulcers with complete exposure of the K-wire

Ambulatory Foot and Ankle Surgery and then imported and diffused in Europe by the scientific contribution of Mariano De Prado (Spain).

Even today it isn't a technique widely used because of the undoubted difficulties and limitations of surgical indication, as well as the psychological resistance encountered by the advocates of traditional surgery.

This is a highly innovative and conceptually revolutionary surgical technique for the treatment of all deformities characterized by an intermetatarsal angle up to 18°, (statistically more than 70% of all feet with hallux valgus) and all hallux valgus-related diseases, such as claw finger, metatarsalgias, deformity of the fifth finger, and many other foot diseases.

There are numerous advantages: minimal surgical incisions, minimally invasiveness, highly reduced execution times, rapid functional recovery that began conceding the load from the day of surgery with a rocker bottom shoe thanks to a poorly painful post-operative time.

The surgical technique is not, however, as simple as it seems and has a number of specific risks, therefore, requiring a steep and long learning curve.

Our experience from January 2010 to January 2012 counts 213 cases of which we not only refer the results, but also the limits and the most common difficulties.

## Methods

The technique involves the surgical correction of hallux valgus deformity with three tiny incisions and four surgical times always under fluoroscopic control. (7-8)

The correct sequence of surgical time is essential premise of the whole project:

- 1) exostosectomy of the head of the 1st metatarsal;
- 2) subcapital Reverdin-Isham osteotomy of 1st metatarsal;
- 3) adductor tenotomy;
- 4) Akin osteotomy of the 1st phalanx of the hallux

In the first half a mini-incision at the base of the metatarsal head's eminence is done, and after having gently peeled off the capsule, a wedge burr, with a high torque and low speed drill, is introduced and makes it possible to regularize the medial eminence.

This resection must be very accurate and absolutely not excessive, since the total conservation of the first metatarsal head is essential for a proper articular balance.

Through the same approach the second half, which has the aim of obtaining a proper reorientation of the diverted articular surface, by correcting the angle "PASA" is done. This goal is achieved through a transverse wedge osteotomy performed proximal to the metatarsal head, with a special high-speed drill.

This osteotomy allows to properly redirect the base of the hallux (Reverdin-Isham osteotomy by the creators of this procedure), taking care to preserve the lateral "hinge bone".

The burr movement must be tilting in dorso-plantar, such as to create an osteotomy of the 3/4 of the metatarsal circumference, retaining an "external hinge" on which the first metatarsal's axis is rotated into varus; the amount of correction will depend on the wedge burr width. Care is taken to not interrupt the lateral

cortex, which is not always easy for different reasons either in the osteoporotic bone or in the sclerotic bone. In the osteoporotic bone it is very easy to totally osseotomize the metatarsus, on the contrary in the sclerotic bone it is possible that the lateral hinge will make it hard to close the osteotomy or it could brake during the procedure.

The tenotomy of the adductor hallucis and the release of the lateral aspect of the MTP joint, which is responsible for retraction of the external diversion of the finger, is performed in the third half. It is done introducing with upper outer approach a specific beaver blade in the joint space. This blade will be over the lateral capsular ligamentous compartment of the joint and the hallux is forced in varus thus obtaining the automatic section of the soft tissue, the hallux correction and the reorientation of the sesamoid bones.

The fourth and final half is the phalangeal, it is performed through a third medial incision, just medial to the base of the first phalanx of the hallux. On the proximal phalanx is then performed a wedge osteotomy with metaphyseal external hinge, so that its closure leads to the realignment of the finger (Akin osteotomy) thus completing the perfect joint realignment of the first ray.

The duration of the procedure ranges from 15 to 30 minutes, the correction of the deformities is only maintained by a crepe bandage and immediate full weight bearing is allowed with a special rocker bottom postoperative shoe.

We use to run normally 3 dressings in 30 days with skin control and renewal of the bandage.

After 35-40 days full weight bearing is allowed with regular, comfortable shoes and custom made silicone toe spreader is always recommended.

## Results

Our experience in the correction of hallux valgus with percutaneous technique began in January 2010, and consider until January 2012 213 cases (184 females - 29 males) with a mean age of 55 (min 25y - 85y max) and interquartile range (IQR) of 50-68 years, with a minimum five months follow-up and a 29 months maximum one.

Patients were evaluated according to the American Orthopaedic Foot and Ankle Society (AOFAS) hallux-metatarsophalangeal-interphalangeal scale and after a minimum five months follow up we had 114 excellent cases (53%), 83 good ones (39%) and 16 average ones (8%). Among the averages: 6 DASA over-correction, 12 M1 fractures, 9 P1 fractures and 1 superficial infection.

The average score has improved from a preoperative median of 45 points to a postoperative median of 90 points. When dividing the overall score into pain, function and alignment, we observed an improvement from a median preoperative score of 20 to 40 points postoperatively for pain; from a median preoperative score of 30 points to 40 points postoperatively for function; and from a median preoperative score of 0 points to 14 points postoperatively for alignment.

There are many advantages of this surgical technique which, in response to a radiological long healing offers a rapid functional recovery of patient autonomy, thanks to little postoperative pain.

The surgical times are greatly reduced, minimal surgical scar, less possibility of intra and postoperative complications compared to open surgery collect wide acceptance from the patients.

## Discussion

Even if there are many advantages we should not underestimate the limits and possible errors in using this technique.

As with any surgical procedure it will be essential to accurately select the patients for psychological attitude, compliance and understanding of the procedure to prevent expectations derived from self-taught information.

Furthermore a strict indication observance will be essential (IMA angle < 18°, PASA < 40°).

