Cancer Cell Research
20 (2018) 507-510
Available at http:// www.cancercellresearch.org
ISSN 2161-2609

Evaluation of curative effects of single segmental bilateral screw system implantation and resection of spinal canal neurilemmoma

Dexun Wang, Huacong Wang, Qizun Wang, Zhongying Wang, Shuzhong Li*
Department of Spine Surgery, the Affiliated Hospital of Qingdao University, Qingdao, 266100, China

Abstract: **Patients who underwent single segment bilateral screw system implantation and resection of spinal canal neurilemmoma were retrospectively analyzed. A total of 38 patients underwent single segmental bilateral screw rod system implantation and spinal canal neurilemmoma resection in Laoshan Hospital, Qingdao University Affiliated Hospital between January 2016 and January 2018. Patients were followed up three months postoperatively. The Lovett score of muscle strength, visual analogue score (VAS), and Japanese Orthopaedic Association Scores (JOA) before and after surgery were analyzed to evaluate the effect of single segmental bilateral screw system implantation and spinal canal neurilemmoma resection. JOA and Lovett scores were significantly higher than preoperatively (P <0.05). The postoperative pain score was lower than preoperatively (P <0.05). Bilateral screw rod implantation and resection of spinal canal neurilemmoma may be of benefit for the treatment of spinal canal neurilemmoma.**

Keywords: Spinal canal neurilemmoma; Curative effects; Evaluation

Received 2 August 2018, Revised 8 September 2018, Accepted 10 September 2018

*Corresponding Author: Shuzhong Li

1. Introduction

Early detection and surgical treatment are the first choice for the treatment of spinal cord schwannoma[1,2]. Operative approaches include minimally invasive surgery and open surgery, among others. Although minimally invasive surgery has many advantages, conventional open surgery still demonstrates superiority. However, open surgery is a common complication, which leads to the destruction of bone structure, the destruction of surrounding tissues, instability of the spine after operation, and patient pain after the operation. Based on the retrospective analysis of 38 patients who received posterior laminectomy, neurilemmoma resection and screw rod system implantation during the period of 2016.01-2018.01, we found that the screw and rod system implantation had a good effect on the prognosis.

2. Methods

2.1. Demographic information

A total of 38 patients (male 16, female 22, age 12-78, average age 52.6 years) were selected in this work. A total of seven cases had cervical spine tumors, 12 had thoracic vertebrae tumors, four had thoracolumbar junction tumors, and 15 cases were lumbar vertebrae tumors. All patients underwent preoperative examination, including radiographic examination and MRI examination. Individual patients had enhanced MRI examination and there were no legal problems with diagnosis and treatment processes.

2.2. Clinical characteristics

In this group, except for one patient with recurrence, all patients were newly diagnosed. The longest case history was greater than 20 years and the shortest case history was two days. According to the location and size of the tumor, 18 patients had different clinical manifestations besides somatic pain. There were 16 patients with varying degrees of limb numbness and weakness, of which only one was characterized by unstable walking. The longest hospital stay was 22 days, the shortest was five days, and the average time was 11.7 days. The longest operative time was 276 minutes and the shortest time was 55 minutes; the average time was 152.6 minutes. Postoperative discharge time was 21 days, the shortest was 3 days, and the average was 7.9 days.

2.3. Surgical treatment

After successful general anesthesia, all patients underwent a midline incision, stripping of the paraspinal muscle to the outer edge of the articular process, and implantation of four pedicle screws bilaterally (Figure 1). The upper and lower articular processes and laminae were opened at the intervertebral foramen and the soft tissue, lamina, and foramen of the tumor were excised after exposure of the visual field and the larger tumor tissue was removed after segmental separation. After the visual field was clear, the residual tumor was resected and the bleeding was stopped by bipolar electrocoagulation. If the tumor invaded into the epidural space, the tumor tissue could be resected after unilateral "T" incision of the dura. After complete resection of the mass, decompression and fragmentation were performed with bilateral intertransverse bone grafts, then suture and drainage were performed. Postoperatively, the drainage tube was pulled out according to drainage rate and antibiotics were used regularly to prevent infection.

