BrJP. 2025, v.8:e20250024 • https://doi.org/10.63231/2595-0118.20250024-en SBED

BrJP
Brazilian Journal of Pain

ORIGINAL ARTICLE

Neurolysis surgery for pain in Hansen's disease patients in the western Amazon region: retrospective study

Cirurgia de neurólise na dor em pacientes com hanseníase no território da Amazônia ocidental: estudo retrospectivo

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Submitted on:
December 9, 2024.
Accepted for publication on:
March 18, 2025.
Conflict of interests:
none.
Sponsoring sources:
none.

Associate editor in charge:
Oscar Cesar Pires

ABSTRACT

BACKGROUND AND OBJECTIVES: Hansen's disease is a multifactorial, secular and endemic disease in Brazil. The public health system has been organized to offer comprehensive care support to patients. In Rondônia and the Amazon region, it is no different. Among the complications, peripheral nerve damage generates a great deal of morbidity, but for some patients, the surgical intervention of neurolysis is possible to relieve pain, improve functionality and consequently positively impact the lives of those involved. The objective of this study was developed by a team of health professionals working to combat Hansen's disease in the Amazon context who decided to study how this surgical technique interferes with patients' pain.

METHODS: Seventy medical records of patients were selected, and the patients were questioned about their pain level on a scale of zero to 10 before and after surgery, and up to 150 days later.

RESULTS: The initial results suggest that surgery provides significant pain relief, improving aspects of patients' daily lives. The analysis revealed a statistically significant reduction in postoperative pain levels, indicating that it is a beneficial intervention for patients with neuropathy related to Hansen's disease.

CONCLUSION: This study suggests an improvement in quality of life through pain relief for patients undergoing neurolysis, showing that neurolysis not only reduces pain, but represents a significant step in restoring dignity and improving the living conditions of these patients.

KEYWORDS: Hansen's disease, Neurolysis, Pain.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A hanseníase é uma doença multifatorial, secular e endêmica no Brasil, o sistema público de saúde tem se organizado para oferecer um suporte de atendimento integral aos pacientes. Em Rondônia e na região amazônica, não é diferente. Dentre os acometimentos, a afecção dos nervos periféricos gera muita morbidade, porém para parte dos pacientes é possível a intervenção cirúrgica da neurólise, visando alívio da dor, melhora da funcionalidade e impactando positivamente na vida dos pacientes. O objetivo deste estudo foi desenvolvido por uma equipe de profissionais da saúde atuantes no combate à hanseníase no contexto amazônico que se dispôs a estudar a forma como esta técnica cirúrgica interfere na dor dos pacientes.

MÉTODOS: Foram selecionados 70 prontuários de pacientes que foram questionados acerca do seu nível de dor em escala de zero a 10 em momento de pré e pós-operatório e de até 150 dias depois.

RESULTADOS: Dessa forma, os resultados iniciais sugerem que a cirurgia proporciona alívio relevante da dor, melhorando aspectos da vida diária dos pacientes. A análise revelou uma redução estatisticamente significativa dos níveis de dor pós-operatória, indicando ser uma intervenção benéfica para pacientes com neuropatia hansênica.

CONCLUSÃO: Este estudo sugere melhora na qualidade de vida através do alívio da dor ao paciente submetido a neurólise, mostrando que a neurólise não apenas reduz a dor, mas representa um passo significativo ao restaurar a dignidade e melhorar as condições de vida desses pacientes.

DESCRITORES: Dor, Hanseníase, Neurólise.

