



Analysis of the Therapeutic Efficacy of Rhizotomy in Pain Treatment

Carolina Tainá Torres¹, Jader Mette Batisti¹, Tadeu Romagnoli Neto¹, Amanda Jasper Militão¹, Leone Romagnoli Cardoso¹, Ana Carolina Munaro Coelho¹, Eloá Vicentin Cesnik¹, Natanny Busk Jacinto¹, Isadora Pedroche da Rocha¹, Maria Luiza Roncon Pivetta¹, Helena de Geus Ribeiro¹, Amanda Kimie Aoki¹, Beatriz de Melo Henrique¹, Isabela Facchin Bidoia¹, Mariana Costa Ditzel¹, Isabela Maria Craveiro Silva¹, Gianluca Reusing Penteado¹, Emanuella Guizelin dos Santos Fermo¹, Marcos Augusto Pires de Carvalho², Ana Carolina Portella de Carvalho², Tiago Medeiros Corrêa de Araújo³, Juliana Alves de Oliveira Pessôa³, Sofia Brito Lourenço⁴, Vicente Mateus de Vasconcelos Martins Frota⁵, Débora Patrícia Feitosa Medeiros Eufrásio⁶, Tainara Maier Marques⁷, Eduardo Fernandes dos Santos⁸, Ana Luiza Pinheiro Habib⁹

NARRATIVE LITERATURE REVIEW

ABSTRACT

Considering the growing burden of chronic pain and the urgent need for effective, minimally invasive treatments, rhizotomy has gained prominence as a viable therapeutic option. However, the variability in techniques, such as endoscopic, radiofrequency, and chemical rhizotomy, and the differing outcomes across patient populations underscore the necessity for a comprehensive evaluation of its efficacy. This study aims to systematically review the therapeutic effectiveness of various rhizotomy techniques in managing chronic pain, focusing on their application in conditions like lumbar facet joint pain, trigeminal neuralgia, and cancer-related pain. To achieve this, a narrative literature review was conducted, employing a structured methodology based on established guidelines from experts in the field. The review covered studies published between 2000 and 2023, sourced from reputable academic databases such as PubMed, Scopus, and Web of Science, using specific descriptors like "rhizotomy," "pain management," "endoscopic rhizotomy," and "radiofrequency." The inclusion criteria were stringent, focusing on studies that reported quantitative or qualitative outcomes related to pain relief, complications, and the impact on patients' quality of life following rhizotomy. The results of this review indicate that rhizotomy, particularly the endoscopic and radiofrequency variants, consistently provides significant pain relief and functional improvement across various conditions. The long-term benefits of selective dorsal rhizotomy, especially in reducing pain and improving function in patients with spastic cerebral palsy, were notably highlighted. However, the review also

points out that the efficacy of rhizotomy can vary depending on the specific technique employed, the underlying condition being treated, and individual patient characteristics. This comprehensive analysis allows us to conclude that rhizotomy is indeed a valuable option in the realm of pain management, offering substantial benefits in terms of both pain relief and enhanced quality of life. Nevertheless, it also emphasizes the need for further research to optimize these techniques and better understand the factors that influence patient outcomes, ultimately paving the way for more personalized and effective pain management strategies.

Keywords: Rhizotomy; Pain management; Endoscopic rhizotomy; Radiofrequency ablation; Chronic pain.

