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Original Research

Evaluation of Surgical Management of Multilevel Cervical Spinal Stenosis & Cord Injury with Cervical Spine Fracture at a Tertiary Care Hospital

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ABSTRACT

Background: Spinal stenosis is characterized by the compression of nerve roots due to various pathological factors, resulting in symptoms such as pain, numbness, and weakness. Surgical options are warranted for patients experiencing considerable functional limitations due to one to two-level disease or deformity. Hence, the present study was conducted to evaluate surgical management of multilevel cervical spinal stenosis & cord injury with cervical spine fracture at a tertiary care hospital.

Materials &Methods: A total of 100 patients with cervical vertebrae trauma were enrolled. A total of 40 patients presenting with multilevel cervical spinal stenosis and spinal cord injuries associated with unstable fractures were identified based on CT and MRI evaluations. These patients were categorized according to the specific type of their conditions: five patients exhibited ossification of the posterior longitudinal ligament alongside one intervertebral disc rupture; nine patients had two-disc herniations and one rupture; seven patients experienced two herniations and two ruptures; and 19 patients were found to have three herniations and three ruptures. An open-door expansive spinal decompression was executed via the posterior approach, and the suspended laminae were secured to the connecting rod. Following the surgical intervention, skull traction was removed, and standard postoperative medical management was initiated, which included glucocorticoid therapy, dehydration treatment, conventional nerve nutrition, and prophylactic antibiotics. The safety of the cervical pedicle screw (CPS) placement was assessed through radiological evaluations. All findings were documented in a Microsoft Excel spreadsheet and subsequently analyzed statistically using SPSS software.

Results: Mean age of the patients was 45.3 years. 80 percent of the patients were males while the remaining 20 percent were females. Four screws fixations, Six screw fixations and Eight screw fixations were seen in 32.5 percent, 45 percent and 22.5 percent of the patients respectively. Mean operative time was 183.6 minutes while mean intraoperative blood loss was 412.3 ml. Mean JOA improved from preoperative value of 3.95 to final postoperative value of 8.07. Cerebrospinal fluid leakage, pulmonary infection and urinary tract infection were seen in 2.25 percent, 5 percent and 2.25 percent of the patients respectively.

Conclusion: The open-door expansive laminoplasty, when paired with posterior transpedicular screw fixation, is a viable procedure that results in reduced blood loss.

Key words: Spinal, Stenosis, Injury.

INTRODUCTION

Spinal stenosis is characterized by the compression of nerve roots due to various pathological factors, resulting in symptoms such as pain, numbness, and weakness. This condition predominantly affects the cervical region of the neck and the lumbar region of the lower back, although the thoracic spine can also experience compression, often due to a herniated disc. There are three distinct anatomical sites within the vertebral canal that may be impacted by spinal stenosis.[1, 2] The first is

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the central canal, which contains the spinal cord; its narrowing in the anterior-posterior dimension can lead to the compression of neural structures and a decrease in blood flow to the spinal cord in the cervical region and the cauda equina in the lumbar region. The second site is the neural foramen, the openings through which nerve roots exit the spinal cord, which can become compressed due to factors such as disc herniation, hypertrophy of the facet joints and ligaments, or instability caused by slippage of one vertebral body over another. Finally, the lateral recess, found only in the lumbar spine, is the area along the pedicle where a nerve root enters just prior to exiting through the neural foramen; this area can also be compressed due to hypertrophy of the facet joint.[3, 4]Conservative management is recommended when there are no severe clinical symptoms present. Surgical options, such as anterior cervical discectomy or corpectomy with fusion, posterior cervical discectomy and fusion, laminectomy, laminoplasty, or a combination of these techniques, are warranted for patients experiencing considerable functional limitations due to one to two-level disease or deformity.[5, 6]Hence; the present study was conducted to evaluate surgical management of multilevel cervical spinal stenosis & cord injury with cervical spine fracture at a tertiary care hospital.

MATERIALS & METHODS

A total of 100 patients with cervical vertebrae trauma were enrolled. A total of 40 patients presenting with multilevel cervical spinal stenosis and spinal cord injuries associated with unstable fractures were identified based on CT and MRI evaluations. These patients were categorized according to the specific type of their conditions: five patients exhibited ossification of the posterior longitudinal ligament alongside one intervertebral disc rupture; nine patients had two-disc herniations and one rupture; seven patients experienced two herniations and two ruptures; and 19 patients were found to have three herniations and three ruptures. The SLIC (subaxial cervical spine injury classification) scores for all patients exceeded 5 points, with a mean score of 5.73 points. The patient was positioned in a prone orientation, and the surgical procedure was conducted under general anesthesia with tracheal intubation. A posterior median incision was created utilizing an electric knife, allowing for a meticulous layer-by-layer dissection from the skin to the spinous process along the midline of the ligament. The bilateral paravertebral muscles adjacent to the articular process were carefully separated to reveal the affected spinous process, lamina, and facet joints. The bone at the site designated for screw placement was drilled in accordance with anatomical landmarks and preoperative transpedicular computed tomographic imaging, and a custom aiming device was affixed to the spinous process either above or below the targeted segment for screw insertion. An open-door expansive spinal decompression was executed via the posterior approach, and the suspended laminae were secured to the connecting rod. Following the surgical intervention, skull traction was removed, and standard postoperative medical management was initiated, which included glucocorticoid therapy, dehydration treatment, conventional nerve nutrition, and prophylactic antibiotics. The safety of the cervical pedicle screw (CPS) placement was assessed through radiological evaluations. All findings were documented in a Microsoft Excel spreadsheet and subsequently analyzed statistically using SPSS software.