HIGHLIGHTS

- Neurolysis proved to be highly effective in reducing neuropathic pain in Hansen's disease patients, reducing the average pain from 8.71 to 0.81 ($p<0.001$)
- The upper limbs showed the best response to treatment, with the right upper limb achieving a 93.9% reduction in pain
- Relief of pain remained consistent over time, with no significant reduction in the periods evaluated after surgery. This result was reinforced by 57.9% of patients with right upper limb disorders, who reported no pain in the first 30 days after the procedure

INTRODUCTION

Hansen's disease is a chronic infectious condition caused by *Mycobacterium leprae (ML)*, a bacillus that mainly affects the skin, peripheral nerves, upper respiratory tract and eyes. The main means of transmission is direct contact with secretions of infected individuals, and its progression can cause permanent physical disabilities, especially if diagnosis and treatment are not early carried out. Despite being one of humanity's oldest reported diseases, its impact on public health is still significant, especially in developing countries like Brazil, where the incidence rate remains high[1].

Pripheral neuropathy is one of the most prominent and debilitating hallmarks of Hansen's disease. This characteristic occurs due to the invasion of *ML* into the nervous system, leading to inflammation, compression and damage to nerve fibers. This variant of neuropathy is clinically manifested by loss of sensation, muscle weakness and chronic pain, severely impacting patients' quality of life (QoL)[2]. Neuropathic pain is, above all, a debilitating symptom and affects patients' daily functionality, which can lead to a state of physical and emotional incapacity if not properly managed.

Given the complexity and severity of the neurological complications associated with this disease, several treatment approaches have been explored to manage these conditions. The objective of the neurolysis surgery is to alleviate symptoms by decompressing the affected nerves. The surgical technique consists, in short, of releasing the compressed nerve at the main anatomical constriction points, promoting pain relief and the recovery, even if partial, of the nerve's function, theoretically resulting in a significant improvement in patients' QoL[3].

In order to correctly adapt the patient to the expected responses, there are, in addition to the reasons and contraindications pertinent to any surgical procedure, formal indications for its performance. In this context, the Ministry of Health, in a document published in 2008, mentions: patients with a formal contraindication to the use of corticosteroids; nerve abscess, with some particularities during the procedure, such as the approach of possible caseous material; patients with neuropathy that does not respond to treatment in 4 weeks; patients with sub entrant and reentrant neuropathy; patients with subluxating ulnar nerve; patients with chronic neuropathy with late neural deficit and pain[4].

Neurolysis surgery, the way it is carried out in Rondônia's public health system, consists of two procedures for each limb treated, since it is protocol for only one limb to be operated in each surgery. For the upper limb (UL), after proper preparation and anesthesia, the patient will undergo a distal procedure to release the median nerve, followed by the release of the cubital nerve in the elbow region. For the lower limb (LL), the individual undergoes an intervention on the common peroneal nerve in the lateral region near the neck of the fibula, followed by a technique to release the posterior tibial nerve in the region of the medial malleolus.

This guideline taken during the neurolysis surgery aims to release strategic anatomical points which, in themselves, are already natural constriction points in the canal through which the nerve passes. However, with pathological inflammation and the consequent increase in the circumference of the nerve, a constriction point impairing the transmission of nerve impulses can occur, causing pain, paresthesia and deformity, among other issues. Furthermore, in advanced cases, the so-called "hourglass sign" occurs, when the compression is so intense as to anatomically and irreversibly modify the nerve[5].

Although there are already published studies proving the efficacy of neurolysis in different contexts, the literature still lacks consistent data on the medium and long-term results of this intervention in patients living with the disease or its sequelae. Moreover, there is a need to evaluate the impact of this surgery on patients' QoL, taking into account not only pain relief, but also functional recovery and social reintegration.

The main objective of the present study was to evaluate the results of the neurolysis surgery in relieving neuropathic pain and improving the QoL of Hansen's disease patients. The specific objectives were:

1. Analyze the effectiveness of the surgery in reducing neuropathic pain;
2. Identify possible correlations between patient characteristics (age, length of illness, affected limb) and surgical results;
3. Assess the evolution of pain throughout the postoperative period.

METHODS

Study design and population

This is a retrospective observational study that analyzed the medical records of 70 patients who underwent neurolysis surgery in public health hospitals in the state of Rondônia between January 2023 and December 2024.

