Surgical treatment of mild to moderate hallux valgus by percutaneous Akin technique with exostectomy and lateral release

Tratamento cirúrgico do hálux valgo leve a moderado pela técnica de Akin modificada por via percutânea com exostectomia e liberação lateral

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ABSTRACT

Objective: To present clinical and radiographic results of surgical correction of mild to moderate hallux valgus using the modified percutaneous Akin technique with exostectomy and lateral release. **Methods**: We evaluated prospectively 24 feet from 15 patients with mild to moderate hallux valgus, considering a hallux valgus angle from 12° to 30°, intermetatarsal angle from 8° to 15°, and distal metatarsal angle <10°. Patients were evaluate between May and November 2013, and then reevaluated in February 2016, a mean follow-up of 28.8 months (27 to 33) of postoperative evolution. Patients underwent percutaneous Akin technique associated with exostectomy and percutaneous lateral release. The Patients were evaluated using the *American Orthopaedic Foot and Ankle Society* – AOFAS score by radiographic measurement of the hallux valgus angle and intermetatarsal angle, and by subjective satisfaction of Johnson. **Results:** The mean AOFAS score from 55.6 became 94.2 after surgery. The mean hallux valgus angle from 21° (15° to 27°) became 9.2° (4° to 21°), and the intermetatarsal angle from 11.2° (6° to 15°) became 10.3° (8° to 13°). All patients reported satisfaction with the result. **Conclusion:** Surgical technique described was effective to treat mild to moderate hallux valgus with improvement of the AOFAS score, higher level of patient satisfaction, good radiographic corrections and lower surgical aggression.

Keywords:
Hallux valgus/surgery; Hallux valgus/radiography; Minimally invasive surgical procedures/methods

RESUMO

Objetivo: Apresentar os resultados clínicos e radiográficos da correção cirúrgica do hálux valgo leve a moderado pela técnica de Akin modificada pela via percutânea associada à exostectomia e à liberação lateral. **Métodos**: Foram avaliados prospectivamente 24 pés em 15 pacientes com hálux valgo leve a moderado, considerando o ângulo de valgismo do hálux de 12 a 30°, o ângulo intermetatarsal de 8 a 15° e o ângulo articular metatarsal distal <10°. Estes pacientes foram avaliados entre maio e novembro de 2013, e reavaliados em fevereiro de 2016, com 28,8 meses (27 a 33) de média de evolução pós-operatória. Eles foram submetidos à técnica de Akin por via percutânea associada à exostectomia e à liberação lateral, também por via percutânea. Os pacientes foram avaliados pelo *American Orthopaedic Foot and Ankle Society Score* (AOFAS), por medição radiográfica do ângulo de valgismo do hálux e do ângulo intermetatarsal, e pelo grau de satisfação subjetiva de Johnson. **Resultados**: O AOFAS passou de uma média de 55,6 pontos para 94,2 pontos após a cirurgia. O ângulo de valgismo do hálux passou de uma média de 21° (15° a 27°) para 9,2° (4° a 21°) e o ângulo intermetatarsal foi de 11,2° (6° a 15°) para 10,3° (8° a 13°). Todos os pacientes se encontraram satisfeitos com o resultado. **Conclusão**: A técnica cirúrgica descrita se mostrou eficaz no tratamento do hálux valgo leve a moderado, com melhora do AOFAS, alto índice de satisfação dos pacientes, boas correções radiográficas e menor agressão cirúrgica.

Descritores:
Hálux valgo/cirurgia; Hálux valgo/radiografia; Procedimentos cirúrgicos minimamente invasivos/métodos

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INTRODUCTION

Hallux valgus is a disease known for more than a century, and its treatment and cause are still controversial. Many techniques have been described for surgical treatment of this disease.[1] However, we do not believe that one technique, such as Trnka,[2] can resolve all cases of hallux valgus because of the complexity of this disease. However, we do believe in protocols that involve an in-depth anatomical, functional and radiographic study to determine the right technique for each specific characteristic.

We used the technique described by Akin[3] in 1925; this approach has changed many times over the years and has been mostly forgotten because of limitations to be indicated in more severe cases. However, this technique is currently used as a complementary procedure to accompany most modern techniques.[4] We used the concept of minimally invasive surgery developed by Isham[5] and adapted it to the Akin technique, much as Stephen Isham himself adapted the technique of Reverdin.[6] A percutaneous osteotomy was carried out in the base of the proximal phalanx of hallux, followed by exostectomy and lateral release using percutaneous approach, described as follows.

