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ORIGINAL ARTICLE

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Evaluation of surgical outcomes of arthroscopic subtalar arthrodesis performed through two lateral portals

Avaliação dos resultados cirúrgicos da artrodese subtalar artroscópica realizada através de dois portais laterais

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ABSTRACT

Objective: The purpose of this study is to present the surgical outcomes of twelve patients undergoing arthroscopic subtalar arthrodesis using two lateral portals (anterior and medial) in the sinus tarsi.

Methods: A retrospective study was conducted with twelve patients (7 men and 5 women) with a mean age of 55.1 (36-74) years who underwent arthroscopic subtalar arthrodesis through the sinus tarsi between May 2015 and December 2016. The post-surgical follow-up was 12 months. Consolidation time and postoperative complications were evaluated, and a validated functional questionnaire from the American Orthopedic Foot and Ankle Society (AOFAS) and the visual analog scale (VAS) for pain were applied both before and after surgery. Results: The mean bone fusion time was 11.5 weeks. Bone consolidation was observed in all analyzed patients. Four patients developed late complications, three of which were related to screw positioning in the calcaneus, while one was related to residual hindfoot varus deformity. Screw-related complications are common with all subtalar arthrodesis techniques, and such complications are considered less relevant when evaluating the effectiveness of the presented technique. The mean preoperative AOFAS score was 42.3 (27-66) points, while the mean postoperative score was 83 (73-94) points. The mean preoperative VAS score for pain was 8.1 (5-10) points, and the mean postoperative score was 2.1 (0-5) points. The above data are similar to those reported in other published studies and reflect high bone consolidation rates.

Conclusion: Arthroscopic subtalar arthrodesis through two lateral portals in the sinus tarsi is a safe and effective technique for the treatment of primary and secondary disorders of the subtalar joint. Correct positioning of screws and hindfoot alignment must be carefully ensured to avoid complications related to the synthesis material and hindfoot varus deformity.

Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Subtalar joint; Arthrodesis; Arthroscopy; Heel.

RESUMO

Objetivo: A proposta do estudo é apresentar os resultados cirúrgicos de doze pacientes submetidos à artrodese subtalar artroscópica através do uso de dois portais laterais (anterior e médio) no seio do tarso.

Métodos: Realizou-se um estudo retrospectivo de doze paciente (7 homens e 5 mulheres), com média de idade de 55,1(36-74) anos, submetidos à artrodese subtalar artroscópica através do seio do tarso, no período de maio de 2015 a dezembro de 2016, com seguimento pós-cirúrgico de doze meses. Foi avaliado o tempo de consolidação, complicações pós-operatórias e aplicado um questionário funcional validado da *American Orthopaedic Foot and Ankle Society* (AOFAS) e escala visual analógica de dor (EVA), pré e pós-tratamento cirúrgico.

Resultados: A média do tempo de fusão óssea foi de 11,5 semanas. A consolidação óssea ocorreu em todos os paciente analisados. Quatro pacientes evoluíram com complicações tardias, sendo três referentes ao posicionamento dos parafusos no calcâneo e um relacionado à deformidade

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residual em varo do retropé. As complicações relacionadas com os parafusos são comuns em todas as técnicas de artrodeses subtalares, sendo considerada uma intercorrência de menor relevância na avaliação da efetividade da técnica apresentada. A média da escala AOFAS pré-operatória foi de 42,3(27-66) pontos, enquanto que a média pós-operatória foi de 83(73-94) pontos. Em relação a escala visual analógica de dor (EVA), a média pré-operatória foi de 8,1(5-10) pontos e a média pós-operatória foi de 2,1(0-5) pontos. Os dados acima relacionados são semelhantes aos principais trabalhos publicados na literatura, evidenciando altas taxas de consolidação óssea.

Conclusão: A artrodese subtalar artroscópica, através de dois portais laterais no seio do tarso é uma técnica segura e efetiva no tratamento de patologias primárias e secundárias da articulação subtalar. Cuidados devem ser tomados para assegurar o correto posicionamento dos parafusos e do alinhamento do retropé, evitando-se que ocorram complicações relacionadas com o material de síntese e deformidade em varo do retropé.

Nível de evidência IV; Estudos Terapêuticos; Série de Casos.

Descritores: Articulação talocalcânea; Artrodese; Artroscopia; Calcanhar.

