

CORRELATION BETWEEN QUALITY OF LIFE AND THE CLINICAL RESULTS OF PATIENTS WITH LEPROSY WITH DROP FOOT AFTER TENDON TRANSFER

AVALIAÇÃO DE PACIENTES COM HANSENÍASE PÓS TRANSPOSIÇÃO TENDÍNEA PARA PÉ CAÍDO E SUA CORRELAÇÃO COM A QUALIDADE DE VIDA

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ABSTRACT

Objective: To evaluate the functional results of surgically correcting drop foot in patients with leprosy and compare their SALSA, Social Participation, and AOFAS score. **Methods:** Overall, 22 patients were subjected to posterior tibial tendon transfer via the subcutaneous route to the foot dorsum with an average follow-up of 56 months (min 12, max 70). In our sample, 15 of the enrolled patients were men and seven, women, aged between 20 and 73 years old who were operated on from January 2014 to December 2017. The Pearson's correlation test (r) was used to measure the correlation among those scales. A $p < 0.05$ was considered significant between the pre- and post-operative AOFAS scale scores. **Results:** Pre-operative average AOFAS score was 59.6 (min 35, max 74) and 77.2 postoperative (min 36, max 97) ($p < 0.0001$), postoperative Salsa and Social Participation scale, 30.6 and 22.5, respectively. Statistical analysis suggests a strong positive correlation between AOFAS and Salsa scales ($r = -0.83$) and AOFAS and social participation ($r = -0.78$). Average dorsiflexion was 5.4 degrees. **Conclusion:** The surgical correction of drop foot positively affects the quality of life and social participation of patients with leprosy. **Level of Evidence III, Retrospective Study.**

Keywords: Peroneal Neuropathies. Leprosy. Tendon Transfer. Drop foot.

RESUMO

Objetivo: Avaliar o resultado funcional da cirurgia de correção de pé caído em pacientes hansênicos e comparar as escalas Screening of Activity Limitation and Safety Awareness (SALSA) e de Participação social pós-operatórias com o escore da American Orthopaedic Foot and Ankle Society (AOFAS). **Métodos:** Avaliamos 22 pacientes submetidos à transposição do tibial posterior para o dorso do pé com mínimo de seguimento de 12 e máximo de 131 meses operados entre janeiro de 2013 e dezembro de 2017. Utilizamos o coeficiente de Pearson (r) para medir o grau de correlação entre as escalas funcionais e consideramos o valor de $p < 0,05$ na análise dos valores pré e pós-operatórios da AOFAS. **Resultados:** A média da AOFAS foi de 59,6 no pré-op (mín 35, máx 74) e 77,2 no pós-op (mín 36, máx 97) ($p < 0,0001$) e das escalas SALSA e participação social de 30,6 e 22,5 no pós-operatório. A análise estatística demonstrou correlação positiva forte ($r = -0,83$) com as escalas SALSA e de participação social ($r = -0,78$) quando comparadas ao AOFAS. O grau de dorsiflexão atingido foi de 5,4 graus em média. **Linha de pesquisa:** Evidência clínica e organizacional, modelos assistenciais, educacionais e avaliação de qualidade em APS – Pós-graduação em Clínica Médica da Faculdade de Medicina da UFRJ. **Conclusão:** A melhora da função através da correção cirúrgica do pé caído possui correlação direta na melhora da qualidade de vida dos pacientes portadores de hanseníase. **Nível de Evidência III, Estudo Retrospectivo.**

Descritores: Neuropatias Fibulares. Hanseníase. Transferência Tendinosa. Pé caído.

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INTRODUCTION

Leprosy remains an important public health problem in many countries in the world. Currently, Brazil continues to show a high

incidence rate of the disease, behind only India in number of new cases. According to a WHO annual report, in 2018, 208,641 new cases were diagnosed in the world, of which 30,957 were in the

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The study was conducted at Hospital Universitário Clementino Fraga Filho, Universidade Federal do Rio de Janeiro.