Eligibility criteria

The study included the medical records of patients who met the following criteria: (1) confirmed diagnosis of Hansen's disease; (2) had undergone neurolysis surgery in the specified period; (3) medical records with complete pre- and post-operative documentation, including pain assessments and a minimum follow-up of 30 days. Medical records with incomplete, illegible data or which did not contain all the information necessary for the proposed analysis were excluded.

Data collection and analysis

Descriptive statistics, measures of position, central tendency and dispersion were used to describe the methods and features of the individuals. Absolute and relative frequencies were calculated for the qualitative variables, while the mean and standard deviation were used for the quantitative variables.

The statistical analysis was carried out in three stages:

1. Comparison of pain before and after surgery: the Wilcoxon test for paired samples was used to compare pain values before

and after surgery with the groups divided according to the affected limb;
2. Analysis by pain ranges over time: the intensity of post-operative pain was classified into four categories (no pain, mild pain, moderate pain and severe pain) and analyzed at different time intervals (up to 30 days, from 30 to 60 days, from 60 to 90 days and over 90 days). The Pearson's chi-square test was used to assess the association between postoperative time and pain intensity;
3. Correlation between post-operative time and pain: Pearson's Correlation Coefficient was used to analyze the relationship between time after surgery and pain intensity in each affected limb.

Considerations on pharmacological treatment

Standard pharmacological treatment, including analgesics, anti-inflammatory drugs, corticosteroids and specific drugs for Hansen's disease, followed the protocol established by the public health network and was the same for all patients, and was therefore not considered as an analysis variable in the study.

RESULTS

The characterization of the individuals is presented. A total of 70 medical records were analyzed. The oldest report was dated February 8, 2023, and the most current was dated from August 8, 2024. With regard to the profile of the patients analyzed, in terms of mean age, the youngest patient was 16 years old on the date of the post-operative visit, and the oldest patient was 66 years old, resulting in a mean age of 45.43 years, with a standard deviation of 12.32.

As for gender, 70% of the patients were female (n = 49) and 30% male (n = 21). The distribution of the disease in the limbs was balanced, with 54.3% of cases affecting the upper limbs (UL) and 45.7% the lower limbs (LL). However, when looking at the laterality and specificity of the affected limbs, the right upper limbs (34.3%) and left lower limbs (25.7%) were the most affected, which may suggest a predisposition to these areas or greater vulnerability of certain peripheral nerves (Table 1).

The average initial pain score reported by patients before surgery was 8.71 on a scale of zero to 10, indicating that most patients suffered from severe pain. The maximum pain value was 10, while the minimum value was 5, suggesting that all patients faced some level of significant discomfort. After surgery, the average reported pain was significantly reduced to 0.81, with a higher standard deviation of 1.49. This difference in meaning is remarkable, reflecting an average 90% improvement in pain relief. The significant decrease, coupled with the significant p-value ($p<0.001$), suggests that neurolysis had a substantial therapeutic impact on reducing neuropathic pain, confirming the effectiveness of the procedure for the majority of patients (Table 2).

Group comparative analysis

The comparison between the UL and LL revealed some important differences in pain reduction:

- Right upper limb: before surgery, the average pain was 8.83 (SD = 1.09), which decreased to 0.54 (SD = 1.14) after the procedure, resulting in a percentage reduction of 93.9%. This was the limb with the greatest reduction in pain, indicating that the nerves affected at this site may respond better to neurolysis;
- Right lower limb: average pain went from 8.86 (SD = 0.95) to 1.29 (SD = 1.73), a reduction of 85.5%;
- Left upper limb: average pain decreased from 7.79 (SD = 1.72) to 0.50 (SD = 1.40), a reduction of 93.6%;
- Left lower limb: reduced by 88.5%, with average pain before surgery of 9.17 (SD = 1.10) decreasing to 1.06 (SD = 1.73) after surgery (Table 3).

Table 1. Characterization of patients.

