Received: 30 February 2024 | Revised: 26 April 2024 | Accepted: 05 May 2024
DOI: 10.48309/JMPCR.2024.450490.1166
Journal of Medicinal and Pharmaceutical Chemistry Research
SAMI

FULL PAPER

Management of spinal schwannoma and post-operative clinical improvement: A case series

Lukas Widhiyanto* |**Ilham Pratamanugroho**

Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

***Corresponding Author:**
Lukas Widhiyanto
Email: lukas-w@fk.unair.ac.id

Spinal Schwannoma is the most common primary spinal tumor. Surgery is the definitive treatment for these types of tumors which provides the possibility for total resection and healing. The design of this study is a descriptive study using case series. In this study, evaluation of the quality of life for a total of three patients with spinal schwannoma using the Short Form-36 (SF-36) questionnaire. An evaluation was conducted to evaluate the functional state of the patient before and after the operation. The collected data was analyzed with a paired t-test using SPSS statistical software. Pre-operative and post-operative clinical, radiological, and histopathologic data are also obtained. Based on the result of the analysis, the mean pre-operative SF-36 total score was 54.04 compared to the mean post-operative total score of 84.64. A paired t-test showed a significant difference between the mean SF-36 total score pre-operative and post-operative (p = 0.013). Good functional clinical improvement was achieved after tumor excision. There was a significant improvement in the quality of life of patients after surgery, with neurological status showing improvement compared to pre-operative conditions. Histopathological analysis confirmed schwannoma in all patients.

KEYWORDS

Schwannoma; pre-operative; post-operative; short form-36.

Introduction

Spinal schwannoma is the most common primary spinal tumor. Initially, local pain is one of the main onset symptoms followed by sensory disturbance before the patient has a motor deficit or sphincter disturbance [1]. Although there is no different sex prevalence, a recent study shows male has higher incidence rates with older age group between fifth-seventh decade is more affected and very rarely affects the younger or adolescent group [2-4]. The current standard diagnostic study for the spinal tumor is an MRI examination with the objective is to evaluate the size and extent of the tumor, evaluate the relation of the tumor to major vascular structure, aid in the surgical approach to achieve total resection, observe disease progression, and estimate the prognosis of disease [5-8].

Schwannoma mostly originates in the intradural extramedullary area. This tumor arises from the root sheath of the spinal cord neurilemma or Schwann cells, so-called neurilemmoma or schwannoma, which are usually single, and mostly benign masses. Tumor localization exists in various parts of the spinal cord, most often in the cervical and

thoracic but rarely in the lumbar and sacral regions. These tumors can grow exophytically above and below the spinal cord dura or involve the spinal roots and interfere with the fibers, but very rarely grow intramedullary, while the majority arise from sensory nerve roots [1,8-9].

Gross total resection is the main treatment for benign schwannoma with a low recurrence rate. Conventional surgical approaches for spinal schwannoma include laminectomy extending to levels above and below the tumor under the midline skin incision and bilateral subperiosteal muscle dissection of the posterior spinal elements. Spinal schwannoma usually manifests with pain or paresthesia as an initial symptom, but new symptoms related to instability and post-laminectomy deformity are the main problems after resection of this tumor, especially after multilevel laminectomy [10].

Important issues to highlight in this paper are the neurological deficit that occurred in each case, the location and surgical resection performed on the patients, and clinical improvement after surgery in each case. Previous study shows that surgical removal of tumors remains the treatment of choice for spinal schwannoma with good results [1]. The authors hypothesize that clinical improvement would be achieved in post-operative cases of spinal schwannoma while the purpose of this study is to evaluate the functional state, neurological status, and quality of life of patients with spinal schwannoma before and after surgery, especially in the Department of Orthopaedic and Traumatology, Dr. Soetomo General Academic Hospital, Surabaya, so that this study may become the basis for management and research of similar cases.