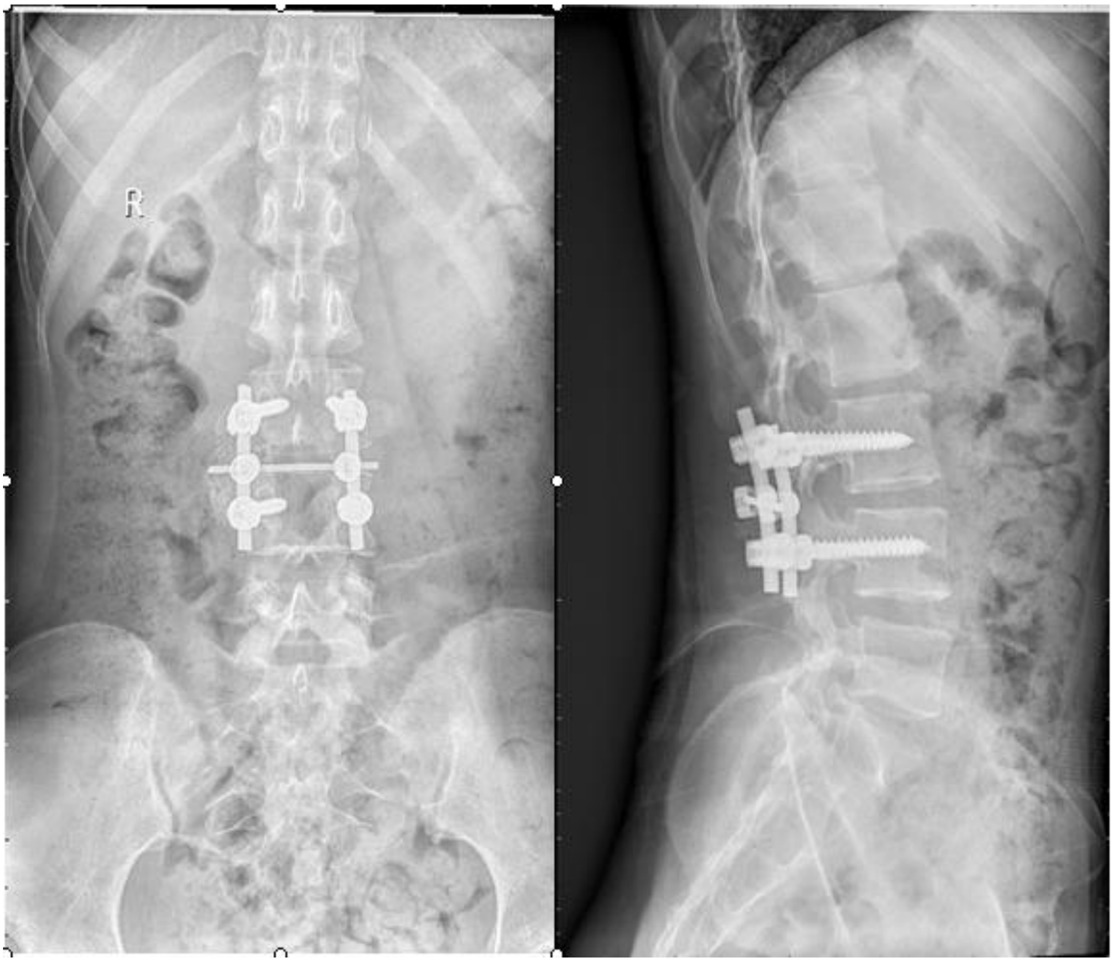

Figure 1. Pedicle screw fixation with titanium alloy rod.

2.4. Cerebrospinal fluid leakage management

We think that on the first postoperative day, drainage flow was higher than average drainage flow or an abnormal increase of drainage flow was regarded as cerebrospinal fluid leakage. Of the 38 patients, there were 16 patients with cerebrospinal fluid leakage, accounting for 42.1%. Mainly because of tumor resection, there was damage to the integrity of the dura. Patients with cerebrospinal fluid leakage were treated with fluid resuscitation, pressure suture, and so on. There was no postoperative infection.

2.5. Observation indicators and evaluation criteria

Radiographic examination was performed 3 months after internal fixation and JOA scores were evaluated for pain and muscle strength. Postoperative spinal stability, pain, muscle strength, and treatment scores were evaluated and complications were counted. Pain was assessed by language description score (VAS), muscle strength was graded by Lovett grading, and JOA score was used for treatment. Radiographic examination was performed 3 days and 3 months postoperatively. Pain, muscle strength, neurological function, and quality of life were measured. Evaluation criteria included language description score, Lovett muscle strength grading, and JOA score. JOA17 for cervical vertebra, JOA11 for thoracic vertebra, and JOA29 for lumbar vertebra were used. The JOA curative effect evaluation standard was as follows: when the treatment improvement rate was $\geqslant 75$, it was superior; 50%-74% was good; and 25%-49% was bad. The improvement rate of treatment = (postoperative score- preoperative score)/(total score-preoperative score) $\times 100\%$.