	Statistics	
	All procedures	**n=70**
Patient's features - Mean [Min - Max]	Age	45.43 years [16 - 66]
	Length of illness	14.11 months [02 - 36]
Gender	Female	49 (70%)
	Male	21 (30%)
Location of the disease	Inferior	32 (45.7%)
	Superior	38 (54.3%)
Limbs	Lower right	14 (20%)
	Lower left	18 (25.7%)
	Upper right	24 (34.3%)
	Upper left	14 (20%)

Table 2. Pain diagnosis.

	Mean	Median	Minimum	Maximum	Standard deviation
Before	8.71	8.50	5.00	10.00	1.29
After	0.81	0.00	0.00	5.00	1.49

Table 3. Comparison of the evolution of pain before and after the surgical procedure.

	Pain	Mean	Median	Minimum	Maximum	Standard deviation	p-value
Right lower limb	Before	8.86	8.50	8.00	10.00	0.95	0.001
	After	1.29	0.00	0.00	4.00	1.73	
Left lower limb	Before	9.17	10.00	7.00	10.00	1.10	0.000
	After	1.06	0.00	0.00	5.00	1.73	
Right upper limb	Before	8.83	9.00	6.00	10.00	1.09	0.000
	After	0.54	0.00	0.00	4.00	1.14	
Left upper limb	Before	7.79	8.00	5.00	10.00	1.72	0.001
	After	0.50	0.00	0.00	5.00	1.40	

Wilcoxon signed-rank test.

Figure 1 shows the variation in the patient's pain reduction after treatment.

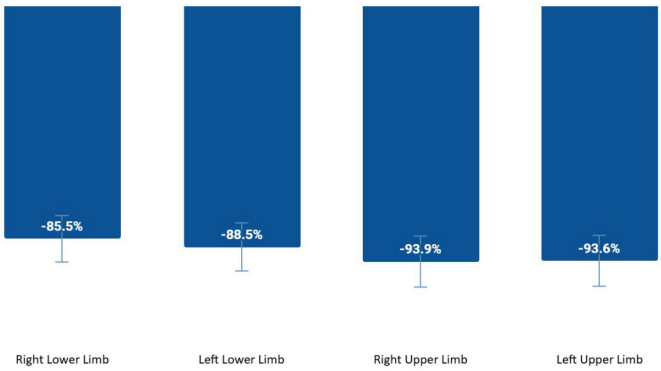

Figure 1. Percentage of pain reduction after surgical procedure.

Analysis of the influence of time on patient pain

Analysis of the general evolution of pain over time (Figure 2) shows that the average pain intensity remained low throughout the post-operative period, highlighting the continued effectiveness of the treatment. In the first 30 days, the average pain was lower in all limbs, with the left lower limb showing an average of 0.00 and the right upper limb, 0.46. Although there were slight variations in the mean values in the periods up to 90 days, especially in the lower limbs, the pain remained low, showing that the relief obtained after the procedure is sustained over time.

In addition, the overall mean pain decreased progressively, almost disappearing after 90 days, which reinforces that the impact of surgery is long-lasting and significant, maintaining pain relief over the long term. The Friedman test corroborates these findings, with a value of $p = 0.087$, indicating that there is not enough evidence to say that pain has changed significantly over time. Therefore, it can be concluded that relief remains stable, showing that neurolysis offers consistent pain control, with no clear tendency indicating its significant increase over time.

Table 4 evaluates the influence of postoperative time on the range of pain, dividing patients into groups according to the time after surgery.

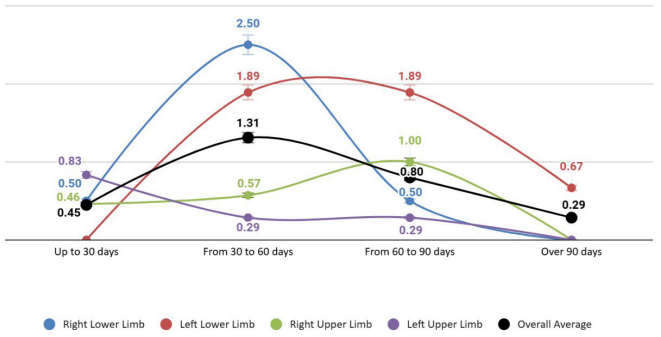

Figure 2. Evolution of pain over time.