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Americas.¹ Also according to the report, the overall prevalence of the disease was 184,238 cases at the end of 2018, a reduction of 8,474 cases in relation to 2017. Brazil had 28,660 new cases, an increase over the previous year, which had 26,875 cases, totaling 13.7% of cases worldwide. Of these new cases in Brazil, 2,109 already showed a disability grade 2 at the time of diagnosis, showing the great importance of reconstructive procedures to improve these patients' quality of life and function.²

The Brazilian Ministry of Health uses tests based on physical examinations and questionnaire responses, including the SALSA/risk awareness and social participation scale — a functional evaluation protocol aiming to know how individuals perform daily activities and interact/participate in their daily lives with their family members and community³ before, during, and after clinical/surgical treatment. The results of these patterns have been questioned, since such questionnaires fail to include specific tests to assess the function of affected limbs after surgical intervention since some cases may show a lack of correlation between the actual functional result observed with the SALSA and social participation scale scores. To better understand function after the surgical treatment of foot drop in patients with leprosy, and aiming to recognize social and labor market reintegration, we used the American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale,⁴ which specifically evaluates lower limb function and symptoms, comparing it with the already established Salsa and Social Participation scales.

MATERIALS AND METHODS

Ethical aspects

This study complied with the ethical recommendations of the Research Ethics Committee of HUCFF/FM-UFRJ and CNS/MS 196/96. Research was initiated after its approval and registration under no. 96/13. All patients included in this study were duly informed of it and those who agreed to participate gave us their consent by signing informed consent forms, a copy of which was given to them.

Study design

This is a retrospective and cross-sectional study with functional evaluation, as well as measurement of activity levels and social participation of patients with leprosy subjected to the surgical correction of foot drop via transfer of the posterior tibial tendon to the foot dorsum. The following questionnaires were used and validated in Brazil: SALSA, social participation, and the AOFAS ankle-hindfoot scales.

Study population

Between January 2014 and December 2017, 29 patients with leprosy underwent surgery to correct foot drop. Of these, one died, another suffered amputation below the knee due to complications unrelated to tendon transfer or leprosy, three were lost in follow-up, and two refused to participate in this study. Thus, our sample totaled 22 patients. Among these, 15 individuals were men and seven, women aged from 20 to 83 years old with a minimum of one-year follow-up (mean of 39.1 months, minimum of 12 and maximum of 70 months). Inclusion criteria were patients aged 18 years or older with foot drop caused by leprosy who were submitted to surgical correction via subcutaneous posterior tibial tendon transfer (Table 1). Exclusion criteria were the presence of ulcers or other deformities in the lower limbs in addition to concomitant surgeries on the affected foot and ankle.

Data collection

Functional evaluation was based on 1) measurement of the active range of motion of the tibiotarsal joint via a goniometer parallel to the sole of the foot and the longitudinal axis of the leg, in which positive values correspond to dorsiflexion and negative values to plantar

Table 1. Patients with leprosy subjected to posterior tibial tendon transfer to treat foot drop. Clinical form of the disease, postoperative time, gender, operated side, and age at the time of surgery.

| Patient | Gender | Side | Age | Postoperative time (months) | Clinical manifestation |
|---------|--------|------|-----|-----------------------------|------------------------|
| 1 | F | L | 73 | 52 | PN, PB |
| 2 | M | R | 61 | 17 | RT, MB |
| 3 | M | R | 64 | 14 | PN, MB |
| 4 | M | L | 35 | 46 | RT, MB |
| 5 | M | R | 58 | 28 | RV, MB |
| 6 | M | R | 65 | 28 | RT, MB |
| 7 | M | R | 50 | 17 | RV, MB |
| 8 | M | R | 34 | 51 | RV, MB |
| 9 | F | L | 53 | 66 | RT, MB |
| 10 | F | R | 59 | 64 | PN, PB |
| 11 | F | R | 65 | 38 | RV, MB |
| 12 | M | R | 20 | 29 | PN, MB |
| 13 | M | R | 57 | 60 | RT, MB |
| 14 | M | L | 68 | 37 | RT, MB |
| 15 | M | R | 40 | 59 | RT, PB |
| 16 | F | R | 50 | 28 | RV, MB |
| 17 | M | L | 39 | 69 | RV, MB |
| 18 | M | R | 54 | 28 | RV, MB |
| 19 | F | L | 46 | 70 | RV, MB |
| 20 | M | R | 71 | 12 | RV, MB |
| 21 | F | R | 68 | 35 | RV, MB |
| 22 | M | L | 62 | 13 | RV, MB |

M: male; F: female; R: right; L: left; PN: pure neural; DT: dimorphic tuberculoid; DV: dimorphic virchowian; PB: paucibacillary; MB: Multibacillary.