Presentation of cases

Case 1

A 37-year-old woman had complained of difficulty moving both legs and could not walk long distances with numbness and tingling sensation on both hands for 10 months before admission which worsened 4 months before admission. There is no history of trauma, lumps, or other cancer. Figure 1 displays a radiological and histopathological examination of the patient. Pre-operative X-ray did not show any abnormality while MRI showed intradural extramedullary tumor with a solid mass at level cervical 3-4 in the left side of the spinal canal extending extradural through the left neural foramina accompanied by erosion of the left cervical 3-4 neural foramina. Debulking surgery and cervical 2-5 posterior stabilization were performed. Post-operative evaluation, the patient had much fewer pain complaints and she was able to walk again. There is improvement in extremities manual muscle testing (MMT) from 3/3 before surgery to 5/5 at 1 year after surgery. Evaluation using SF-36 obtained an average value of 45.81 before surgery and a value of 76.31 after surgery. Based on history, physical examination, and investigations, the patient was diagnosed with schwannoma cervical 3-4.

Case 2

A 47-year-old man with a complaint of worsening stiff neck 1 year before admission. Six months later, weakness in his left hand was felt and he could not button his shirt properly which was accompanied by leg weakness when walking. Figure 2 depicts radiological and histopathological results.

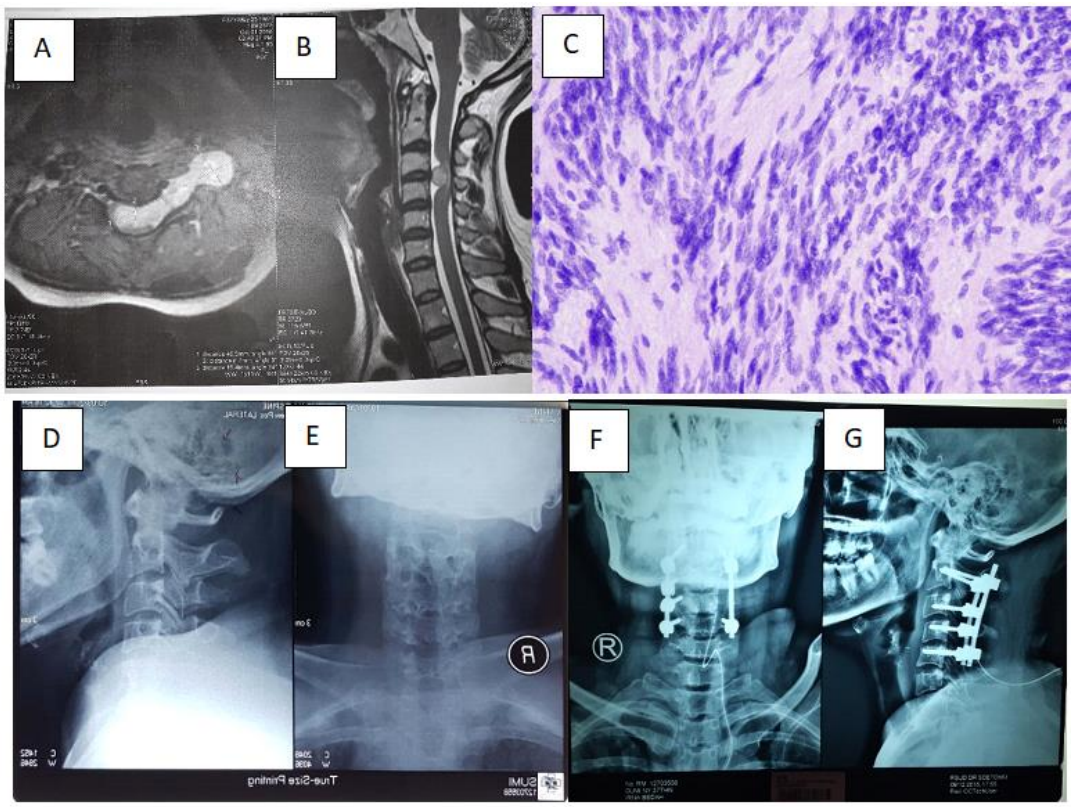

FIGURE 1 (A) Axial view, (B) sagittal view of pre-operative MRI examination, (C) histopathological examination conducted after surgery, (D) anteroposterior (AP) view, (E) lateral view of pre-operative X-ray, (F) AP view, and (G) Lateral view of post-operative X-ray