- Right upper limb: in the first 30 days, 57.9% of patients reported no pain, which represents a significant improvement compared to other limbs. This result indicates that the nerves affected at this location respond well to neurolysis, with a significant and rapid reduction in pain;
- Left upper limb: the effect of neurolysis was more gradual, with 41.7% of patients reporting no pain in the first 30 days and 50% between 30 and 60 days after surgery. This suggests

Table 4. Analysis of the influence of time on the patients' range of pain after the procedure.

	Range of pain	Time (days)				p-value
		Until 30	From 30 to 60	From 60 to 90	Above 90	
Right lower limb	No pain	3 (37.50%)	2 (25.00%)	1 (12.50%)	2 (25.00%)	0.327
	Mild pain	1 (16.70%)	4 (66.70%)	1 (16.70%)	0 (0.00%)	
	Moderate pain	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
	Severe pain	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
Left lower limb	No pain	6 (50.00%)	4 (33.30%)	0 (0.00%)	2 (16.70%)	0.225
	Mild pain	0 (0.00%)	3 (75.00%)	0 (0.00%)	1 (25.00%)	
	Moderate pain	0 (0.00%)	2 (100.00%)	0 (0.00%)	0 (0.00%)	
	Severe pain	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
Right upper limb	No pain	11 (57.90%)	5 (26.30%)	2 (10.50%)	1 (5.30%)	0.793
	Mild pain	2 (40.00%)	2 (40.00%)	1 (20.00%)	0 (0.00%)	
	Moderate pain	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
	Severe pain	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
Left upper limb	No pain	5 (41.70%)	6 (50.00%)	0 (0.00%)	1 (8.30%)	0.67
	Mild pain	0 (0.00%)	1 (100.00%)	0 (0.00%)	0 (0.00%)	
	Moderate pain	1 (100.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	
	Severe pain	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	

(Pearson's Chi-square test). No Pain = score of 0 on the pain scale; Mild Pain: score of 1 to 4; Moderate Pain: score of 5 to 8; Severe pain: score of 9 to 10.

that although pain relief is significant, it develops over time, possibly being more significant in subsequent phases;

- Right lower limb: the proportion of patients reporting no pain was 37.5% in the first 30 days, 25% between 30 and 60 days, and remained consistent at 12.5% and 25% in the following periods;
- Left lower limb: in the first 30 days, 50% of patients reported no pain, with a decrease of 33.3% between 30 and 60 days and an increase to 16.7% after 90 days (p=0.225).

Figure 3 shows that the absence of pain in patients remains significant even over time. In the right upper limb, 57.9% of patients reported no pain in the first 30 days, and this proportion, although gradually decreasing, continues to be present to a lesser extent in the following months. Similar patterns were observed in the lower limbs, such as the right lower limb, in which 37.5% of patients reported no pain initially, with some variations in subsequent assessments.

Pearson's Chi-square test indicated that there was no statistically significant association between time and the report of pain in any of the analyzed limbs (p>0.05). This suggests that the presence or absence of pain is not directly associated with the time elapsed since the surgical procedure, reinforcing that the effect of the treatment does not deteriorate significantly over time.

DISCUSSION

Within the proposed methodology, the results of the present study were able to demonstrate a significant impact of neurolysis surgery on the reduction of pain in Hansen's disease patients, which was evident in the post-operative scores analyzed. These findings are not dissimilar to existing literature on the subject, suggesting that neurolysis is and can be integrated as an effective intervention for the management of neuropathic pain in Hansen's disease patients, especially in cases where there is severe nerve compression[6].

