

Clinical and functional outcomes of Lambrinudi arthrodesis for correcting fixed equinus deformity

Resultados clínicos e funcionais da artrodese de Lambrinudi no tratamento do pé equino rígido

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ABSTRACT

Objective: To evaluate the clinical and functional outcomes of correction of fixed equinus deformity by Lambrinudi arthrodesis.

Methods: Eight patients with fixed equinus deformity were retrospectively assessed. Of these patients, three cases developed secondary to Charcot-Marie-Tooth disease, and five cases developed secondary to fibular nerve injury following trauma. All patients underwent Lambrinudi arthrodesis using the open technique, and functional improvement was analysed postoperatively. The mean age of the patients was 27 years and six months, and six patients were men.

Results: The results were evaluated using the ankle and hindfoot score of the American Orthopedic Foot and Ankle Society (AOFAS) scale. The mean score in the postoperative period was 61.71 points, ranging from 41 to 74 points. The difference in the tibia-ground angle in the pre- and postoperative period was measured, and there was a significant correction of this angle.

Conclusion: The outcomes of Lambrinudi arthrodesis in patients with fixed equinus deformity were satisfactory concerning the improvement of pain, gait, a high degree of correction of the deformity according to the difference in the tibia-ground angle between the pre- and postoperative period, and preservation of the ankle joint.

Level of Evidence IV; Therapeutic Studies; Case Series.

Keywords: Arthrodesis; Equinus deformity; Pes cavus; Clubfoot; Treatment outcome.

RESUMO

Objetivo: Avaliar os resultados clínicos e funcionais do tratamento do pé equino rígido, por meio da artrodese de Lambrinudi.

Métodos: Foram avaliados retrospectivamente oito pés com a deformidade em equino rígido. Destes, três pacientes foram diagnosticados com doença de Charcot-Marie-Tooth e outros cinco com seqüela de trauma com conseqüente lesão do nervo fibular. Todos foram submetidos à artrodese de Lambrinudi por via aberta e a melhora funcional foi analisada no pós-operatório. A média de idade dos pacientes foi de 27 anos e seis meses e seis pacientes eram do sexo masculino.

Resultados: Os resultados foram avaliados por meio do questionário da escala do tornozelo e retopé da *American Orthopedic Foot and Ankle Society Score* (AOFAS). O valor em média no pós-operatório foi de 61,71 pontos, variando de 41 a 74 pontos. Foi realizada também a mensuração da diferença do ângulo tibiosolo no pré e pós-operatório, com correção importante desse ângulo.

Conclusão: A artrodese de Lambrinudi em pacientes com pé equino rígido apresentou resultados satisfatórios com melhora da dor, marcha e capacidade de grande correção do equino através da análise da diferença do ângulo tibiosolo no pré e pós-operatório, preservando a articulação do tornozelo.

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

Descritores: Artrodese; Pé equino; Pé cavo; Pé torto; Resultado do tratamento.

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INTRODUCTION

Equinus deformity refers to a condition characterised by limited dorsiflexion of the ankle joint and restricted passive movement, with subsequent shortening of the Achilles tendon that can be associated with arthrosis of the ankle and hindfoot joints⁽¹⁾ (Figure 1).



Figure 1. Radiograph of fixed equinus deformity.
Source: Author's personal archive.

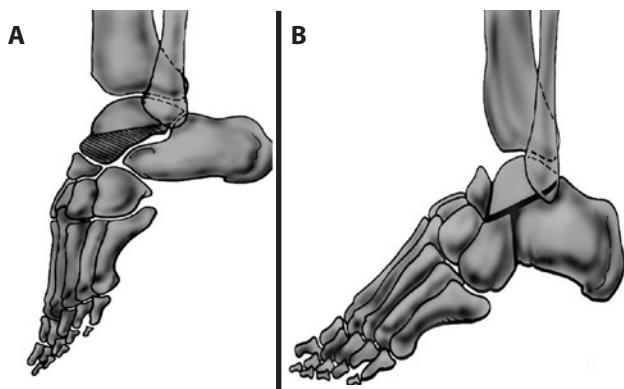


Figure 2. (A) Illustration of the preoperative condition and (B) postoperative outcome after Lambrinudi triple arthrodesis.
Source: Drawing by Lucas Esteves/MILU.