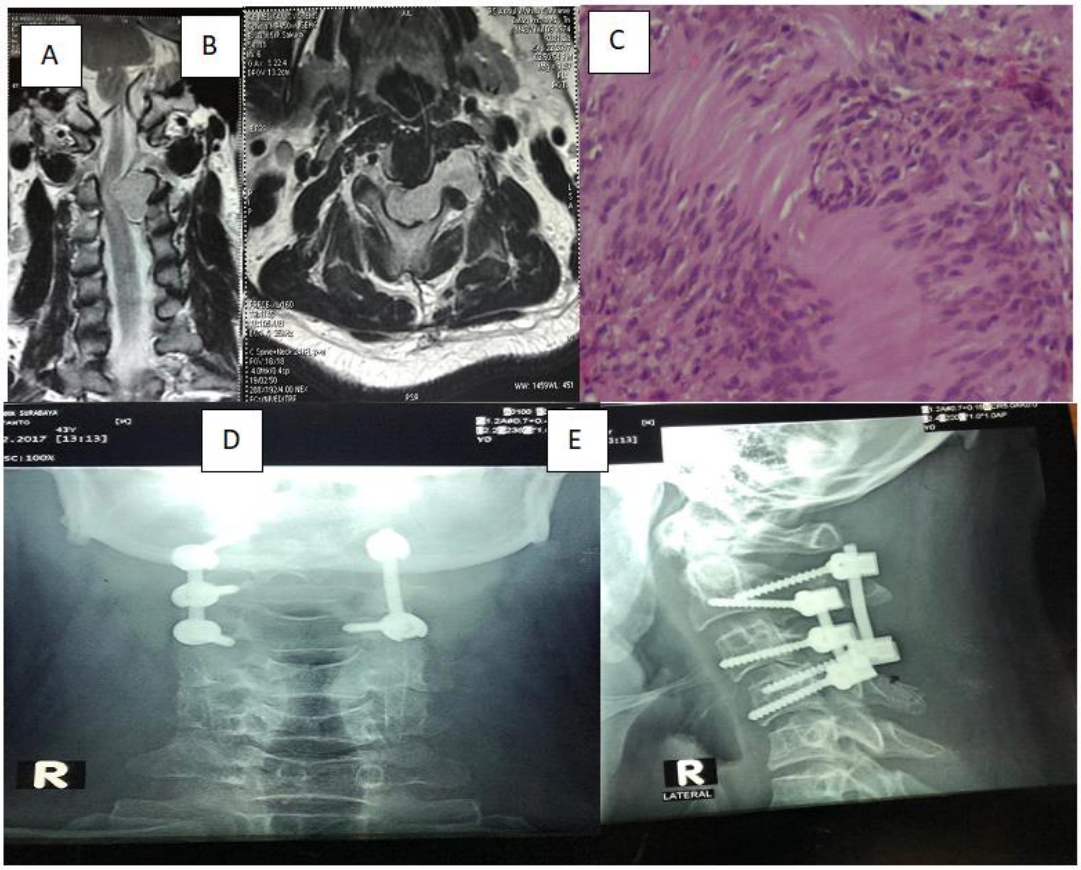

FIGURE 2 (A) Sagittal view, (B) axial view of pre-operative MRI, (C) postoperative histopathology examination, (D) AP view, and (E) Lateral of postoperative X-ray

Pre-operative MRI showed an intradural mass at level cervical 2-3 in the left side of the spinal canal extending extradural through the left neural foramina. Histopathology examination shows pieces of nerve tissue with spindle core cell proliferation arranged in partial bundles in the palisading matrix fibril structure, there is also a microcystic area but no malignancy was found. The patient underwent tumor debulking and posterior stabilization surgery. After surgery, the patient felt the strength of both hands and feet had returned. Neck pain is still seldom felt. Muscle power of extremities increased from MMT 4/4 preoperatively to 5/5 at 1 year after surgery. Evaluation using SF-36 obtained an average value of 74.5 before surgery and a value of 99 after surgery. This patient was diagnosed with schwannoma cervical 2-3 based on the history, physical examination, and investigations.

Case 3

A 47-year-old man, with back pain accompanied by a tingling sensation on both legs for 2 years before admission. Back pain was worsening and accompanied by paralysis and numbness in both legs 1 year before admission. Bladder and bowel incontinence was also felt by the patient. Figure 3 demonstrates pre-operative X-ray, MRI, post-operative X-ray, and histopathologic result.