flexion and 2) muscle strength graduation, according to the criteria established by the modified Medical Research Council (MRC), on a scale ranging from 0 (muscle paralysis) to 5 (normal muscle strength). Patients were asked to answer social participation questionnaires before and after surgical intervention, as well as the SALSA scale, already validated for Brazilian Portuguese, which assesses how individuals perform daily activities and self-care, with their respective scores. The AOFAS scale, which Rodrigues et al.⁵ also validated for Brazilian Portuguese, was used on a point scale which considered pain, function, ability to walk, and alignment as parameters. Data were collected by physical examinations and interviews in which the selected questionnaires were applied. After data collection, the information was quantified, digitized, and stored in a spreadsheet on the responsible researcher' computer via the EPI INFO application version 3.4.3. SPSS V.13 for WINDOWS and EPI INFO VERSION 3.4.3 were used for data analysis. Descriptive analysis was shown in illustrative tables, graphs, and observed data.

The AOFAS scores are: 0-20, very severe limitation; 21-40, severe limitation; 41-60, moderate limitation; 61-80, mild limitation; and 81-100, no limitation.

The SALSA scale scores are: 10-24, without limitation; 25-39, mild limitation; 40-49, moderate limitation; 50-59, severe limitation; and 60-80, very severe restriction.

Social Participation Scale scores are: 0-12, no significant restriction; 13-22, slight restriction; 23-32, moderate restriction; 33-52, severe restriction; and 53-90, extreme restriction.

Statistical analysis

AOFAS scores were separately compared with SALSA and SOCIAL PARTICIPATION scores by the Pearson's statistical correlation test. A $p < 0.05$ was considered statistically significant when comparing pre- and postoperative AOFAS.

Surgical technique

Transfer of the posterior tibial tendon (TTP) to the foot dorsum was performed as described by Srinivasan, Mukherjee, and Subramaniam.⁶ The TTP is sectioned next to its insertion in the navicular bone and a second posteromedial incision is performed eight to 12 cm above the medial malleolus to identify the tibialis posterior muscle belly. Next, the TTP is proximally stretched and longitudinally divided (Figure 1). An incision is made in the dorsal region of the foot to individualize the hallucis longus and extensor digitorum longus tendons. Then, two tunnels are constructed in the subcutaneous tissue, superficial to the retinaculum of the extensors and the TTP is then transferred to the foot dorsum (Figure 2). The medial tape is sutured to the extensor hallucis longus (Figure 3) and the lateral tape to the extensor digitorum longus tendon with the foot in dorsiflexion between 20 and 30 degrees (Achilles lengthening is performed if necessary) (Figure 4), maintaining traction in the distal direction of the TTP tapes and in the proximal direction of the extensor hallucis longus and extensor digitorum longus tendons for good transfer tension (Figures 5 and 6). Postoperative treatment is performed via a cast immobilization boot set in a 20-degree dorsiflexion during the first two weeks, followed by another four weeks with an unsupported cast boot in a neutral position. After this period, rehabilitation begins with a removable boot used for an additional six weeks for protection.



Figure 1. Division of the posterior tibial tendon into medial and lateral tapes.



Figure 2. Use of tunneling clamps to subcutaneously transfer the posterior tibial tendon.



Figure 3. Suture of the medial tape to the extensor hallucis longus tendon.



Figure 4. Suture of the lateral tape to the extensor digitorum longus.



Figure 5. Final aspect.



Figure 6. Foot position at the end of the surgery.

RESULTS

Table 2 shows the respective pre- and postoperative AOFAS, SALSA, and postoperative social participation scale scores. According to the SALSA scale results, 14 patients showed no limitations, three, mild ones, one, moderate ones, two, severe ones, and two, very severe ones. Social participation was very active, considering that patients' average score was only 22.5 points, with the lowest value of 0 and a maximum of 80 (higher scores indicate greater difficulty in daily activities, working, and social isolation). We found 12 patients with no restrictions, four, with mild ones, no patients with moderate ones, one, with severe ones, and five, with extreme ones.

Average active dorsiflexion was 5.4 degrees (maximum of 20, minimum of -10 degrees) and plantar flexion, -27.9 degrees (maximum of -35, minimum of -12 degrees), with a mean ROM of 28.3 degrees (dorsiflexion + plantar flexion) (Figures 7 and 8). Only two patients failed to reach a neutral dorsiflexion position (0 degree), reflecting a low AOFAS scale score (36 and 52). Mean AOFAS scores were 59.6 in the pre- and 77.2 in the postoperative period with a $p < 0.0001$. In total, two patients showed inversion deformities due to loss of lateral tape tension, one evolving hindfoot stiffness with varus and forefoot adduction, whereas the other showed a mild deformity which failed to affect the final transfer result, with an 83 AOFAS score. Muscle strength after the minimum six-month follow-up was at least grade three in all patients, and 15 patients reached grade four. Clinically, no patient showed plantar arch fall.