2.6. Statistical methods

Values are presented as the mean ± SD. Clinical features were compared using the Student's t-test for quantitative variables and the chi-squared test for categorical variables. All statistical analyses were conducted using SPSS software, version 20.0 (SPSS Inc., Chicago, IL, USA). All reported P values were two-sided, and a P value of < 0.05 was considered statistically significant.

3. Results

Table 1 shows that postoperative VAS scores were significantly lower than preoperative scores, and that VAS scores of patients 3 months postoperatively were lower than those of patients on the day of discharge. The difference was statistically significant (P <0.01). The effect was more obvious as operative time increased. According to information provided in Table 1, JOA scores of patients with different pathological segments increased significantly compared with those of the previous period (P <0.01); the improvement rate of JOA was proportional to change in time (P <0.01). According to Table 2, distribution of muscle strength changed (a, P <0.05; b, P <0.05), which indicated that muscle strength recovered in different degrees postoperatively compared with preoperatively.

Table 1. VAS, JOA score in 38 patients

Items	Preoperative	Day of discharge	3 months after discharge
VAS score	4.13±2.65	1.92±1.62**	0.76±0.82**
Cervical JOA (n=7)	9.29±0.49	13.71±0.95**	15.86±0.38**
Thoracic JOA (n=15)	5.80±0.86	7.80±0.94**	9.87±0.52**
Lumbar JOA (n=16)	16.56±2.10	22.31±2.06**	26.94±1.06**
Improvement Rate（%）		44.99±15.65	82.05±8.34

Values are mean ±SD, **P<0.01 vs preoperative

Table 2. Comparison of muscle force grading before and after the treatment (%)

Items	Muscle force grading		
	III	IV	V
Preoperative	36.8	47.4	15.8
Day of discharge	10.5[a]	68.4[a]	21.1[a]
3 months after discharge	0[b]	23.7[b]	76.3[b]

[a]*P*<0.05, vs preoperative; [b]*P*<0.05, vs preoperative.

4. Discussion

Neurilemmoma is a type of neurogenic tumor, also called schwannoma, and one of the most common benign tumors of the spinal canal. Data showed that the incidence of neurilemmoma accounted for about 25% of the space-occupying lesions in the spinal canal. Its clinical symptoms are mostly related to the corresponding segments of the spinal cord, time of nerve root compression, degree of compression, and so on. The disease is also varied, and can include pain, limb numbness, dysfunction of defecation and urination, and even paraplegia[3]. Because the clinical manifestations of spinal canal neurilemmoma are similar to those of disc herniation, it is easy to misdiagnose spinal canal neurilemmoma as intervertebral disc herniation, in the absence of a relevant examination. There are many reports of misdiagnosis[4,5]. MRI plays an important role in the diagnosis of spinal canal neurilemmoma, especially in the application of enhanced MRI. MRI has high diagnostic accuracy and resolution[6]. Surgical treatment has great advantages in the treatment of spinal canal neurilemmoma. Neurilemmoma is not sensitive to radiotherapy or chemotherapy[7,8]. Therefore, surgical treatment is the most effective treatment at present. The main purpose of surgical resection is to remove the tumor, relieve and alleviate local nerve compression, and traction of the tumor. Complete resection of neurilemmoma can significantly reduce recurrence rate[1,2]. At present, posterior total laminectomy, posterior hemilaminectomy, and minimally invasive excision are the operative approaches, with each operation having its own unique advantages and disadvantages.

The key to surgical treatment is to remove the neurilemmoma completely, relieve the compression of the spinal cord and nerve, restore nerve function, eliminate nerve symptoms, and reduce recurrence. Minimally invasive surgery is a new operative method, which has the characteristics of less trauma, faster recovery, better quality of life, and higher economic benefit[9]. Compared with traditional surgery, minimally invasive surgery makes it difficult to remove the tumor completely, and has poor adaptability to tumor location, size, and other factors[10]. Open surgery has many adverse factors, such as more trauma, a long recovery period, more destruction of bone tissue, and instability of the spine after the operation[2]. Open surgery has the advantages of a good visual field, clear exposure, and ease of completing resection. Semilaminectomy is an approach that is between minimally invasive surgery and total laminectomy. Minimally invasive surgery is not optimal for addressing position and size of the tumor[11].

