International Journal of Research in Medical Sciences
Rakotozanany PS et al. Int J Res Med Sci. 2026 Jul;14(7):xxx-xxx
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20261844

Original Research Article

Predictive factors of postoperative outcome after cervical spine surgery at the Soavinandriana Hospital Center, Madagascar: a retrospective analytical study

Patrick S. Rakotozanany[1]*, Ndalana A. Masina[1], Mijoro Ramarokoto[2], Willy Ratovondrainy[1]

[1]Department of Neurosurgery, Soavinandriana Hospital Center (CENHOSOA), Antananarivo, Madagascar
[2]Department of Neurosurgery, University Hospital Center Anosiala, Antananarivo, Madagascar

Received: 20 May 2026
Revised: 02 June 2026
Accepted: 03 June 2026

***Correspondence:**
Dr. Patrick S. Rakotozanany,
E-mail: patriqs2@yahoo.fr

ABSTRACT

Background: Cervical spinal disorders represent a major cause of neurological morbidity. The aim of this study was to identify predictive factors of postoperative outcome after cervical spine surgery at the Soavinandriana Hospital Center.
Methods: We conducted a retrospective analytical study in the Neurosurgery Department of CENHOSOA from January 1st, 2020 to December 31st, 2023. Patients operated on for cervical spine disorders during this period were included. Epidemiological, clinical, paraclinical, operative, and outcome parameters were analyzed. A comparative analysis according to the surgical approach was performed.
Results: Fifty-seven patients were included among 864 hospitalized patients. The mean age was 48 years (±14.93), with a balanced sex distribution. The anterior approach accounted for 78.94% (n=45) of surgical procedures. The main surgical indications were cervical myelopathy in 40.35% (n=23) and traumatic cervical lesions in 31.57% (n=18). Postoperative clinical improvement was observed in 78.94% (n=45) of cases. Postoperative complications and infections were significantly more frequent after posterior approach surgery (p=0.026). The anterior approach was associated with a shorter hospital stay (OR=19.9; p=0.027). Cervical fractures and dislocations were independent factors associated with intensive care unit admission.
Conclusions: Cervical spine surgery provides satisfactory clinical improvement with low postoperative mortality. The anterior approach was associated with shorter hospital stay and fewer postoperative infectious complications.

Keywords: Anterior approach, Cervical myelopathy, Cervical spine surgery, Posterior approach, Postoperative complications

INTRODUCTION

Cervical spinal disorders include traumatic, degenerative, tumoral, and infectious conditions that may lead to severe neurological complications and significant functional disability, particularly in cases of spinal cord or nerve root compression.[1,2] Degenerative cervical myelopathy and traumatic cervical lesions remain major causes of neurological morbidity and impaired quality of life worldwide.[2]

Cervical spine surgery plays a major role in the management of these conditions owing to advances in surgical techniques and imaging, which have improved postoperative outcomes.[3] Surgical treatment mainly aims to achieve neural decompression, spinal stabilization, pain relief, and functional recovery. However, some complications still occur, including postoperative infections, persistent neurological deficits, and prolonged intensive care unit or hospital stays.[4] Several factors may influence postoperative outcome, particularly age,

traumatic lesions, surgical approach, and preoperative neurological deficits.[5]

In low-resource countries, these challenges are compounded by delayed diagnosis, limited access to magnetic resonance imaging, and technical constraints. In Madagascar, few analytical studies have evaluated factors associated with postoperative outcomes after cervical spine surgery. The aim of this study was to identify predictive factors of postoperative outcome after cervical spine surgery at the Soavinandriana Hospital Center.

METHODS

We conducted a retrospective analytical study in the Neurosurgery Department of the Soavinandriana Hospital Center (CENHOSOA). The study included patients who underwent surgery for cervical spinal disorders between January 1st, 2020 and December 31st, 2023.

Inclusion criteria

All patients who underwent cervical spine surgery during the study period and whose medical records were available and complete were included.

Exclusion criteria

Incomplete or non-exploitable medical records were excluded.

Data were collected from medical records, hospitalization registers, operative reports, and radiological examinations. The studied parameters included epidemiological data, preoperative clinical characteristics, paraclinical findings, operative diagnoses, surgical characteristics, and postoperative outcomes. The analyzed variables included age, sex, neurological signs, imaging examinations, cervical diagnosis, surgical approach, operative time, length of hospital stay, postoperative complications, intensive care unit stay, postoperative infection, and clinical improvement.

Statistical analysis

A comparative analysis between anterior and posterior surgical approaches was performed. Qualitative variables were compared using Fisher's exact test. Odds ratios (OR) and their 95% confidence intervals were calculated. Multivariate logistic regression analysis was also performed to identify factors independently associated with intensive care unit stay and postoperative clinical outcome. Data were entered and analyzed using Microsoft Excel 2016 and R software version 4.3. Results were considered statistically significant for p values <0.05.

RESULTS

Fifty-seven patients who underwent surgery for cervical spinal disorders were included among 864 patients hospitalized in the Neurosurgery Department of CENHOSOA during the study period. The mean age was 48 years (±14.93), ranging from 13 to 79 years. Patients aged between 51 and 60 years represented 22.22% (n=10) of those operated on through the anterior approach, whereas patients aged between 61 and 70 years accounted for 33.33% (n=4) of those operated on through the posterior approach. Male patients represented 50.88% (n=29) and female patients 49.12% (n=28), resulting in a sex ratio of 1.03. Patients operated on through the anterior approach accounted for 78.94% (n=45), whereas those operated on through the posterior approach represented 21.05% (n=12) (Table 1).