The surgical times must be observed: doing the phalangeal time before the adductor hallucis tenotomy will make impossible the tenotomy itself.

The surgical technique, certainly fascinating but delicate, requires a learning curve and general and specific technical attentions.



**Figure 2.** Drill introduced with oblique orientation to avoid cutaneous impingement

#### General techniques attentions:

Preparation of the surgical field that allows easy fluoroscopic viewing on 2 plane without interference with the powered equipment.

Absolute accuracy of the various surgical approaches under fluoroscopic control.

The use of high speed drills can easily damage the skin and cause skin burns and damages within the capsule and periarticular soft tissues. Therefore it is always essential to insert the drill with a suitable angle to avoid even the slightest skin impingement, being careful to maintain a constant cooling wash with plenty of saline (Fig. 2).

In the case of skin burn is preferable to extend the edges of the minincision and put a stitch to prevent septic complications.

Specific technical attentions of the various surgical steps:

#### *First step*

To let the burr work only on the bone without damaging the soft parts, we recommend an extremely abundant and accurate dissection of the capsule of the metatarsal phalangeal joint with special rasps, until a large free volume that allows the drill to work only on the bone is obtained.

Maximum attention of a not excessive M1 exostosectomy (as mentioned earlier) under constantoscopic control.

Accurate squeezing and abundant pressure washing with syringe for the complete ablation of bone chips.

#### *Second step*

To preserve the lateral cortex and the dorsal and plantar soft parts we recommend a careful and continuous fluoroscopic control during the performing of the osteotomy. The burr is introduced transversely in a medial to lateral direction, stopping on the lateral cortex and doing a 3/4 circumference osteotomy of the metatarsal with in-out movements in a radial pattern and oblique dorso plantar direction, parallel to the articular surface, from the superior limit to the inferior, proximally to the sesamoid.

In the case of occasional resection or complete rupture of the hinge (3%) it doesn't usually require any fixation, given the inherent stability caused by the orientation of the Reverdin-Isham osteotomy (Fig. 3).

Finally, special attention should be paid to obtain a sufficient PASA angle correction, increasing the amplitude of the osteotomy with a larger diameter drill andoscopic control of the correction obtained.



**Figure 3.** Reverdin-Isham M1 self-stabilizing oblique osteotomy

*Third step*

The adductor tenotomy presents considerable difficulties and risks both of a partial section, with an increased risk of recurrence, and of an excessive section of the entire external capsular ligamentous apparatus, resulting in very severe varus deformity.

As already described by us, it is essential to maintain steady the blade, the knife in intraarticular position over the lateral capsular ligamentous structures, forcing the hallux into varus until you get the distinct feeling of adductor tenotomy. A fluoroscopic control will confirm the varus correction obtained and the realignment of the sesamoid.

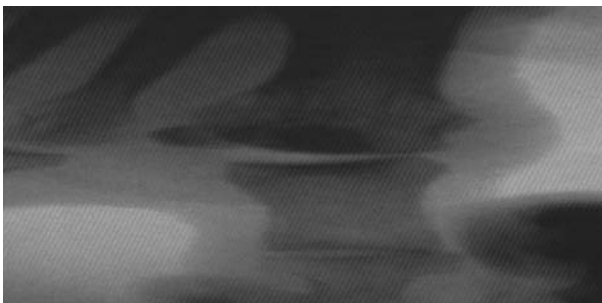
An insufficient arthrolysis, also in front of a correct execution of all remaining surgical times, leads to a poor results with rapid deterioration over time (Fig. 4).

*Fourth step*

The Akin osteotomy of F1 requires the same attention to the metatarsal one for the respect of the external cortical hinge. In this case, however, the attention is essential as this osteotomy has no inherent stability. Therefore, a complete osteotomy causes severe F1 deformities in hyperextension and varus. The radiological result will be bad then, with DASA angle overcorrection, especially if associated with a broad lateral arthrolysis. In our experience strangely in these cases the clinical outcome has always been equally valid, but we have major concerns about the long-term follow-up (Fig. 5).

Postoperative attentions:

A peculiarity of the technique is the absence of fixation. The osteotomies correction depend only on the bandage, which must be strictly performed by the



**Figure 4.** Fluoroscopic control after adductor tenotomy



**Figure 5.** Bad radiological finding, good clinical result

surgeon both intraoperatively and postoperatively. A poorly done bandage may cause defects or overcorrections, which in the case of complete osteotomies can lead to both metatarsal and phalangeal displacements or simply give difficulty of tolerance with pain, swelling and pressure sores, which eliminate completely the specific advantages of the percutaneous technique.

Important finally is the use of a specific postoperative shoe, with rocker bottom sole for a more physiological possible gait that further emphasizes the advantages of the technique.

## Conclusions

Clinical results at follow-up showed increasingly good aesthetic correction of the deformity with absence of pain even in the case of incorrect radiological findings with patient's satisfaction even at 2 years follow up.



As highlighted in the literature, the clinical results obtained with percutaneous "Reverdin-Isham" osteotomy are comparable to those obtained with conventional percutaneous techniques and open surgical procedures, with 89% of patients satisfied or very satisfied at 1 year follow-up. (9-19).

However, the technique is certainly more appreciated by the patient as less painful, faster and with faster functional recovery. The procedure also does not preclude further more invasive action in the future.

It is however not a simple technique, it needs a rigorous indications' observance and it requires a surgical technique with careful attention to small details, thus resulting in a very surgeon dependent technique.

The attention must also continue even during the postoperative time with a demanding nursing.

The bad radiological findings, in the face of valid clinical outcome even at two years follow up, pose serious concerns and make necessary a constant evaluation of the clinical, radiological evolution in the coming years.

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