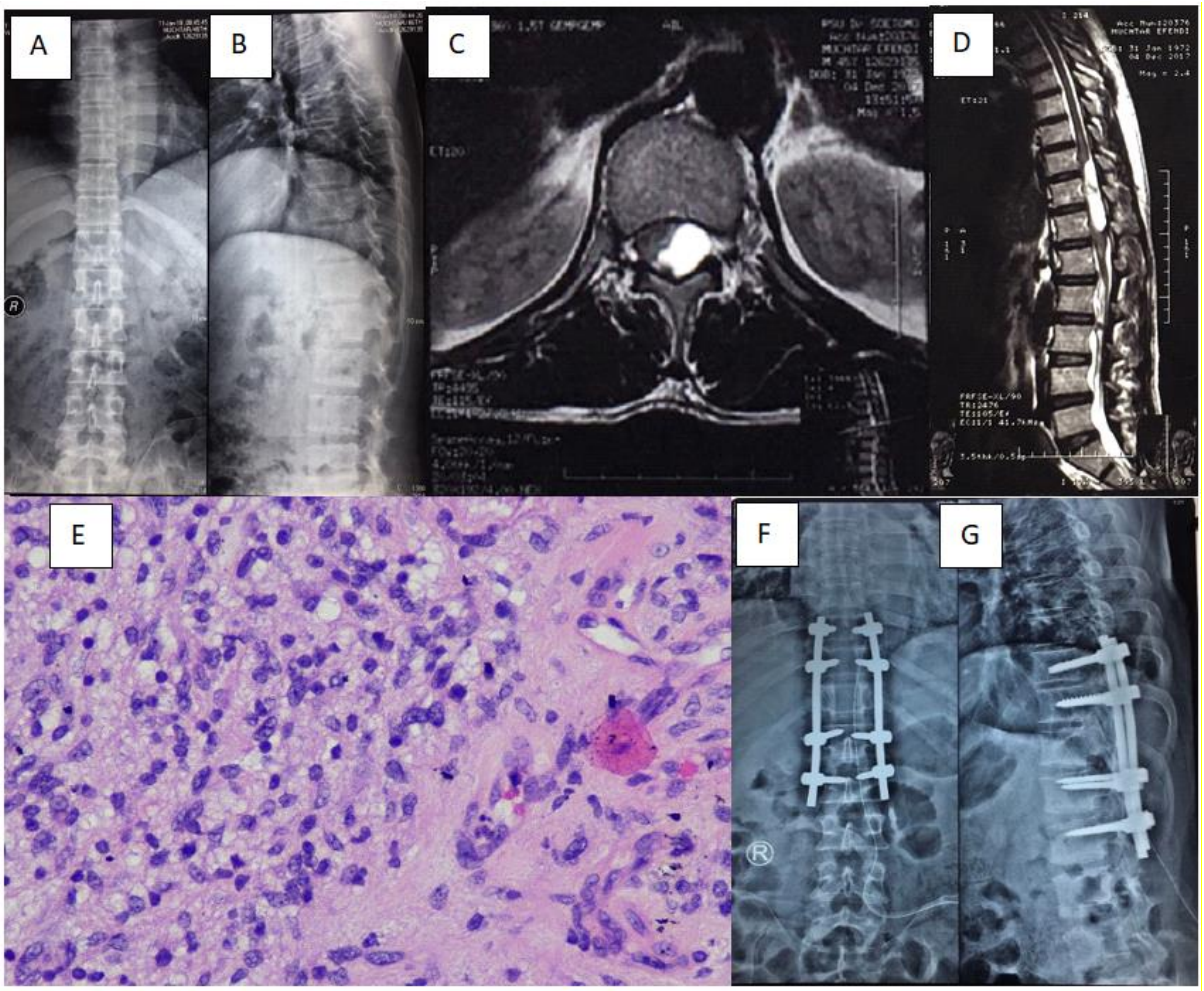

FIGURE 3 (A) AP view, (B) lateral view of pre-operative thoracolumbar X-ray, (C) axial view, and (D) sagittal view of pre-operative thoracolumbar MRI, (E) post-operative histopathology results, (F) AP view, and (G) lateral view of post-operative X-ray