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INTRODUCTION

Subtalar joint arthrodesis is an accepted method for treating various disorders, including primary and post-traumatic osteoarthritis, symptomatic congenital deformities and inflammatory arthritis.

Arthroscopic subtalar arthrodesis, which was first described by Tasto[1,2] was developed to improve upon traditional fusion methods and minimize their invasiveness[3], thus reducing soft tissue injuries and preserving the blood supply to the talus[4].

Surgical descriptions of the procedure include performing the technique through posterior access in the subtalar joint by means of two posterior portals (posterolateral and posteromedial) with the patient in the ventral decubitus position and performing the technique through the sinus tarsi with the patient in the lateral decubitus position.

The objective of this study is to present the surgical outcomes of twelve cases of arthroscopic subtalar arthrodesis performed through two lateral portals (anterior and medial) within the sinus tarsi.

METHODS

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number: 80157617.7.0000.5128.

A retrospective study was performed with twelve patients undergoing arthroscopic subtalar arthrodesis through two lateral portals within the sinus tarsi between May 2015 and December 2016. All patients signed an informed consent form, and the research protocol met all requirements related to human rights.

Of the twelve patients studied, 7 were male, and 5 were female. The mean age was 55.1 (36-74) years.

The preoperative diagnoses included 5 cases of primary hindfoot osteoarthritis, 4 cases of post-traumatic osteoarthritis, 1 case of hindfoot inflammatory disease and 2 cases of congenital deformities.

The visual analog scale (VAS)[5] for pain and the modified American Orthopedic Foot and Ankle Society (AOFAS) scale were used preoperatively and at the final postoperative examination at twelve months. The AOFAS scale is used to evaluate pain, function and alignment and was modified for subtalar arthrodesis to eliminate inversion and eversion movements, with a maximum possible score of 94 points[6]. The VAS for pain is applied by asking a patient to rate her/his pain on a scale of 0 to 10, with 0 indicating no pain and 10 indicating severe pain.

Imaging studies using serial radiographs were performed in the postoperative period to evaluate bone consolidation. The radiographic criteria used to evaluate the success of bone fusion included the presence of bone trabeculation evenly distributed throughout the region of the posterior facet of the subtalar joint on hindfoot lateral radiographs with full weight-bearing. Cases in which complete obliteration of the posterior subtalar facet was not observed on the aforementioned radiographic planes, which was applied to a total of 4 patients, were subjected to an additional investigation by computed tomography after 12 weeks.

Surgical technique

All procedures were performed with the patient under regional (spinal) anesthesia and sedation. The patients

were positioned in dorsal decubitus with a cushion supporting the ipsilateral hip region. A tourniquet was used, and 1g of the antibiotic cefazolin was administered intravenously twenty minutes before the start of surgery.

Access was established through two lateral portals (anterior and medial), with the medial portal located 0.5cm above the top of the fibula and the anterior portal located 1cm away from the medial portal, both in the sinus tarsi (Figure 1). No traction or other portal was used. After introduction of 30º 4.5-millimeter optic and 4.0-millimeter shaver (Figure 2), debridement of the soft tissue was performed in the sinus tarsi and the interosseous and cervical ligaments were identified.

After identification of the posterior subtalar joint (Figure 3), cartilage decortication was performed to approximately 2 millimeters from the subchondral bone using a bone shaver, curettes and osteotomes, with identification of the flexor hallucis longus tendon medially (Figures 4). After decortication, the subtalar joint was attached with two 6.5-mm cannulated percutaneous screws to the calcaneus using fluoroscopy for correct positioning of the screws. The first screw was positioned with the thread in the talar body, and the second screw was inserted into the collar of this bone (Figure 5). Bone grafts were not required in any of the patients.

Figure 1. Lateral portals (anterior and medial) in the sinus tarsi - right foot.
Source: Authors' personal archive.

Figure 2. Positioning of the instruments for subtalar joint arthroscopy.
Source: Authors' personal archive.

