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Original article

Percutaneous hallux valgus surgery: strengths and weakness in our clinical experience

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Abstract. *Background and aim of the work:* The Reverdin-Isham percutaneous osteotomy is indicated in the treatment of mild to moderate hallux valgus deformity. The aim of the work is the evaluation of the technique itself as a possible future landmark in the hallux valgus treatment. *Methods:* Between January 2010 and January 2011 we have performed 138 percutaneous osteotomies. The patients were assessed with a clinical and radiological control after a median five months follow up. The score proposed by the American Orthopaedic Foot and Ankle Society was used for the clinical evaluation. *Results:* The average score has improved from a preoperative median of 45 points to a postoperative median of 91 points. The technique has been largely accepted by the patients because of the speed of the procedure itself, the minimal invasiveness, the short pain and the immediate functional recovery. *Conclusions:* The results we have obtained with the Reverdin-Isham procedure have confirmed that this technique is a valid alternative to other percutaneous techniques and open surgical procedures. However the technique is not simple, it needs the strict indications observance and it needs a steep learning curve, those are features that impose further future studies. (www.actabiomedica.it)

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

Introduction

The hallux valgus is a foot deformity characterized by lateral deviation of the big toe at the metatarsophalangeal joint, the varus of the first metatarsal and the inadequacy of the first ray, which often cause central metatarsalgia (1-3).

Surgical correction involves many techniques 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 reveals that there is not yet an ideal solution for this deformity.

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

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.

The absence of surgical incisions (strictly percutaneous approach through mini-incisions) and the extremely short lead times, minimize the invasiveness gaining wide acceptance from the patients, for whom it is commonly known as the "little holes technique" or incorrectly defined, because of the lack of scars, "laser correction".

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).

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 (exostoses).

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 and load distribution on the forefoot.

This procedure not only consists in the removal of the redundant portion of the metatarsal head but also in the proper reorientation of the articular surface, the so-called "PASA". This goal is achieved through the second half, which is the most correcting action of the entire procedure but also the most difficult to execute properly.

In the second half a transverse wedge osteotomy is 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 osteotomize 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. After having introduced a small beaver blade, which will be over the lateral capsular ligamentous compartment of the joint, the hallux is forced in varus thus obtaining the automatic section of the soft tissues. This leads to 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 curved soled postoperative shoe". Weekly dressing with skin control and crepe bandage renewal are made for 4 weeks. After 30-35 days full weight bearing is allowed with regular, comfortable shoes and custom made 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 2011 138 cases (110 females - 28 males) with a mean age of 55 (min 25 y - 85 y max) and interquartile range (IQR) of 50-68 years, with a minimum five months follow-up and a 15 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 90 excellent cases, 36 good ones and 12 average ones. Among the averages: 6 DASA overcorrection, 2 M1 fractures and 3 P1 fractures. The average score has improved from a preoperative median of 45 points to a postoperative median of 91 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 pre-

operative score of 0 points to 15 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 a little postoperative pain.

The surgical times are greatly reduced so multiple operations can be performed during the surgical procedure at low prices given the non-use of fixation, minimal surgical scar and less possibility of intra and postoperative complications compared to open surgery.

The strictly percutaneous approach and greatly reduced procedure time minimize the invasiveness, therefore gaining wide acceptance from the patients.

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, HV < 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 to avoid errors that could invalidate the outcome.

The use of high speed drills can easily damage the skin and cause skin burns and damages within the capsule and periarticular soft tissues. We recommend to perform a medial plantar and proximal incision regarding the first metatarsal head; to insert the drill at an angle according to this axis (Fig. 1) to avoid impingement and the resulting skin burn during rotation, cooling thoroughly with normosaline.

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.

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

Figure 1. Valgus deformity with preoperative score 0

medial to lateral direction, stopping on the lateral cortex and doing a 3 / 4 circumference osteotomy of the metatarsal and / or of the phalanx with in-out movements in a radial pattern.

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 (Fig. 2).

Figure 2. Postoperative deformity correction with score 15

Figure 3. Iatrogenic 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; checking with fluoroscopic control the correction obtained and the realignment of the sesamoid.

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 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 (Fig. 3). Such displacements, in our experience, don't have obvious clinical complications in the medium term but the long distance course is in evaluation.

Obviously the use of fluoroscopy is essential but must be limited, this is made possible by the professional integration between surgeon, surgeon's assistant and radiologist.

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 nevertheless with medium term patients' satisfaction.

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 long and steep learning curve, a rigorous indications' observance and it requires a surgical technique with careful attention to small details, that can lead to very different X-ray results. It also requires a good patients cooperation in understanding the benefits and limitations of the technique itself and the acceptance of special shoes and a custom made toe spreader.

Further studies are necessary to confirm our initial positive impressions especially for the evolution in radiologically negative cases but, at least at present, clinically valuable.

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