Table 1: General characteristics

Variable	Number	Percentage
Mean age (years)	45.3	
Males	32	80
Females	8	20
Four screws fixations	13	32.5
Six screw fixations	18	45
Eight screw fixations	9	22.5

Table 2: Operative time and intraoperative blood loss

Variable	Mean	SD
Operative time (mins)	183.6	23.8
Intraoperative blood loss (ml)	412.3	48.4

Table 3: Outcome variable

Variables	Mean	p-value
Preoperative JOA	3.95	0.001 (Significant)
Postoperative JOA	8.07	

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Table 4: Complications

Complications	Number	Percentage
Cerebrospinal fluid leakage	1	2.25
Pulmonary infection	2	5
Urinary tract infection	1	2.25

RESULTS

The mean age of the patients was 45.3 years. 80 percent of the patients were males while the remaining 20 percent were females. Four screws fixations, six screw fixations and Eight screw fixations were seen in 32.5 percent, 45 percent and 22.5 percent of the patients respectively. Mean operative time was 183.6 minutes while mean intraoperative blood loss was 412.3 ml. Mean JOA improved from preoperative value of 3.95 to final postoperative value of 8.07. Cerebrospinal fluid leakage, pulmonary infection and urinary tract infection were seen in 2.25 percent, 5 percent and 2.25 percent of the patients respectively.

DISCUSSION

Spinal stenosis is a pathological condition characterized by the constriction of the vertebral spinal canal and the lateral recesses. This narrowing frequently results in the compression of various structures within the spinal canal, such as the spinal cord, adjacent nerve tissues, and cerebrospinal fluid. Several factors may contribute to this narrowing, including the bulging or protrusion of intervertebral discs, posterior herniation of the nucleus pulposus, accumulation of epidural fat, hypertrophy of the posterior longitudinal ligament or the ligamentum flavum, as well as enlargement of the facet joints.[8- 10] Hence; the present study was conducted to evaluate surgical management of multilevel cervical spinal stenosis & cord injury with cervical spine fracture at a tertiary care hospital.

The mean age of the patients was 45.3 years. 80 percent of the patients were males while the remaining 20 percent were females. Four screws fixations, six screw fixations and Eight screw fixations were seen in 32.5 percent, 45 percent and 22.5 percent of the patients respectively. Mean operative time was 183.6 minutes while mean intraoperative blood loss was 412.3 ml. Mean JOA improved from preoperative value of 3.95 to final postoperative value of 8.07. Cerebrospinal fluid leakage, pulmonary infection and urinary tract infection were seen in 2.25 percent, 5 percent and 2.25 percent of the patients respectively. In their comparative study, Charles et al evaluated the therapeutic outcomes of subtotal corpectomy (n = 49) versus laminoplasty (n = 40). Their findings indicated that laminoplasty resulted in superior functional improvement, characterized by reduced intraoperative blood loss (360 ml compared to 572 ml for subtotal corpectomy), a lower incidence of complications (1 out of 40 versus 9 out of 49 for subtotal corpectomy), and a diminished degeneration rate (8% versus 38%). Conversely, Shibuya et al conducted a comparison of anterior subtotal corpectomy (n = 49) and posterior laminoplasty (n = 40) specifically for multilevel vertebral lesions. They reported that subtotal corpectomy was associated with longer operative times and increased intraoperative blood loss, as well as complications such as loss of cervical physiological curvature and the development of kyphosis.[10, 11]