Pre-operative X-ray did not show abnormality while MRI showed cystic intradural extramedullary mass at left-sided posterior to thoracic 10-12 which pushes the spinal cord to the right anterolateral side. Histopathology results show biphasic tumor growth in the form of a dense (hypercellular) dominant area and a loose (hypocellular) area, as shown in Figure 3. The hypercellular area consists of the proliferation of cells with an oval nucleus to the spindle, smooth chromatin, and sufficient cytoplasm, which are arranged to form fascicles. The patient underwent neural decompression, tumor excision with CUSA, and posterior stabilization. After surgery, the patient still feels mild pain spreading from the waist to the legs, but not severe. Both legs still felt tingling sometimes. The patient can walk about 300 meters with no assistance. Urinary and defecation were normal with no incontinence. Leg muscle motor power was increased from MMT 2/2 pre-operatively to 5/5 at 1 year post-operative. Evaluation using SF-36 obtained an average value of 41.81 before surgery and a value of 78.62 after surgery. Based on the history, physical examination, and investigations, the patient was diagnosed with schwannoma thoracic 10-12.

SF-36 Result

Quality of life evaluation using a short-form questionnaire (SF-36) is shown in Table 1. The evaluation includes physical function, physical and emotional role limitation, bodily pain, general health, vitality, social function, and mental health before and after surgery. Descriptive analysis showed the lowest pre-operative SF-36 total score was lowest in the third patient with a score of 41.81 while the highest score was in the second patient with a score of 74.5.

TABLE 1 SF-36 result for each patient

	Patient 1		Patient 2		Patient 3	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Physical function	10	80	65	100	10	80
Role limitation - Physical range	0	50	65	100	0	50
Role limitation - Emotional range	50	50	90	100	50	50
Vitality	75	90	90	100	65	80
Mental Health	84	88	96	100	72	84
Social function	87.5	100	90	100	87.5	100
Bodily pain	10	67.5	15	95	10	100
General health	50	85	85	100	40	85
Mean	45.81	76.31	74.5	99	41.81	78.62

The results of the mean SF-36 pre-operative total score was 54.04 compared to the post-operative total mean score of 84.64. The normality test using Saphiro-Wilk showed normal distribution p=0.215 (p>0.05). Therefore, a paired t-test was used with a value of p = 0.013 which showed a significant difference between the mean pre-operative and post-operative SF-36 scores (Table 2). This shows that there is a significant improvement in quality of life after surgery.

TABLE 2 Average comparison of SF-36 total scores for pre and post-surgery

Variable	N	Mean	Standard Deviation	*p*-value
Pre-operative	3	54.04	17.83	0.013
Post-operative	3	84.64	12.49	

Discussion

There were 3 patients who were diagnosed with spinal Schwannoma. Clinical improvements, neurological status, and functional status based on SF-36 were observed in all patients compared to the pre-operative condition.

Histologically, Schwannoma consists of long-spindle-shaped Schwann cell bundles (type Antoni A) that often mix with areas that are rarely polymorphic Schwann cells embedded in an eosinophilic loose matrix (type B Antoni). The majority of schwannomas are completely intradural, but some expanded extraforaminal as dumbbell masses or purely extradural. Study shows that 75% of schwannomas are intradural extramedullary, 15% completely extradural, and 1% to 19% both intradural and extradural [9]. This corresponds to this study that one of the patients was intradural while two patients were both intradural and extradural. However further study is needed since the risk of some type of malignant schwannoma is found through the examination of immunohistochemical studies [11].

Surgery for spinal schwannoma usually produces good functional post-operative results. Spinal schwannoma also shows a good or stable prognosis even though there may be recurrence in cases of previous subtotal excision surgery. Although minimal invasive resection of intradural extramedullary spinal tumors has been explained, the most commonly reported surgical procedure is single-level posterior laminectomy for access to the spinal sac and spinal cord for tumor resection [9,12-13]. All three presented cases were performed tumor excision surgery through a posterior approach with laminectomy and posterior stabilization. A posterior approach with either semi-laminectomy, laminectomy, combined anterior and posterior approach for giant schwannoma, or minimal invasive surgery (MIS) has been described as a possible surgical approach, however, there is still a limitation of MIS in tumor size more than 16 mm in axial diameter and located other than lumbar spine region [1,10,14].