Figures 9 and 10 show the relation between AOFAS and the SALSA and Social Participation scale scores, respectively. We observed an inversely linear relation between AOFAS and other scale scores. The higher the AOFAS, the lower the other scores. The Pearson's correlation coefficient showed a strong correlation for AOFAS with SALSA ($r = -0.83447$) and for AOFAS with the social participation scale ($r = -0.78638$), showing that foot drop correction positively affects the daily lives and social reintegration of patients with leprosy.

Table 2. Sample patients' Activity Limitation and Safety Awareness, social participation, and the American Orthopaedic Foot and Ankle Society ankle-hindfoot scale scores.

| Patient | SALSA score | Social Participation Scale | AOFAS | Pre-op AOFAS |
|---------|-------------|----------------------------|----------|--------------|
| 1 | 24 | 5 | 88 | 64 |
| 2 | 60 | 72 | 52 | 42 |
| 3 | 31 | 9 | 86 | 74 |
| 4 | 23 | 5 | 90 | 62 |
| 5 | 27 | 20 | 83 | 54 |
| 6 | 21 | 8 | 85 | 68 |
| 7 | 17 | 22 | 87 | 70 |
| 8 | 22 | 0 | 72 | 55 |
| 9 | 76 | 69 | 36 | 35 |
| 10 | 22 | 5 | 75 | 53 |
| 11 | 39 | 60 | 66 | 47 |
| 12 | 19 | 4 | 90 | 72 |
| 13 | 45 | 80 | 60 | 58 |
| 14 | 21 | 0 | 78 | 52 |
| 15 | 12 | 9 | 97 | 67 |
| 16 | 22 | 1 | 85 | 65 |
| 17 | 23 | 21 | 66 | 44 |
| 18 | 24 | 1 | 78 | 62 |
| 19 | 15 | 13 | 90 | 74 |
| 20 | 59 | 55 | 67 | 58 |
| 21 | 23 | 2 | 88 | 64 |
| 22 | 50 | 36 | 80 | 72 |
| | 30.68181818 | 22.59090909 | 77.22727 | 59.63636364 |



Figure 7. Case 15 performing active plantar flexion.



Figure 8. Case 15 performing active dorsiflexion.

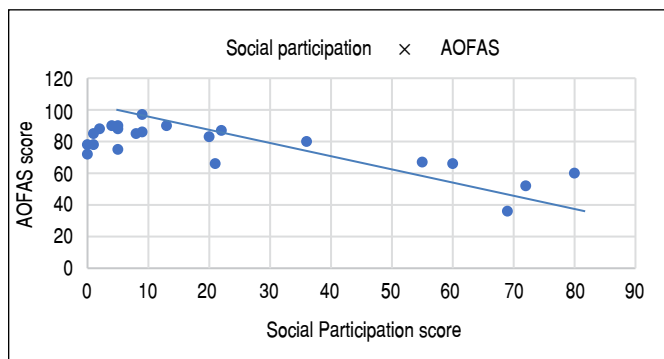


Figure 9. American Orthopaedic Foot and Ankle Society scores by social participation scores.

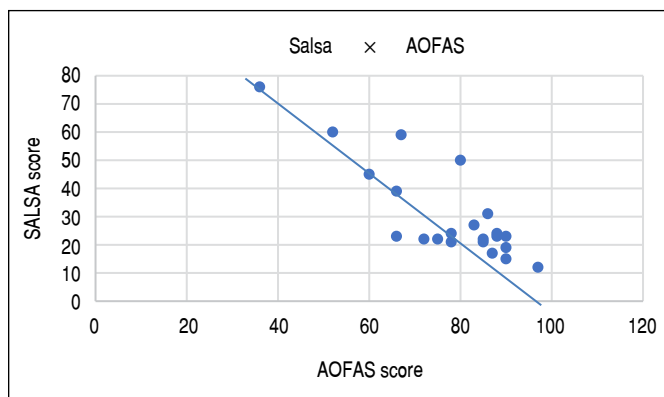


Figure 10. American Orthopaedic Foot and Ankle Society scores by the Screening of Activity Limitation and Safety Awareness scores.