Given the chronic infectious nature of Hansen's disease, it can lead to neurological complications, with peripheral neuropathy being the main cause of pain in affected individuals, leading to significant limitations in the patient's daily life[7,8]. In this context, some previously published studies indicate that neurolysis, by relieving compression on the peripheral nerves, can not only reduce pain, but also improve nerve function and the patient's QoL[9,10] For this reason, the reduction in post-neurolysis pain levels observed in the present study ratifies these conclusions, demonstrating that surgery can be a valuable intervention in the treatment of Hansen's disease related neuropathy.

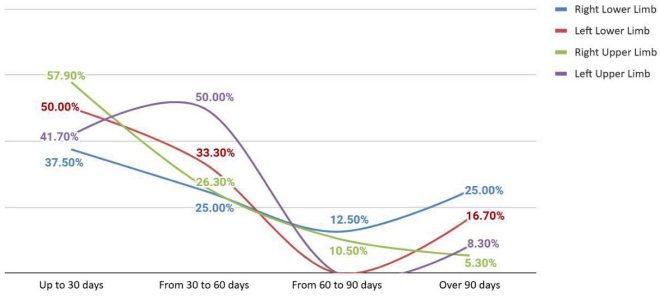

Figure 3. Percentage of absence of pain over time.

Furthermore, there was a slight association between the extent of pain and the ability of the surgery to have an impact. In other words, the analysis of the results shows that the improvement in pain was more pronounced in patients with severe pain before surgery. This finding is consistent with other publications that report this correlation between the severity of preoperative pain and the magnitude of postoperative improvement[11,12]. Moreover, the literature adds that surgical interventions in more advanced stages of the disease can result in better clinical outcomes in comparison, due to the greater level of nerve compression of the anatomical constriction points and the subsequent relief provided by neurolysis[13,14].

It is important to note that, despite the benefits shown, neurolysis surgery, like any other surgical procedure, is not without risks or complications. Some expected events are additional damage to the nerves treated, or even recurrence of pain[15,16]. For this reason, the present study aimed to serve as a basis for future studies to identify predictive factors of surgical success, adapting the selection of patients for the procedure in a more precise and evidence-based way[15,17].

The variability in results between patients can be attributed to various factors, such as the extent of injuries, the presence of other comorbidities and the surgical technique used. These specific points highlight the need for a multidisciplinary approach in the management of Hansen's disease[8,11]. In this sense, the structuring of the health system in the state of Rondônia, aware of the importance of this approach, has a multi-professional team capable of offering patients comprehensive care.

Among the limitations of the study are the retrospective methodology and convenience sampling, which can introduce biases related to the selection of participants and data collection. The retrospective design also made it impossible to control confounding variables. Nevertheless, the systematic monitoring carried out by the multidisciplinary team and the standardized documentation of pain scores allowed for a consistent analysis of the results. In addition, the clinical relevance of the findings strengthens the evidence found, although future prospective studies with a more robust methodological design are needed to consolidate these results.

CONCLUSION

Neurolysis has been an effective and long-lasting intervention for the treatment of neuropathic pain in Hansen's disease patients, providing significant pain reduction in all affected limbs, with more expressive results in the upper limbs, especially the right. The benefits of surgery persisted throughout the follow-up period, with no evidence of significant deterioration in the therapeutic effect, which indicates that the procedure offers a reliable solution for the prolonged relief of neuropathic pain in these patients.

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AUTHORS' CONTRIBUTIONS

Daniel Adner Ferrari: Statistical Analysis, Data Collection, Project Management, Methodology, Writing - Preparation of the Original
Everton dos Santos Coqueiro: Data Collection, Conceptualization, Research, Supervision, Visualization
Felipe Santos Casseb Júnior: Data Collection, Conceptualization, Research, Writing - Preparation of the Original, Supervision, Visualization
Carlos Alberto Lima: Conceptualization, Project Management, Research, Methodology, Supervision, Validation, Visualization
Elifaz de Freitas Cabral: Research, Writing - Review and Editing, Supervision, Visualization
Wanderlei Ruffato: Statistical Analysis, Data Collection, Conceptualization, Project Management, Supervision