In this study, all three patients had overall functional, neurological, and clinical improvement after surgery. Previous studies show that more than 60% of spinal schwannoma patients had complete recovery of neurological deficit and pain 1 year after surgery [15]. However, the risk of recurrence still needs further study, especially in the case of the first patient. This is important because approximately 16% of spinal schwannoma cases experience recurrence or regrowth. The most significant risk factors for recurrence include tumor size exceeding two vertebrae, extraspinal component exceeding 2.5 cm, and tumor erosion into the vertebral body [16]. The other study shows that patients who underwent gross total resection surgery had a low rate of recurrence, even with subtotal removal. This low rate of recurrence, which accounts for only about 7%, is thought to be caused by the slow-growing nature of schwannoma [12,17].

Conclusion

In this study, all patients showed good functional clinical improvement after tumor excision. In the evaluation using SF-36 the mean pre-operative SF-36 total score was 54.04 ± 17.83 compared to the post-operative total mean score of 84.64 ± 12.49. This study found a significant improvement in the quality of life of patients after surgery compared to before surgery, as well as an improvement in neurological status compared to the condition before surgery. However, prompt periodical follow-up of patients should be performed to evaluate for recurrence, and larger data for further research is required to be applicable to the wider population.

Acknowledgements

The authors would like to express gratitude to fellow colleagues at Department of Orthopaedics and Traumatology, Faculty of Medicine, Universitas Airlangga/ Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, for their continuous support during the completion of this paper.

Funding

None.

Authors' Contributions

All authors contributed to study design, implementation, data collection and analysis, drafting, and revising of the manuscript.

Conflict of Interest

The authors have no conflict of interest to declare regarding this paper.

Orcid:

Lukas Widhiyanto:*
https://orcid.org/0000-0002-1241-6172
Ilham Pratamanugroho:
https://orcid.org/0009-0000-0849-818X

References

[1] J. Lenzi, G. Anichini, A. Landi, A. Piciocchi, E. Passacantilli, F. Pedace, R. Delfini, A. Santoro, Spinal nerves schwannomas: experience on 367 cases—historic overview on how clinical, radiological, and surgical practices have changed over a course of 60 years, *Neurology Research International*, **2017**, *2017*. [Crossref], [Google Scholar], [Publisher]

[2] S. Tish, G. Habboub, M. Lang, Q.T. Ostrom, C. Kruchko, J.S. Barnholtz-Sloan, P.F. Recinos, V.R. Kshettry, The epidemiology of spinal schwannoma in the United States between 2006 and 2014, *Journal of Neurosurgery: Spine*, **2019**, *32*, 661-666. [Crossref], [Google Scholar], [Publisher]

[3] I. Sun, M.N. Pamir, Non-syndromic spinal schwannomas: a novel classification, *Frontiers in Neurology*, **2017**, *8*, 269954. [Crossref], [Google Scholar], [Publisher]

[4] A. Pokharel, T.S. Rao, P. Basnet, B. Pandey, N.J. Mayya, S. Jaiswal, Extradural cervical spinal schwannoma in a child: a case report and review of the literature, *Journal of Medical Case Reports*, **2019**, *13*, 1-5. [Crossref], [Google Scholar], [Publisher]

[5] K. Ando, S. Imagama, Z. Ito, K. Kobayashi, H. Yagi, T. Hida, K. Ito, M. Tsushima, Y. Ishikawa, N. Ishiguro, How do spinal schwannomas progress? The natural progression of spinal schwannomas on MRI, *Journal of Neurosurgery: Spine*, **2016**, *24*, 155-159. [Crossref], [Google Scholar], [Publisher]

[6] J. Crist, J.R. Hodge, M. Frick, F.P. Leung, E. Hsu, M.T. Gi, S.K. Venkatesh, Magnetic resonance imaging appearance of schwannomas from head to toe: a pictorial review, *Journal of Clinical Imaging Science*, **2017**, *7*. [Crossref], [Google Scholar], [Publisher]