DISCUSSION

The stigma caused by the disease still represents an important factor of social isolation, negatively affecting the relationship of leprosy patients with their families and peers in their community. Most patients show self-stigmatization and self-deprecation, evidenced from three most common aspects: those linked to individuals' representations about leprosy, those related to impairments in physical appearance, and those resulting from disabling and deforming injuries whose effects go beyond aesthetic issues. In this context, the reparative surgery of lower limbs to correct foot drop in patients with leprosy is of fundamental importance to improve foot function and quality of life and promote their subsequent social reintegration.

Correcting foot drop due to leprosy by transferring TTP is well established in the literature,^{7,8} but there is controversy between the interosseous or subcutaneous routes. Some authors⁹⁻¹¹ recommend the subcutaneous pathway since it is easier to perform, shows no risk of neurovascular injury, provides a larger lever arm, and allows the tendon to slide smoothly, decreasing the possibility of adhesions or invagination of the muscle in the interosseous membrane. Other authors defend the interosseous¹²⁻¹⁵ pathway since, in it, the tensile force is more direct, thus producing less inversion and longer insertion and avoiding the effects of tenodesis related to excessive tension at the suture site. In our sample, we observed two cases which showed inversion deformities after subcutaneous TTP transfer. Ishida, Lwin, and Myint¹⁶ reported similar results in 33 patients subjected to TTP transfer. They found four poor results due to loss of lateral tape tension causing inversion deformity. It is interesting to note that of these four cases, three were subjected to interosseous transfer and only one to the subcutaneous one, showing that the interosseous pathway is also liable to this complication.

Soares¹⁷ compared subcutaneous and interosseous pathways in TTP transfers to treat foot drop in patients with leprosy, reporting a high rate of inversion in the group subjected to the subcutaneous pathway, which led to ulceration of the lateral edge of the foot. This author recommends that the subcutaneous pathway should be reserved for patients with calcified and inflexible interosseous membranes. Aiming to standardize the choice of the best route for each patient, Das et al.¹⁸ recommend subcutaneous posterior tibial tendon transfers for patients with leprosy who show selective deep fibular nerve paralysis with fibular strength of grade 4 or higher, reserving the interosseous pathway for patients with a lower degree of fibular strength (3 or less).

We used insertion in the extensor hallucis longus (medial tape) and extensor digitorum longus/third fibular (lateral tape) as recommended by Srinivasian.⁶ The advantage of this technique is that, since they are more distal, their insertion sites allow a better lever arm, reactivating the extension of the paralyzed hallux and toes, even if only partially. Moreover, the TTP is sutured to the receptor site with the maximum degree of tension, allowing it to naturally stretch by finding its equilibrium point, thus maximizing its functional response. Other authors recommend insertion in more proximal sites,¹⁹ with the medial tape inserted in the anterior tibial tendon and the lateral tape in the short or long fibular tendon. The advantage of this method is a greater tendon excursion, though with a smaller lever arm, reducing dorsiflexion force.

Our statistical analysis showed a strong positive correlation (via Pearson's test) between AOFAS and SALSA and social participation scales ($r = -0.83447$, and $r = -0.78638$, respectively). We observed that each analyzed patient obtained compatible scores in the Salsa, social participation, and AOFAS scales since they follow the same linear regression curve, i.e., they are numerically proportional since the higher the score, the better the function.

Much is known about the disabilities related to leprosy, but very little about how they affect the daily lives of affected people.²⁰ The SALSA and social participation scales aim to evaluate the extent of the limitation to patients' activities, considering several social, psychological, and physical aspects, and their disability. We observed four patients with severe or very severe limitations on the SALSA scale and five, with extreme restrictions in the social participation scale. We believe that these patients show these limitations due to their relation to other psychosocial aspects of living with leprosy rather than disabilities caused by the condition of their feet, evidenced by the significant improvement to AOFAS scores ($p < 0.0001$). The limitations of our study are its retrospective nature, the absence of a more objective method to evaluate muscle strength after tendon transfer, and the lack of pre-operative data on the social participation and SALSA scales.

CONCLUSION

Improving function via the surgical correction of foot drop has a direct correlation to improving the quality of life of patients with leprosy, as shown by the strong correlation between both SALSA and social participation scales with the AOFAS scale after the subcutaneous transfer of the posterior tibial tendon to the foot dorsum.

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