We use this technique only in more mild cases of hallux valgus with no change of the distal metatarsal articular angle (DMAA) and no need for osteotomy to correct articular inclination. In more severe cases, we carried out procedures already developed by De Prado et al.[7] and by the Group of Research and Study in Minimally Invasive Surgery of the Foot (GRECMIP).[8,9] For associated conditions, such as mechanical metatarsalgias and toe deformity, we also performed percutaneous procedures described by the aforementioned authors.

This study presents clinical and radiographic results of surgical repair of mild and moderate hallux valgus obtained by using the modified percutaneous Akin technique associated with exostectomy and lateral release.

METHODS

We prospectively evaluated 24 feet of 15 patients with mild to moderate hallux valgus. We considered the following as indications for the procedure: hallux valgus angle (HVA)[10] of 12º to 30º, intermetatarsal angle (IMA) of 8º to 15º, and distal metatarsal articular angle <10°. The HVA was defined as an angle composed of the medium diaphysary axis of the proximal phalanx of the hallux and the mechanical axis of first metatarsus. The IMA was considered to be the angle between straight segments that corresponds to the mechanical axis of the first metatarsus and the axis of the second metatarsus. The DMAA consists of the perpendicular line to the joint surface of the first metatarsal head, with a perpendicular line throughout the diaphysis axis of the first metatarsus. All angles were measured digitally using digital radiographs.

We included patients who were seen at the medical office in 2013 with mild to moderate hallux valgus that did not improve with conservative treatment (i.e., change in shoes, analgesia and physiotherapy) for 6 months. We excluded patients with metatarsophalangeal arthritis of the hallux with instability of the wedge metatarsal joint of the first ratio and those with rheumatoid arthritis.

Patients were examined weekly for 30 days to change dressings and monthly to follow the progress of bone consolidation for 1 year after surgery. To evaluate patients, we used the American Orthopaedic Foot and Ankle Society Score (AOFAS),[11] followed by clinical and radiographic assessment and Johnson's subjective degree of satisfaction[12], which was carried out before the surgery. The paired *t* test was used to assess results, with a significance level of <0.05.

Surgical technique

The procedure was carried out under locoregional anesthesia (peripheral block) or spinal anesthesia, depending on anesthesia preference, with the patient in the dorsal decubitus position and with feet free-hanging. The foot undergoing surgery was supported over a scope instrument without tourniquet (Figure 1). An incision was made on the plantar basis of the heel spur (exostosis) of the first

Figure 1 | Positioning of patient with free-hanging feet under scopy device showing the incision site for exostectomy.

metatarsus with a Beaver scalpel blade 64 until it reached the bone separating the periosteum. Then, the periosteum was detached from the metatarsal head by scraping or using a scalpel, according to the preference of the surgeon; the exostectomy was done through the orifice with a Wedge burr 3.1. The bone was removed to the joint limit of the distal metatarsus. After removal of detritus by manual compression and, posteriorly, with scraping and, sometimes, using saline solution, a new dorsolateral incision was made on the metatarsophalangeal hallux joint to perform adductor tenotomy for hallux valgus and lateral capsulotomy. For this, we moved the finger medially, promoting a hallux varus, introducing the Beaver scalpel with the cutting face laterally and deeply, thereby performing the lateral capsulotomy and adductor tenotomy (Figure 2A and B). Lastly, we made a medial incision on the basis of the proximal phalanx using a Wedge burr 3.1. An incomplete osteotomy was performed to obtain a closing wedge after manual movement of compression, thereby completing the osteotomy and maintaining the greater stability needed for fixation (Figure 3). The desired shortening of the proximal phalanx of hallux was 2 to 3mm, which always occurred when the technique was done correctly.

A dressing with gauze and adhesive tape was used to keep the toe in neutral position at the posterior view, with 10º of postoperative flexion (Figure 4) in order to avoid mild extension of the hallux during the consolidation time. The dressing was changed weekly for 4 weeks. Immediate total weight bearing was possible, as was the use of a rigid-soled shoe.