Análise da Eficácia Terapêutica da Rizotomia no Tratamento da Dor

RESUMO

Considerando o crescente impacto da dor crônica e a necessidade urgente de tratamentos eficazes e minimamente invasivos, a rizotomia tem ganhado destaque como uma opção terapêutica viável. No entanto, a variabilidade das técnicas, como rizotomia endoscópica, por radiofrequência e química, e os diferentes resultados observados entre as populações de pacientes, ressaltam a necessidade de uma avaliação abrangente de sua eficácia. Este estudo tem como objetivo revisar sistematicamente a eficácia terapêutica das diversas técnicas de rizotomia no manejo da dor crônica, com foco em sua aplicação em condições como dor na articulação facetária lombar, neuralgia do trigêmeo e dor relacionada ao câncer. Para tanto, foi realizada uma revisão narrativa da literatura, seguindo uma metodologia estruturada baseada em diretrizes estabelecidas por especialistas na área. A revisão abrangeu estudos publicados entre 2000 e 2023, selecionados em bases de dados acadêmicas respeitadas, como PubMed, Scopus e Web of Science, utilizando descritores específicos como "rizotomia", "manejo da dor", "rizotomia endoscópica" e "radiofrequência". Os critérios de inclusão foram rigorosos, focando em estudos que apresentaram resultados quantitativos ou qualitativos relacionados ao alívio da dor, complicações e impacto na qualidade de vida dos pacientes após a rizotomia. Os resultados desta revisão indicam que a rizotomia, especialmente nas variantes endoscópica e por radiofrequência, proporciona consistentemente alívio significativo da dor e melhoria funcional em diversas condições. Os benefícios a longo prazo da rizotomia dorsal seletiva, especialmente na redução da dor e na melhoria da função em pacientes com paralisia cerebral espástica, foram notavelmente destacados. No entanto, a revisão também aponta que a eficácia da rizotomia pode variar dependendo da técnica específica utilizada, da condição subjacente a ser tratada e das características individuais dos pacientes. Essa análise abrangente nos permite concluir que a rizotomia é, de fato, uma opção valiosa no campo do manejo da dor, oferecendo benefícios substanciais tanto em termos de alívio da dor quanto na melhoria da qualidade de vida. Contudo, enfatiza-se a necessidade de mais pesquisas para otimizar essas técnicas e entender melhor os fatores que influenciam os resultados dos pacientes, abrindo caminho para estratégias de manejo da dor mais personalizadas e eficazes.

Palavras-chave: Rizotomia; Manejo da dor; Rizotomia endoscópica; Ablação por radiofrequência; Dor crônica

Instituição afiliada – Unicesumar¹, Faculdade Zarns², Uninassau³, UFRJ⁴, Unifor⁵, Unichristus⁶, Uniderp⁷, UFPE⁸, Unidompedro⁹

Dados da publicação: Artigo recebido em 08 de Julho e publicado em 28 de Agosto de 2024.

DOI: <https://doi.org/10.36557/2674-8169.2024v6n8p5203-5216>

Autor correspondente: Carolina Tainá Torres mateusafmelo@gmail.com

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).



INTRODUÇÃO

Rhizotomy, a surgical procedure targeting nerve roots to alleviate chronic pain, has gained significant attention in the field of pain management due to its potential to provide long-lasting relief for patients suffering from various conditions such as lumbar facet joint pain, trigeminal neuralgia, and cancer-related pain. As the global burden of chronic pain continues to rise, there is an increasing need for effective, minimally invasive treatments that can improve patient outcomes while reducing dependency on opioid medications. Rhizotomy, with its diverse techniques such as endoscopic and radiofrequency methods, offers a promising solution to this pressing healthcare challenge.

Despite the widespread use of rhizotomy in clinical practice, the literature reveals several gaps in understanding its long-term efficacy and safety across different patient populations. Previous studies have shown varying degrees of success depending on the type of rhizotomy performed and the underlying condition being treated. However, many of these studies are limited by small sample sizes, retrospective designs, and short follow-up periods, making it difficult to draw definitive conclusions about the overall effectiveness of rhizotomy. Additionally, while some research has explored the impact of specific procedural parameters, such as temperature and ablation duration in radiofrequency rhizotomy, there remains a lack of comprehensive studies directly comparing different rhizotomy techniques.

Further complicating the understanding of rhizotomy's effectiveness is the variability in patient responses to the procedure. Literature suggests that factors such as underlying neurological conditions, previous surgical interventions, and patient demographics can significantly influence outcomes. For instance, studies on selective dorsal rhizotomy (SDR) have highlighted its long-term benefits for patients with spastic cerebral palsy, yet the broader applicability of these findings to other populations remains unclear. Similarly, while microsurgical rhizotomy has shown promise for managing trigeminal neuralgia in multiple sclerosis patients, its comparative efficacy against other treatments requires further investigation.

The objective of this study is to systematically review and synthesize existing

research on the therapeutic efficacy of rhizotomy in pain treatment. By comparing different rhizotomy techniques and their outcomes across various conditions, this study aims to provide a clearer understanding of the procedure's role in pain management, identify best practices, and highlight areas where further research is needed to optimize patient care.

METODOLOGIA

For this study, a narrative literature review was chosen as the method, allowing for a critical and interpretative analysis of published studies on the therapeutic efficacy of rhizotomy in pain management. The narrative review is particularly suitable for this topic as it enables the integration and synthesis of different rhizotomy approaches, such as endoscopic, radiofrequency, and chemical rhizotomy, providing a comprehensive view of the available evidence and highlighting variations in outcomes based on the technique used and the clinical conditions of the patients. This method is ideal for exploring both the historical aspects and recent advancements in the application of rhizotomy in pain management, emphasizing how each approach contributes to pain relief and the improvement of patients' quality of life.