This deformity may have several causes, including neurological diseases and fibular nerve injury due to trauma. The prevalence of this condition has increased in recent years, largely because of an increase in the number of motorcycle accidents^(2,3).

This study evaluated the outcomes of equinus deformity correction using the Lambrinudi triple arthrodesis technique (Figure 2).

This procedure was first described in 1927 and became famous worldwide as a favourable and efficient technique for treating patients with equinus deformities, especially for cases secondary to poliomyelitis^(4,5). This procedure restores the plantigrade position of the foot via arthrodesis of the hindfoot and locks the talus in the equinus position⁽⁶⁾.

The objective of this study was to evaluate the clinical and functional outcomes of patients with equinus deformity who underwent Lambrinudi triple arthrodesis.

METHODS

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number 53934216.8.0000.5152.

The inclusion criteria were patients with equinus foot deformity who underwent the Lambrinudi technique from 2011 to 2014 in our service. Thirteen cases were initially identified. The exclusion criteria were patients with equinus deformity secondary to poliomyelitis who underwent the Lambrinudi technique, which included a total of five cases. One case was excluded because of the poor quality of pre- and postoperative radiographs. Cases of cerebral palsy and paediatric cases were also not included in the study.

Therefore, eight patients with equinus deformity were ultimately retrospectively assessed, including three cases that developed secondary to Charcot-Marie-Tooth disease and five cases that developed secondary to fibular nerve injury after trauma.

All patients were operated on by the same surgical team following the arthrodesis technique described by Lambrinudi.

The clinical and functional outcomes were reviewed after surgery. The shortest and longest postoperative periods were one and five years, respectively.

Data analysis

The clinical and functional outcomes were evaluated using a version of the American Orthopaedic Foot and Ankle Society (AOFAS) scale translated, adapted and validated for Brazil. This score is composed of nine items divided into

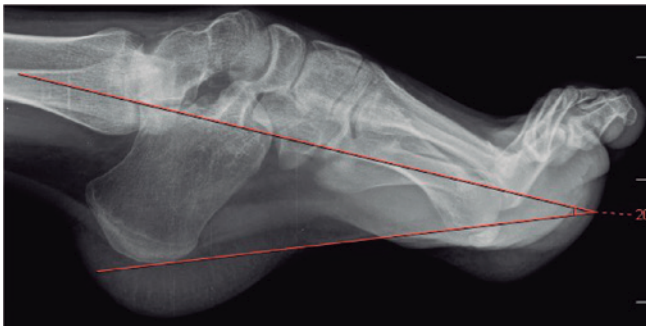


Figure 3. Tibia-ground angle in the preoperative period; the complementary angle should be considered.

Source: Author's personal archive.



Figure 4. Tibia-ground angle in the postoperative period.

Source: Author's personal archive.

three categories: pain (40 points), function (50 points) and alignment (10 points)⁽⁷⁾.

Because the analysis was retrospective, as all patients had undergone surgery before the study, the scale was scored postoperatively to preclude an analysis based on patients' memory of the preoperative period and because our main objective was to determine the postoperative functional satisfaction of the patient.

The degree of correction of the equinus deformity was analysed by measuring the angle between the axis of the tibia and the axis of the foot sole (i.e., the tibia-ground angle) in the pre- and postoperative period on X-rays of the foot in the orthostatic position (Figures 3 and 4).

RESULTS

The mean age of all patients was 27 years and six months, and six patients were men.

The variation between the tibia-ground angles in the pre- and postoperative period and the satisfaction scores based on the AOFAS scale are shown in Table 1.