Liu et al, in another previous study, retrospectively analyzed 20 cases of multi-level cervical spinal stenosis complicated with traumatic cervical instability and spinal cord injury treated with Open-door laminoplasty combined with bilateral lateral mass screw fixation. All included patients were followed up for an average period of 26.5 months after ODL-BLMSF. The average Pavlov ratio at the C5 level significantly improved from 0.57 ± 0.1 preoperatively to 1.13 ± 0.1 and 1.12 ± 0.04 at 6 months postoperatively and at the last follow-up. Importantly, this approach significantly increased the JOA score from 5.0 ± 2.6 before surgery to 11.65 ± 4.3 and 12.1 ± 4.3 at 6 months postoperatively and at the last follow-up, with an average Japanese Orthopaedic Association recovery rate of 59.1%; and the average Nurick disability score decreased from 3.0 ± 1.3 (preoperative) to 1.65 ± 1.22 and 1.5 ± 1.2. Meanwhile, the neck disability index score decreased from 30.3 ± 4.3 preoperatively to 13.2 ± 9.2 at 6 months, and to 12.45 ± 8.6 at the final follow-up, while the VAS score decreased from 4.0 ± 1.5 preoperatively to 1.5 ± 0.7 at 6 months, and to 1.15 ± 0.7 at the final follow-up.[12]Li QW et al. conducted a comparative study on the clinical outcomes of total laminectomy combined with lateral mass screw fixation versus single open-door laminoplasty for the management of cervical spinal cord injuries that do not involve fractures or dislocations. The study retrospectively analyzed clinical data from 75 patients, comprising 65 males and 10 females, with ages ranging from 33 to 83 years, and a mean age of 60.1 ± 11.4 years. To assess the improvement in clinical symptoms and functional recovery at 12 months post-operation, various evaluation tools were employed, including the Visual Analogue Scale (VAS), Nurick pain scale, Japanese Orthopaedic Association (JOA) scores, and the American Spinal Injury Association (ASIA) injury scale. The results indicated no statistically significant differences in operation duration, intraoperative blood loss, or length of hospital stay between the two treatment groups (P > 0.05). However, significant

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improvements were observed in JOA, VAS, ASIA, and Nurick scores when comparing preoperative and postoperative assessments across all patients, with no notable differences between the groups. Additionally, while there was a significant difference in the occurrence of C5 nerve root palsy and axial pain between the two groups, the rates of cerebrospinal fluid leakage complications did not differ significantly.[13]

CONCLUSION

The surgical management of cervical spinal stenosis continues to be a subject of debate within the medical community. Various treatment modalities are frequently employed; nevertheless, there is a notable deficiency in clinical research addressing the surgical approaches for multilevel cervical spinal stenosis, particularly in cases complicated by spinal cord injury.The open-door expansive laminoplasty, when paired with posterior transpedicular screw fixation, is a viable procedure that results in reduced blood loss.

REFERENCES

1. Wada E, Suzuki S, Kanazawa A, Matsuoka T, Miyamoto S, Yonenobu K. Subtotal corpectomy versus laminoplasty for multilevel cervical spondylotic myelopathy: a long-term follow-up study over 10 years. Spine (Phila Pa 1976) 2001;26(13):1443–1447.
2. Emery SE, Bohlman HH, Bolesta MJ, Jones PK. Anterior cervical decompression and arthrodesis for the treatment of cervical spondylotic myelopathy. J Bone Joint Surg Am. 1998;80:941–951.
3. Melancia JL, Francisco AF, Antunes JL. Spinal stenosis. Handb Clin Neurol. 2014;119:541-9.
4. Akar E, Somay H. Comparative morphometric analysis of congenital and acquired lumbar spinal stenosis. J Clin Neurosci. 2019 Oct;68:256-261.
5. Schroeder GD, Kurd MF, Vaccaro AR. Lumbar Spinal Stenosis: How Is It Classified? J Am AcadOrthop Surg. 2016 Dec;24(12):843-852.
6. Shim DM, Kim TG, Koo JS, Kwon YH, Kim CS. Is It Radiculopathy or Referred Pain? Buttock Pain in Spinal Stenosis Patients. Clin Orthop Surg. 2019 Mar;11(1):89-94.
7. Hirabayashi K, Bohlman HH. Multilevel cervical spondylosis. Spine. 1995;20:1732–1734.
8. DiAngelo DJ, Foley KT, Vossel KA, Rampersaud YR, Jansen TH. Anterior cervical plating reverses load transfer through multilevel strut-grafts. Spine (Phila Pa 1976) 2000;25(7):783–795.
9. Huang D, Du K, Zeng S, Gao W, Huang L, Su P. The security analysis of transpedicular screw fixation in the lower cervical spine and a case report. Spine (Phila Pa 1976) 2011;36(26):E1702–E1708.
10. Edwards CC 2nd, Heller JG, Murakami H. Corpectomy versus laminoplasty for multilevel cervical myelopathy: an independent matched-cohort analysis. Spine (Phila Pa 1976) 2002;27(11):1168–1175.
11. Shibuya S, Komatsubara S, Oka S, Kanda Y, Arima N, Yamamoto T. Differences between subtotal corpectomy and laminoplasty for cervical spondylotic myelopathy. Spinal Cord. 2010;48(3):214–220.
12. Liu G, Hu L, Ma W, Xu D, Gu Y, Hu Y, Ruan H, Tian K. Clinical Outcomes of Open-Door Laminoplasty Combined with Bilateral Lateral Mass Screw Fixation for Multi-Level Cervical Spinal Stenosis with Traumatic Cervical Instability and Spinal Cord Injury: A Retrospective Study. Orthop Surg. 2023 Jul;15(7):1781-1789.
13. Li QW, Wang L, Wang H. [A case-control study:the clinical efficacy of total laminectomy with lateral mass screw fixation and single open-door laminoplasty for cervical spinal cord injury without fracture and dislocation]. Zhongguo Gu Shang. 2022 Feb 25;35(2):136-41.