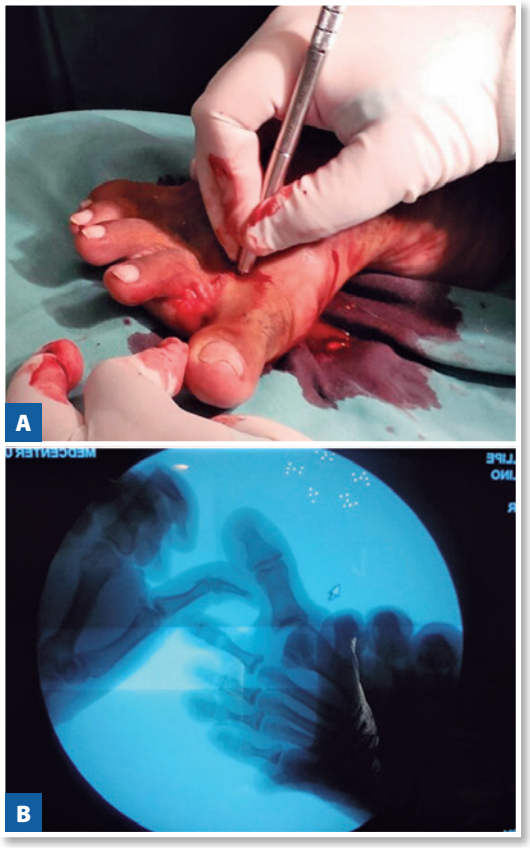

Figure 2 | (A) Procedure carried out in percutaneous lateral release. (B) Test confirmed under scopy of the percutaneous lateral release.

Figure 3 | Akin osteotomy position under scopy and visualization of final correction.

Figure 4 | Anteroposterior position of foot after immediate postoperative dressing.

RESULTS

Results were obtained from 24 feet of 15 patients who underwent surgery; 87% of them were women and their mean age was 52 years. The mean HVA was 21º (15º to 27º) before the surgery and 10.2º (4º to 21º) after the surgery; therefore, the average angle correction obtained was 10.8º (7º to 20º), which was considered statistically significant ($p>0.05$) (Figures 5 and 6). The mean preoperative HVA was 21º (15º to 27º), and on reassessment done an average of 28.8 months (27 to 33) after the surgery, the mean HVA was 10.2º (4º to 21º); this difference was statistically significant ($p<0.05$) (Figures 5 and 6). The average angular correction obtained was 10.8º (7º to 20º).

The initial mean IMA was 11.2º (6º to 15º) and the final was 10.3º (8º to 13º), with mean correction obtained of 0.9º (0 to 2º). Initial mean AOFAS score was 55.6 (34 to 65) points and final was 94.2 points (77 to 100) ($p<0.05$) (Table 1). When the disease was bilateral, we operated on the two feet at the same time, which occurred in 9 patients. Sixty percent of operated feet needed an additional procedure to correct other diseases. Two feet had Tailor's bunion, two had clinodactyly of the second toe, three had mechanical metatarsalgia of central ratios, and six had toe deformities. All patients underwent percutaneous techniques, corrective osteotomy and tenotomy as described by De Pradoet al.[7]

Figure 6 | Aesthetic aspect after 7 days of evolution.

Figure 5 | (A and B) Anteroposterior radiographs before surgery and 28 months after surgery. (C and D) radiographs before surgery (C) and 25 months after surgery.

One case evolved with transitory neuritis of the hallux and another with significant rigidity of the metatarsophalangeal joint that improved only 1 year after the surgery. The patient with neuritis had a final AOFAS score of 90 and the patient with joint rigidity had a final AOFAS score of 100 at a 28-month reassessment because of complete remission of symptoms.

At the last follow-up, all patients were satisfied with results, according to Johnson's degree of subjective satisfaction scale. We did not observe any severe complications, such as pseudoarthrosis, recurrences, infections or burning during the study or during the follow-up.