The methodology for this study was developed based on guidelines established by experts in narrative review, as described by Rother (2007) and Greenhalgh (2014). These authors provide a solid foundation for conducting narrative reviews, including the careful selection of relevant literature, the assessment of the quality of the included studies, and the synthesis of data in a way that respects the methodological heterogeneity and the different outcomes presented in the analyzed studies.

Following the recommendations of these experts, special attention was given to identifying potential biases in the analyzed studies, as well as to providing a transparent and balanced presentation of the findings, ensuring that the review offers a well-informed and substantiated perspective on the topic. The search for sources was conducted in academic databases recognized for their relevance, such as PubMed, Scopus, and Web of Science. Specific descriptors were used, including "rhizotomy," "pain management," "endoscopic rhizotomy," "radiofrequency," and "chronic pain treatment," applying Boolean operators like "AND" and "OR" to refine the results. The

temporal scope considered publications from 2000 to 2023, ensuring the inclusion of a contemporary and relevant perspective on the subject.

The inclusion criteria for the articles focused on studies that presented quantitative or qualitative data on the outcomes of rhizotomy, including results such as pain relief, complications, duration of effect, and impact on patients' quality of life. By applying these rigorous methodological standards, the study aims to align with the quality requirements demanded by academia and clinical practice, ensuring a significant contribution to the existing literature and providing a robust foundation for future research and therapeutic practices in pain management through rhizotomy.

RESULTADOS

Table 1. Studies on the Therapeutic Efficacy of Rhizotomy in Pain Treatment

Author, Year	Study Title	Study Summary
DU, Tao et al., 2022	Pain-Free Survival After Endoscopic Rhizotomy Versus Radiofrequency for Lumbar Facet Joint Pain	Comparison between endoscopic rhizotomy (ER) and radiofrequency (RF) for lumbar facet joint pain, showing that ER had better efficacy at 6 and 12 months.
PAO, Ludovic P. et al., 2019	Reducing opioid usage: a pilot study comparing postoperative selective dorsal rhizotomy protocols	Pilot study comparing postoperative pain management protocols for selective dorsal rhizotomy, showing that a modified protocol reduced opioid use.
XIE, Eric et al., 2019	Association Between Radiofrequency Rhizotomy Parameters and Duration of Pain Relief in Trigeminal Neuralgia Patients with Recurrent Pain	Analysis of radiofrequency rhizotomy parameters and the duration of pain relief in patients with trigeminal neuralgia.
DUFF, Patricia; DAS, Basabjit; McCRORY, Connail, 2016	Percutaneous radiofrequency rhizotomy for cervical zygapophyseal joint mediated neck pain	Retrospective study on the efficacy of percutaneous cervical radiofrequency rhizotomy for treating pain mediated by the cervical zygapophyseal joint.

SON, Byung-chul et al., 2014	Dorsal Rhizotomy for Pain from Neoplastic Lumbosacral Plexopathy in Advanced Pelvic Cancer	Evaluation of the efficacy of selective dorsal rhizotomy for pain from neoplastic lumbosacral plexopathy in terminal pelvic cancer patients.
RAAFAT, R. MAHFOUZ et al., 2021	Chemical Dorsal Rhizotomy in Lung Cancer Pain	Study on the efficacy of chemical dorsal rhizotomy with phenol in treating chronic malignant thoracic pain in lung cancer patients.
LI, Zhen-Zhou et al., 2014	Evaluation of endoscopic dorsal ramus rhizotomy in managing facetogenic chronic low back pain	Evaluation of the efficacy of endoscopic dorsal ramus rhizotomy in treating facetogenic chronic low back pain.
TYURNIKOV, V. M. et al., 2015	Experience in the use of high-frequency selective percutaneous rhizotomy in trigeminal neuralgia associated with multiple sclerosis	Retrospective study on the efficacy of high-frequency selective percutaneous rhizotomy in trigeminal neuralgia associated with multiple sclerosis.
MELONCELLI, Stefano et al., 2020	Endoscopic radiofrequency facet joint treatment in patients with low back pain	Prospective study on the efficacy of endoscopic radiofrequency rhizotomy in treating chronic low back pain caused by facet syndrome.
DAUNTER, Alecia K.; KRATZ, Anna L.; HURVITZ, Edward A., 2017	Long-term impact of childhood selective dorsal rhizotomy on pain, fatigue, and function	Case-control study evaluating the long-term effects of selective dorsal rhizotomy on pain, fatigue, and function in adults with spastic cerebral palsy.
MAJID, Abdul et al., 2019	Comparative Study Regarding Efficacy of Radiofrequency Rhizotomy and the Microvascular Decompression in the Treatment of Trigeminal Neuralgia	Comparison of the efficacy of radiofrequency rhizotomy with microvascular decompression in the treatment of trigeminal neuralgia.
NAIR, Sumil K. et al., 2023	The influence of prior percutaneous rhizotomy on outcomes following microvascular	Study analyzing the impact of prior percutaneous rhizotomy on the outcomes of microvascular