In the preoperative period, the angles were obtuse, demonstrating equinus deformities. In the postoperative period, the angle approached a right angle, and the foot sole presented an almost plantigrade position (Figure 5).

DISCUSSION

Equinus deformity strongly affects patients' quality of life, causing gait difficulty and pain⁽⁶⁾. The surgical options for deformity correction include arthrodesis and the use of an external fixator.

Arthrodesis has a lower risk of infection and a high degree of correction of varus and valgus deformities, providing realignment and gait improvement⁽⁸⁾.

Our results demonstrated that hindfoot arthrodesis preserved the tibiotarsal joint (Lambrinudi technique) and

Table 1. Variations in the tibia-ground angle in the pre- and postoperative period and postoperative scores based on the AOFAS scale.

	Tibia-ground angle: preoperative	Tibia-ground angle: postoperative	AOFAS score
Patient 1 – foot 1	160°	110°	62
Patient 1 – foot 2	155°	100°	72
Patient 2	150°	92°	74
Patient 3	147°	100°	68
Patient 4	140°	100°	67
Patient 5	126°	98°	61
Patient 6	125°	103°	63
Patient 7	153°	95°	73

Source: Prepared by the author based on the results of the study.



Figure 5. Postoperative clinical aspect.

Source: Author's personal archive.

may therefore be used to correct severe hindfoot deformities other than deformities developing secondary to poliomyelitis. Patient satisfaction was high, with high mean scores (61.71 points) on the AOFAS scale in the postoperative period; thus, there was improvement in pain and gait scores and consequent improvement in overall quality of life.

These improvements are even more impressive considering that the overall score for mobility was generally low because the surgical procedure utilized was arthrodesis; the gait was necessarily compromised in some patients via the shortening of the limb, even in cases in which the foot was restored to an almost plantigrade position.

One of the limitations of the study is that a preoperative analysis using the AOFAS scale was not conducted. However, the mean postoperative score indicated good function of the operated limb and a high level of patient satisfaction with the procedure. This limitation is present because the analyses were performed retrospectively, and thus, any preoperative scores would be based on the potentially unreliable memories of patients, some of whom underwent surgery many years before the study.

Our results convincingly demonstrate improvement in function, and we are therefore encouraged to continue using the technique and to perform a prospective study involving a larger number of patients and thorough pre- and postoperative evaluation.

Our results indicated significant improvement in the tibia-ground angles, restoring the foot to an almost plantigrade position and preserving the tibiotarsal joint. Although the foot was not in a completely plantigrade position following the procedure, the slight remaining equinus deformity may be compensated by the mobility, albeit small, of the tibiotarsal joint, which was not corrected by arthrodesis-as is done in other surgical techniques for fixed equinus correction.

CONCLUSION

Lambrinudi arthrodesis has considerable advantages for the correction of fixed equinus deformities secondary not only to poliomyelitis but also to trauma and Charcot-Marie-Tooth disease.

The correction based on the proposed technique improved patient quality of life, improved gait by restoring the foot to an almost plantigrade position, decreased pain, and resulted in good deformity correction.

Author contributions: Each author contributed individually and significantly to the development of this study: JARMJ *(<https://orcid.org/0000-0002-0831-1861>) conceived and planned the activities that led to the study, wrote the article and participated in the review process; CJP *(<https://orcid.org/0000-0002-2156-5380>) conceived and planned the activities that led to the study, wrote the article and participated in the review process and approved the final version; EGE *(<https://orcid.org/0000-0002-0446-8810>) participated in the review process and approved the final version; FMB *(<https://orcid.org/0000-0001-7856-4517>) interpreted the results of the study and participated in the review process; RTF *(<https://orcid.org/0000-0002-6755-2155>) interpreted the results of the study and wrote the manuscript; DVPC *(<https://orcid.org/0000-0002-2606-6388>) interpreted the results of the study and wrote the manuscript. *ORCID (Open Researcher and Contributor ID).

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