DISCUSSION

The literature contains many reports on techniques described by Akin and other adaptations, as well as associated with more modern techniques.[10] A variety of types of fixations exist, such as wires, staples, plates and screws, all with practically zero indexes of pseudoarthritis.[13,14] We highlight Cullen et al.[15] and Toth et al.,[16] who performed conventional Akin osteotomies without fixation, using only absorba-

Table 1 | Patient identification

Case	Sex	Age	Side	HVA before	HVA after	IMA before	IMA after	Initial AOFAS	AOFAS score
1	F	63	R	22	13	6	8	50	80
2	F	58	L	25	14	8	8	50	100
3	F	74	B	22 e 20	10 e 11	10 e 12	8 e 10	60 e 60	100 e 100
4	F	46	B	15 e 23	8 e 4	10 e 14	12 e 8	58 e 58	100 e 100
5	F	37	L	27	18	12	10	60	100
6	F	31	B	18 e 21	10 e 11	10 e 11	8 e 11	49 e 49	100 e 100
7	M	28	B	18 e 15	7 e 5	12 e 9	12 e 12	65 e 65	95 e 95
8	F	25	B	22 e 22	14 e 12	14 e 12	12 e 12	60 e 60	100 e 95
9	F	52	B	18 e 18	9 e 4	14 e 11	12 e 10	60 e 60	90 e 90
10	F	78	R	22	10	10	10	34	85
11	F	72	L	25	14	11	11	57	77
12	F	74	B	25 e 23	10 e 9	12 e 11	12 e 11	50 e 50	95 e 95
13	F	64	L	23	3	12	8	60	95
14	F	74	B	19 e 19	7 e 4	10 e 12	9 e 10	50 e 50	90 e 90
15	F	49	B	25 e 22	5 e 9	15 e 13	13 e 12	60 e 60	95 e 95

F: female; M: male; R: right; L: left; B: bilateral; HVA: hallux valgus angle; IMA: intermetatarsal angle.

ble suture and with good final positioning, and no cases of consolidation in a series of 115 feet. We found no cases of non-consolidation with the technique used, and for this reason we agree with non-fixation of osteotomy in the hallux.

According to Mann and Coughlin,[17] the isolated Akin osteotomy favors relapse because it does not reduce the IMA and maintain the negative effect of the adductor of hallux. Therefore, we performed adductor tenotomy associated with lateral release and used compressive and corrective dressing, balancing these deforming powers; this contributed to the good results, such as reported by Kayali.[18] We highlight that the procedure was done only when the IMA was <15°; when values were greater than this, we used another correction technique. In our study, no recurrence was seen over 28.6 months of mean follow-up.

Martinez-Nova et al.[19] also performed lateral release associated with Akin's treatment of mild to moderate hallux valgus, with similar results in the short term; they found a 14º improvement in HVA and a 2.8º improvement in IMA. Another report showed reduction of weight bearing over the hallux after surgery with Akin's technique according to the baropodometry platform that measures pressure under the foot before and after surgery.

We compared our technique with other popular techniques in Brazil, such as Chevron osteotomy[20,21] and Chevron associated with Akin;[22-25] both techniques used open surgery to treat mild to moderate hallux valgus. We obtained HVA correction of 9.8º, similar to these studies, and IMA correction of less than 2º to 3º. Clearly, our technique has advantages concerning immediate weight bearing after surgery with free ambulation. In the mentioned studies, weight bearing was authorized only 4 weeks after surgery.

Pansini et al.[26] performed Akin osteotomy in 89.1% hallux valgus surgeries, highlighting the importance of this procedure for surgical correction of hallux valgus associated with other techniques.

Carvalho et al.[27] found that the result of a percutaneous technique is similar to that of surgery of two feet at the same time, with economic and labor advantages and without harm for the result and low incidence of complications. Lara et al.[28] reported less pain after surgery as an advantage of the percutaneous procedure compared with conventional surgeries. Radwan et al.[29] compared the percutaneous technique described by Bosch et al.[30] with conventional Chevron in mild to moderate hallux valgus surgeries; they also reported similar results with advantages in aesthetic aspects and degree of satisfaction with the percutaneous procedure. Amaya[31] described advantages and fewer complications of percutaneous Akin corrective osteotomy for interphalangeal hallux valgus compared with opening surgery.

CONCLUSION

Our technique has advantages compared with conventional procedures because it is percutaneous and preserves the local biology, as well asa high degree of satisfaction reported by patients. This technique is simple and is the first step along the learning curve for percutaneous procedures because it includes less complex osteotomies. The pro-

cedure was efficient for treating mild to moderate hallux valgus, with improvement in AOFAS, good radiographic corrections, and less surgical aggression.

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