It is undeniable that open surgery for spinal bone structure, as well as destruction of paraspinal muscles and surrounding vessels will affect prognosis[12]. According to the Denis column theory, the posterior column plays an important role in maintaining spinal stability. It has been shown that the removal of the articular process can result in increased intersegmental rotation, which may affect spinal stability. Pedicle screw implantation can obviously improve stability of the spine and prevent instability. It can also significantly reduce postoperative pain[13,14]. To a certain extent, pedicle screw implantation can maintain the position of the vertebral body, replace the ligament, the role of the spinous process, and restore the stability of the spine[1]. In addition, open surgery can fully expose the surgical visual field, which is conducive to complete resection of the tumor. Hemostasis in open surgery is also more complete than with other procedures, and can more effectively prevent postoperative bleeding.

5. Conclusion

Based on the statistical analysis of this group of patients, it can be concluded that after open surgery single segment laminectomy, bilateral pedicle screw implantation, and spinal canal mass resection, postoperative prognosis is good. We believe that pedicle screw implantation can effectively prevent postoperative vertebral instability and reduce postoperative pain. Of the 38 patients undergoing surgical treatment, no significant vertebral body slippage was found at postoperative follow-up. Therefore, although this operation is a traditional approach, combined with pedicle screw implantation, it has great advantages in the treatment of spinal canal neurilemmoma.

References

[1] Yu NH, Lee SE, Jahng TA, et al. Giant invasive spinal schwannoma: its clinical features and surgical managemen[J]t. Neurosurgery, 2012, 71(1):58-66.

[2] Yeh KT, Lee RP, Yu TC, et al. Surgical outcome of spinal neurilemmoma: two case reports[J]. Medicine, 2015, 94 (5):e490.

[3] Engelhard HH, Villano JL, Porter KR, et al. Clinical presentation, histology, and treatment in 430 patients with primary tumors of the spinal cord, spinal meninges, or cauda equina[J]. Journal of neurosurgery Spine, 2010, 13(1):67-77.

[4] Kulcu DG, Naderi S. Differential diagnosis of intraspinal and extraspinal non-discogenic sciatica[J]. Journal of clinical neuroscience: official journal of the Neurosurgical Society of Australasia, 2008, 15(11):1246-1252.

[5] Pan J, Wang Y, Huang Y. Coexistence of intervertebral disc herniation with intradural schwannoma in a lumbar segment: a case report[J]. World journal of surgical oncology, 2016, 14:113.

[6] Parmar H, Patkar D, Gadani S. Cystic lumbar nerve sheath tumours: MRI features in five patients[J]. Australasian radiology, 2001, 45(2):123-127.

[7] Li H, Weng Y, Zhou D, et al. Experience of operative treatment in 27 patients with intraspinal neurilemmoma[J]. Oncology letters, 2017, 14 (4):4817-4821.

[8] Huang JH, Simon SL, Nagpal S, et al. Management of patients with schwannomatosis: report of six cases and review of the literature[J]. Surgical neurology, 2004, 62 (4):353-361.

[9] Zhu YJ, Ying GY, Chen AQ et al. Minimally invasive removal of lumbar intradural extramedullary lesions using the interlaminar approach[J]. Neurosurgical focus, 2015, 39 (2):E10.

[10] Xing S, Wei S, Yu Z et al. Micro surgical resection of intra- and extraspinal dumbbell-shape schwannoma through enlarged intervertebral foramen approach[J]. Journal of Kunming Medical University, 2017, 38(09):71-73.

[11] Ng Z, Ng S, Nga V et al. Intradural spinal tumors-review of postoperative outcomes comparing intramedullary and extramedullary tumors from a single institution's experience[J]. World neurosurgery, 2018, 109:229-232.

[12] Fessler RG, O'Toole JE, Eichholz KM, et al. The Development of minimally invasive spine surgery[J]. Neurosurgery Clinics of North America, 2006, 17(4).

[13] Fan Z, Zheng L, Bingqiang W, et al. Effects on single segmental lumbar stability after graded facetectomy and laminectomy: a finite element study[J]. Zhonghua Yi Xue Za Zhi, 2015, 95(13):973.

[14] Liu XY, Zheng YP, Li JM. Laminoplasty for the treatment of extramedullary intradural tumors in the thoracic and lumbar spine: greater than two - year follow-up[J]. Orthopaedic Surgery, 2010, 1(4):275-279.