	decompression for trigeminal neuralgia	decompression in patients with trigeminal neuralgia.
KAO, Chih-Hao et al., 2021	Percutaneous Radiofrequency Rhizotomy Is Equally Effective for Trigeminal Neuralgia Patients with or without Neurovascular Compression	Investigation on whether the presence of neurovascular compression affects the efficacy of radiofrequency rhizotomy in patients with trigeminal neuralgia.
BIGDER, Mark G. et al., 2019	Microsurgical rhizotomy for trigeminal neuralgia in MS patients: technique, patient satisfaction, and clinical outcomes	Study evaluating microsurgical rhizotomy for trigeminal neuralgia in patients with multiple sclerosis, comparing it with other procedures.

Du et al. (2022) conducted a comparative study on pain-free survival after endoscopic rhizotomy (ER) versus radiofrequency (RF) for lumbar facet joint pain. Fifty-five patients with lumbar facet joint pain were included, of which 19 underwent ER and 36 underwent RF. The results showed a significant reduction in the Numeric Rating Scale (NRS) and Oswestry Disability Index (ODI) scores in both groups at 6 and 12 months compared to preoperative values. However, the ER group showed better efficacy than the RF group in terms of NRS, ODI, and Global Impression of Change (GloC) scores at 6 and 12 months. The pain-free survival curves indicated that the median pain-free duration was 20 months for ER and 10 months for RF.

Pao et al. (2019) conducted a pilot study comparing postoperative pain management protocols in selective dorsal rhizotomy (SDR) to reduce opioid use. Thirty patients were evaluated, divided into two groups: one received traditional pain management with patient-controlled analgesia (PCA), while the other group received a modified protocol with dexmedetomidine infusion and adjunct medication. The results showed that the group with the modified protocol required fewer opioid doses and smaller total amounts of opioids, with statistically significant or trending differences compared to the PCA group. Both groups had comparable pain scores, indicating that the modified management was effective in reducing opioid use without compromising pain control.

Xie et al. (2019) investigated the association between radiofrequency rhizotomy (RF) parameters and the duration of pain relief in patients with recurrent trigeminal

neuralgia. The retrospective analysis included 338 patients treated with RF. The results showed that rhizotomy temperature was significantly associated with both the degree of immediate postoperative pain relief and the duration of pain relief. Ablation duration was also significant but not when analyzed alongside age, sex, and race. Patients with multiple sclerosis and those undergoing repeated RFs had shorter durations of pain relief.

Duff, Das, And Mccrory (2016) retrospectively reviewed the outcomes of 44 cases of percutaneous radiofrequency rhizotomy for cervical zygapophyseal joint mediated neck pain. At 12 months, 63.64% of patients were pain-free, with a median duration of complete pain relief of 52 weeks. Patients who experienced pain relief had ceased using prescription analgesics by their 6-week review. There were no repeat cervical RF rhizotomies, procedure-related infections, or unplanned hospital admissions.

Son et al. (2014) evaluated the efficacy of selective dorsal rhizotomy for pain from neoplastic lumbosacral plexopathy in terminal pelvic cancer patients. Six patients underwent dorsal rhizotomies of the involved segments. The results indicated a significant reduction in pain ratings and daily narcotic use after the procedure. No adverse neurological effects were observed, and no recurrence of pain from neoplastic lumbosacral plexopathy was noted.

RAAFAT, MAHFOUZ, EL SHEIKH, And SAMY (2021) studied the efficacy and safety of chemical dorsal rhizotomy with phenol in treating chronic malignant thoracic pain in lung cancer patients. Thirty patients received phenol in dorsal rhizotomy corresponding to the pain dermatome. The Visual Analog Scale (VAS) scores, quality of life, and quality of sleep scores significantly improved on Day 1, 1 week, 1 month, and 3 months compared to pre-block. Regarding complications, one case had dorsal back pain, and three cases had numbness.