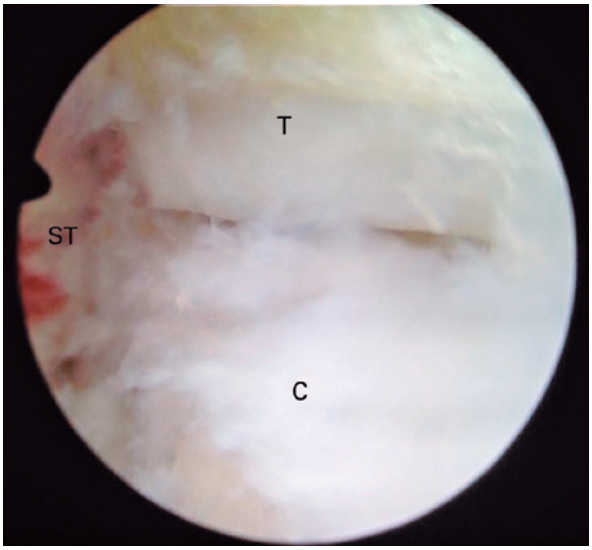

Figure 3. Arthroscopic view of the posterior subtalar joint through the lateral portals. T: Talus; C: Calcaneus; ST: Sinus tarsi.
Source: Authors' personal archive.

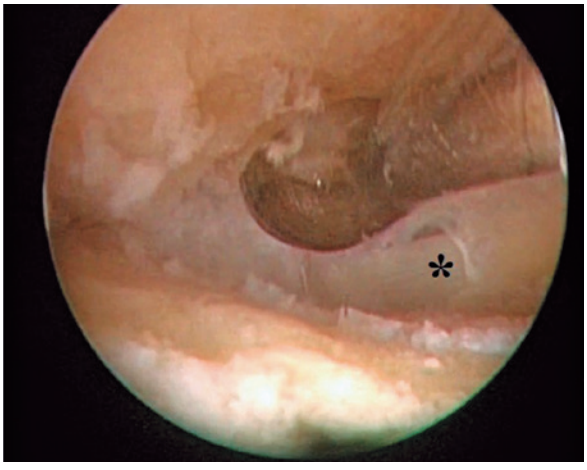

Figure 4. Curettage of the posterior subtalar joint and identification of the flexor hallucis longus tendon (asterisk).
Source: Authors' personal archive.

Figure 5. Intra-operative image of screw positioning.
Source: Authors' personal archive.

In one case, an external device (a *Hintermann* retractor) was used for joint distraction.

The skin incision was sutured with simple stitches and a plaster splint was used for joint immobilization.

Postoperatively, the patients were restricted from weight-bearing for five to six weeks. After this period, they began using an immobilizing boot support, which was removed after two weeks, and then walking was encouraged. Postoperative rehabilitation included physical therapy for muscle strengthening/proprioception.

RESULTS

The mean bone consolidation time was 11.5 weeks, including the patients in whom consolidation was confirmed by computed tomography. Bone consolidation was observed in all analyzed patients. Four patients developed late complications, including three patients with mechanical complications in the posterior-inferior region of the heel due to the screws and one patient with residual hindfoot varus deformity.

The mean preoperative AOFAS score was 42.3 (27-66) points, while the mean postoperative score was 83 (73-94) points. The mean preoperative VAS score was 8.1 (5-10) points, and the mean postoperative score was 2.1 (0-5) points.

DISCUSSION

Subtalar arthrodesis has traditionally been performed using the open technique, with union rates ranging from 65% to 100% depending on the surgical technique, patient selection and the need for bone grafting[7].

Easley et al.[8] reported a union rate of 84% in 148 patients after open subtalar arthrodesis, which is lower than the rates obtained using the arthroscopic technique in several studies, with a reported union rate of 97% in a mean period of 11.2 weeks[9-11].

Scranton[9] compared 17 cases of subtalar arthrodesis, including 12 open subtalar arthrodesis cases and 5 arthroscopic subtalar arthrodesis cases. Joint fusion was achieved in all arthroscopic arthrodesis patients and in 11 open arthrodesis patients.

Open and arthroscopic subtalar arthrodesis procedures are indicated for the treatment of subtalar joint disorders, which can be primary, such as idiopathic arthritis, or secondary, including post-traumatic, rheumatic or congenital arthritis or disorders due to neurological conditions. Open subtalar arthrodesis is also indicated for correction of severe subtalar joint deformities (congenital or acquired) or after failure of prior subtalar arthrodesis as these cases require extensive soft tissue and bone debridement. Arthroscopic techniques have the advantage of reducing the risk of surgical site infection and surgical dehiscence, reducing the time to bone fusion and enabling earlier patient rehabilitation.