[7] R.R. Kalra, O.N. Gottfried, M.H. Schmidt, Spinal schwannomas: an updated review of surgical approaches, *Contemporary Neurosurgery*, **2015**, *37*, 1-8. [Crossref], [Google Scholar], [Publisher]

[8] K. Kobayashi, S. Imagama, K. Ando, T. Hida, K. Ito, M. Tsushima, Y. Ishikawa, A. Matsumoto, M. Morozumi, S. Tanaka, N. Ishiguro, Contrast MRI findings for spinal schwannoma as predictors of tumor proliferation and motor status, *Spine*, **2017**, *42*, 150-155. [Crossref], [Google Scholar], [Publisher]

[9] S. Matsuda, Y. Kajihara, M. Abiko, T. Mitsuhara, M. Takeda, V. Karlowee, S. Yamaguchi, V.J. Amatya, K. Kurisu, Concurrent schwannoma and meningioma arising in the same spinal level: a report of two cases, *NMC Case Report Journal*, **2018**, *5*, 105-109. [Crossref], [Google Scholar], [Publisher]

[10] S.E. Lee, T.A. Jahng, H.J. Kim, Different surgical approaches for spinal schwannoma: a single surgeon's experience with 49 consecutive cases, *World Neurosurgery*, **2015**,

84, 1894-1902. [Crossref], [Google Scholar], [Publisher]
[11] B. Li, J. Li, W. Miao, Y. Zhao, J. Jiao, Z. Wu, X. Yang, H.Wei, J. Xiao, Prognostic analysis of clinical and immunohistochemical factors for patients with spinal schwannoma, *World Neurosurgery*, **2018**, *120*, 617-627. [Crossref], [Google Scholar], [Publisher]
[12] K. Yamane, T. Takigawa, M. Tanaka, S. Osaki, Y. Sugimoto, T. Ozaki, Factors predicting clinical impairment after surgery for cervical spinal schwannoma, *Acta Medica Okayama*, **2013**, *67*, 343-349. [Crossref], [Google Scholar], [Publisher]
[13] A. Pompili, F. Caroli, F. Crispo, M. Giovannetti, L. Raus, A. Vidiri, S. Telera, Unilateral laminectomy approach for the removal of spinal meningiomas and schwannomas: impact on pain, spinal stability, and neurologic results, *World Neurosurgery*, **2016**, *85*, 282-291. [Crossref], [Google Scholar], [Publisher]
[14] Q. Deng, Z.Tian, W. Sheng, H. Guo, M.E. Dan, Surgical methods and efficacies for cervicothoracolumbar spinal schwannoma, *Experimental and Therapeutic Medicine*, **2015**, *10*, 2023-2028. [Crossref], [Google Scholar], [Publisher]
[15] C. Hohenberger, J. Hinterleitner, N.O. Schmidt, C. Doenitz, F. Zeman, K.M. Schebesch, Neurological outcome after resection of spinal schwannoma, *Clinical Neurology and Neurosurgery*, **2020**, *198*, 106127. [Crossref], [Google Scholar], [Publisher]
[16] T. Takahashi, T. Hirai, T. Yoshii, H. Inose, M. Yuasa, Y. Matsukura, S. Morishita, Y. Kobayashi, K. Utagawa, A. Kawabata, J. Hashimoto, Risk factors for recurrence and regrowth of spinal schwannoma, *Journal of Orthopaedic Science*, **2023**, *28*, 554-559. [Crossref], [Google Scholar], [Publisher]
[17] M. Sowash, O. Barzilai, S. Kahn, L. McLaughlin, P. Boland, M.H. Bilsky, I. Laufer, Clinical outcomes following resection of giant spinal schwannomas: a case series of 32 patients. *Journal of Neurosurgery: Spine*, **2017**, *26*, 494-500. [Crossref], [Google Scholar], [Publisher]

How to cite this article: Lukas Widhiyanto, Ilham Pratamanugroho, Management of spinal schwannoma and post-operative clinical improvement: A case series. *Journal of Medicinal and Pharmaceutical Chemistry Research*, 2024, 6(10), 1598-1605. **Link:** https://jmpcr.samipubco.com/article_195660.html