Li et al. (2014) evaluated the efficacy of endoscopic dorsal ramus rhizotomy in managing facetogenic chronic low back pain. The study included 58 patients, of which 45 received endoscopic rhizotomy, and 13 received conservative treatment. The VAS scores of low back and referred pain in the operation group were significantly lower at any postoperative time point compared to before medial branch blocks. The operation group also had higher percentages of pain relief and better MacNab scores at 1-year follow-up.

Tyurnikov et al. (2015) performed a retrospective analysis of 28 patients with trigeminal neuralgia associated with multiple sclerosis who underwent high-frequency selective percutaneous rhizotomy. The results showed good outcomes in the form of pain syndrome regression in 100% of the patients. Six patients experienced disease recurrence during a follow-up period of 3 months to 14 years. Complications included dysesthesia in 4 patients, with no deaths or severe complications.

Meloncelli et al. (2020) conducted a prospective study on the efficacy of endoscopic radiofrequency rhizotomy in treating chronic low back pain due to facet syndrome. The study included 50 patients with chronic low back pain due to facet joints, followed for 2 years. The Numeric Rating Scale (NRS) and Oswestry Disability Index (ODI) scores significantly improved in the postoperative period. Younger patients and those with 1-2 joints treated had better outcomes.

Daunter, Kratz, And Hurvitz (2017) evaluated the long-term effects of selective dorsal rhizotomy (SDR) on pain, fatigue, and function in adults with spastic cerebral palsy. This case-control study included adults with cerebral palsy who had undergone SDR in childhood. The results showed that adults who had SDR reported less pain, less fatigue, and less functional decline compared to a non-surgical control group.

Majid et al. (2019) compared the efficacy of radiofrequency rhizotomy (RFR) with microvascular decompression (MVD) in the treatment of trigeminal neuralgia. The randomized controlled trial included 110 patients, divided into two groups. After six months, 54.5% of patients in the MVD group were completely pain-free, compared to 34.5% in the RFR group. The MVD group also had fewer complications.

Nair et al. (2023) analyzed the impact of prior percutaneous rhizotomy on the outcomes of microvascular decompression (MVD) in patients with trigeminal neuralgia. The study included 947 patients, of whom 151 had a history of prior rhizotomy. Patients with a history of rhizotomy had a higher frequency of preoperative numbness and higher pain scores. However, final follow-up pain scores did not differ significantly between the groups. Survival analysis showed that prior rhizotomy did not increase the risk of pain recurrence after MVD.

Kao et al. (2021) investigated whether the presence of neurovascular compression (NVC) affects the efficacy of radiofrequency rhizotomy (RF) in patients with trigeminal neuralgia. The retrospective study included 62 patients, of whom 35 had NVC.

The results showed that the presence of NVC did not significantly affect the improvement in pain after one year of RF treatment. Both groups had comparable improvements in pain severity.

Bigder *et al.* (2019) evaluated microsurgical rhizotomy (MSR) for trigeminal neuralgia in multiple sclerosis patients (MS-TN). The study included 14 patients undergoing MSR and 93 undergoing other procedures. The results showed that the time to treatment failure (TTF) was significantly longer after MSR (79 months) compared to other procedures (10-13 months). MSR resulted in a higher proportion of excellent pain scores compared to other procedures.

CONSIDERAÇÕES FINAIS

This review of studies on the therapeutic efficacy of rhizotomy in pain treatment highlights the diverse applications of the procedure across various conditions, including lumbar facet joint pain, trigeminal neuralgia, and cancer-related pain. The findings consistently demonstrate that different rhizotomy techniques, such as endoscopic and radiofrequency rhizotomy, provide significant pain relief, with varying degrees of effectiveness depending on the specific condition and patient population. The importance of these studies lies in their potential to inform clinical practice, offering evidence-based insights into optimizing pain management strategies while minimizing opioid use and improving patient outcomes.

The analysis also emphasizes the long-term benefits of selective dorsal rhizotomy (SDR) in reducing pain, fatigue, and functional decline in adults with spastic cerebral palsy, as well as the effectiveness of microsurgical rhizotomy in managing trigeminal neuralgia in patients with multiple sclerosis. These findings have important implications for the development of tailored pain management protocols that address the unique needs of different patient populations, potentially reducing the reliance on more invasive or pharmacological treatments.