Several previous arthroscopic subtalar arthrodesis studies have reported excellent results, with 90% - 95% fusion rates and postoperative AOFAS scale scores of 78 points or more[7]. Many descriptions of different techniques for the same indications are available in the literature, including posterior and lateral approaches, the former of which is used more often. However, access through two lateral portals in the sinus tarsi significantly decreases the risk of sural nerve injury associated with the use of a posterolateral portal[12-14].

Amendola et al.[4] described a series of eleven patients undergoing posterior arthroscopic subtalar arthrodesis using bone grafts and reported only one case of nonunion, a mean fusion time of 10 weeks and an AOFAS scale score increase from 36 to 86 points.

More recently, Lee et al.[10] described a series of sixteen patients and reported a 94% fusion rate after eleven weeks using posterior access for subtalar arthrodesis. Oliva et al.[11] conducted a study of nineteen patients and achieved a rate of 94.7% for bone consolidation and an average AOFAS score of 80.2 points using a posterior approach.

Frey et al.[12] demonstrated that using a lateral approach allows visualization of 90% of the subtalar joint. Likewise, in a cadaver study, Lui et al.[13] demonstrated that using two

lateral portals in the sinus tarsi can allow access to 97% of the articular surface.

In another study using cadavers, Lintz et al.[14] concluded that more than 90% of the posterior subtalar facet can be accessed through two lateral portals (anterior and medial) and that this strategy has the advantage of safety in relation to the risk of neurovascular injury.

Recently, Lopes et al.[15] published an updated article on arthroscopic subtalar arthrodesis techniques, describing the specific features of each technique (posterior and lateral approaches) and corresponding results. They concluded that with both approaches, the consolidation rates were higher than 90% and the fusion times were short (a mean of 8 weeks).

The present study yielded similar data to those in many published studies, showing high bone consolidation rates for arthroscopic subtalar arthrodesis using the lateral route. Three of the twelve analyzed patients developed late complications related to screw positioning in the calcaneus. These cases were resolved by removal of the material. Notably, this complication is common with all subtalar arthrodesis techniques and may be related to the point of entry of the screw in a more plantar position in the calcaneus. Only one patient later developed residual hindfoot varus deformity, which was considered a more relevant complication in this study than described previously. However, the deformity was resolved by performing calcaneal lateral closing wedge osteotomy (*Dwyer* osteotomy).

The advantages of the lateral technique are as follows: the absence of fine structures within the surgical field, the ease of conversion to an open technique if necessary and better patient positioning, especially for obese patients and those with low respiratory reserves for whom the ventral decubitus position is restrictive.

Notably, the lack of a control group and the small number of patients were limiting factors in this study. Therefore, additional studies should be conducted to compare the techniques described above.

CONCLUSIONS

Arthroscopic subtalar arthrodesis through two lateral portals in the sinus tarsi (anterior and medial) is a safe and effective technique for the treatment of subtalar joint disorders with low complication rates and high success rates. This procedure is indicated for the treatment of primary and secondary subtalar joint disorders. Correct positioning of screws and hindfoot alignment must be carefully ensured to avoid complications related to the synthesis material and hindfoot varus deformity.

Authors' contributions: Each author contributed individually and significantly to the development of this article: RFV *(https://orcid.org/0000-0002-7025-0457) conceived and planned the activities that led to the study, wrote the article, interpreted the results of the study, participated in the review process, approved the final version; JMBM *(https://orcid.org/0000-0002-4224-8149) conceived and planned the activities that led to the study, wrote the article, interpreted the results of the study, participated in the review process, approved the final version; RAG *(https://orcid.org/0000-0003-3056-9401) conceived and planned the activities that led to the study, wrote the article, performed the surgeries, interpreted the results of the study, participated in the review process, approved the final version; AHG *(https://orcid.org/0000-0002-3644-4928) conceived and planned the activities that led to the study, participated in the review process, approved the final version; BCPC *(https://orcid.org/0000-0002-7106-0639) participated in the review process, approved the final version; WVF *(https://orcid.org/0000-0001-8087-8435) conceived and planned the activities that led to the study, participated in the review process, approved the final version. *ORCID (Open Researcher and Contributor ID).

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