Future research should focus on large-scale, randomized controlled trials that directly compare the efficacy of different rhizotomy techniques across diverse patient

groups. Additionally, studies exploring the molecular and neurological mechanisms underlying the varying responses to rhizotomy could provide valuable insights into optimizing treatment protocols. Investigating the long-term outcomes of rhizotomy, including quality of life and functional improvements, would further enhance the understanding of its role in comprehensive pain management.

However, the reviewed studies have limitations, including small sample sizes, retrospective designs, and limited follow-up periods, which may impact the generalizability of the findings. Moreover, variability in study methodologies and patient selection criteria can lead to inconsistencies in reported outcomes. Addressing these limitations in future research will be crucial for establishing more definitive conclusions regarding the efficacy and safety of rhizotomy in pain treatment.

REFERÊNCIAS

DAUNTER, Alecia K.; KRATZ, Anna L.; HURVITZ, Edward A. Long-term impact of childhood selective dorsal rhizotomy on pain, fatigue, and function: a case-control study. **Developmental Medicine & Child Neurology**, v. 59, n. 10, p. 1089-1095, 2017.

DU, Tao et al. Pain-free survival after endoscopic rhizotomy versus radiofrequency for lumbar facet joint pain: a real-world comparison study. **Pain Physician**, v. 25, n. 1, p. E87, 2022.

DUFF, Patricia; DAS, Basabjit; MCCRORY, Connail. Percutaneous radiofrequency rhizotomy for cervical zygapophyseal joint mediated neck pain: A retrospective review of outcomes in forty-four cases. **Journal of Back and Musculoskeletal Rehabilitation**, v. 29, n. 1, p. 1-5, 2016.

KAO, Chih-Hao et al. Percutaneous radiofrequency rhizotomy is equally effective for trigeminal neuralgia patients with or without neurovascular compression. **Pain Medicine**, v. 23, n. 4, p. 807-814, 2022.

LI, Zhen-Zhou et al. Evaluation of endoscopic dorsal ramus rhizotomy in managing facetogenic chronic low back pain. **Clinical Neurology and Neurosurgery**, v. 126, p. 11-17, 2014.

MAJID, ABDUL et al. Comparative Study Regarding Efficacy of Radiofrequency Rhizotomy and the Microvascular Decompression in the Treatment of Trigeminal Neuralgia. **Pakistan Journal Of Neurological Surgery**, v. 23, n. 3, p. 193-198, 2019.

RAAFAT, R. MAHFOUZ et al. Chemical Dorsal Rhizotomy in Lung Cancer Pain. **The Medical Journal of Cairo University**, v. 89, n. June, p. 1283-1288, 2021.

MELONCELLI, Stefano *et al.* Endoscopic radiofrequency facet joint treatment in patients with low back pain: technique and long-term results. A prospective cohort study. **Therapeutic Advances in Musculoskeletal Disease**, v. 12, p. 1759720X20958979, 2020.

NAIR, Sumil K. *et al.* The influence of prior percutaneous rhizotomy on outcomes following microvascular decompression for trigeminal neuralgia. **Journal of neurosurgery**, v. 140, n. 4, p. 1155-1159, 2023.

PAO, Ludovic P. *et al.* Reducing opioid usage: a pilot study comparing postoperative selective dorsal rhizotomy protocols. **Journal of Neurosurgery: Pediatrics**, v. 25, n. 3, p. 305-310, 2019.

SON, Byung-chul *et al.* Dorsal rhizotomy for pain from neoplastic lumbosacral plexopathy in advanced pelvic cancer. **Stereotactic and Functional Neurosurgery**, v. 92, n. 2, p. 109-116, 2014.

TYURNIKOV, V. M. *et al.* Experience in the use of high-frequency selective percutaneous rhizotomy in trigeminal neuralgia associated with multiple sclerosis. **Zhurnal voprosy neirokhirurgii imeni NN Burdenko**, v. 79, n. 5, p. 34-42, 2015.

XIE, Eric *et al.* Association between radiofrequency rhizotomy parameters and duration of pain relief in trigeminal neuralgia patients with recurrent pain. **World neurosurgery**, v. 129, p. e128-e133, 2019.

BIGDER, Mark G. *et al.* Microsurgical rhizotomy for trigeminal neuralgia in MS patients: technique, patient satisfaction, and clinical outcomes. **Journal of Neurosurgery**, v. 130, n. 6, p. 1877-1888, 2018.