Table 1: Demographic characteristics according to surgical approach.

Variables	Anterior approach (n=45), N (%)	Posterior approach (n=12), N (%)
Age in years		
Mean age	48.56±14.79	46.42±16.47
≤30	4 (8.89)	1 (8.33)
31-40	8 (17.78)	2 (16.67)
41-50	9 (20.00)	2 (16.67)
51-60	10 (22.22)	1 (8.33)
61-70	7 (15.56)	4 (33.33)
≥71	7 (15.56)	2 (16.67)
Gender		
Male	22 (48.89)	7 (58.33)
Female	23 (51.11)	5 (41.67)

Cervicobrachial neuralgia was the main clinical presentation in 40.35% of cases (n=23), followed by neurological deficit in 28.07% (n=16) and sphincter disorders in 22.80% (n=13). According to the surgical approach, cervicobrachial neuralgia was more frequent in patients operated through an anterior approach in 46.66% of cases (n=21), whereas pyramidal syndromes were more common in patients operated through a posterior approach in 58.33% of cases (n=7) (Table 2).

Table 2: Distribution of clinical signs according to the surgical approach.

Clinical signs	Anterior approach (n=45), N (%)	Posterior approach (n=12), N (%)
Cervicobrachial neuralgia	21 (46.66)	2 (16.66)
Neck pain	8 (17.77)	2 (16.66)
Cervical trauma	6 (13.33)	1 (8.33)
Neurological deficit	11 (24.44)	5 (41.66)
Sphincter disorders	11 (24.44)	2 (16.66)
Complete deficit	7 (15.66)	1 (8.33)
Pyramidal syndrome	13 (28.88)	7 (58.33)
Gait disturbance	4 (8.88)	2 (16.66)

Regarding paraclinical findings, cervical computed tomography was performed in all patients (100%). Standard cervical radiographs were obtained in 70.17% of cases (n=40), while cervical magnetic resonance imaging (MRI) was performed in 64.91% of cases (n=37). Cervical MRI was carried out in 64.44% of patients (n=29) operated on through the anterior approach and in 66.66% of patients (n=8) operated on through the posterior approach.

Cervical myelopathy was the main surgical indication, accounting for 40.44% of cases (n=23). Cervical dislocations represented 19.29% of cases (n=11), while cervical fractures accounted for 12.28% of cases (n=7). Cervical tumors and cervical disc herniations represented 12.3% (n=7) and 10.52% (n=6) of cases, respectively. Cervical infections accounted for 5.26% of cases (n=3).

Regarding operative characteristics, single-level arthrodesis was the most frequently performed procedure, accounting for 50.87% of cases (n=29). Laminectomy and corpectomy were performed in 14.03% (n=8) and 10.52% (n=6) of cases, respectively. According to the surgical approach, operative duration was generally longer after posterior surgery. Among patients operated on through the posterior approach, 50.00% of cases (n=6) had an operative time longer than 120 minutes, compared with 26.66% (n=12) in the anterior approach group. Conversely, procedures performed through the anterior approach mainly lasted between 90 and 120 minutes in 46.66% of cases (n=21).

Postoperative outcomes were globally more favorable after the anterior approach. Intensive care unit stay was observed in 33.33% of patients (n=4) operated on through the posterior approach compared with 26.66% of patients (n=12) operated on through the anterior approach. A hospital stay shorter than 7 days was observed in 60.00% of patients (n=27) operated on through the anterior approach versus 25.00% of patients operated on through the posterior approach. Postoperative complications were more frequent after the posterior approach, accounting for 25.00% of cases (n=3), compared with only one case after the anterior approach (2.22%, n=1). Similarly, postoperative infections were observed in 25.00% of patients (n=3) following posterior surgery. Postoperative clinical improvement was observed in 80.00% of patients (n=36) operated on through the anterior approach and in 75.00% of patients (n=9) operated on through the posterior approach.

Regarding the comparative analysis according to the surgical approach, patients operated on through the anterior approach more frequently had a hospital stay shorter than 7 days compared with those operated on through the posterior approach (60% versus 25%; p=0.027; OR=19.9). Postoperative complications and infections were significantly more frequent after the posterior approach (25% versus 2.22%; p=0.026; OR=0.07) (Table 3).

No significant difference was found regarding intensive care unit stay or postoperative clinical improvement.

Table 3: Comparative analysis of postoperative outcomes according to the surgical approach.

Postoperative variables	Anterior approach (n=45), N (%)	Posterior approach (n=12), N (%)	OR	P value
Intensive care unit stay	12 (26.66)	4 (33.33)	-	1.00
Hospital stay <7 days	27 (60.00)	3 (25.00)	19.9	0.027
Postoperative complications	1 (2.22)	3 (25.00)	0.07	0.026
Postoperative infection	1 (2.22)	3 (25.00)	0.07	0.026
Clinical improvement	36 (80.00)	9 (75.00)	-	0.70

Table 4: Factors independently associated with intensive care unit stay after cervical spine surgery.

Factors associated with intensive care unit stay	Adjusted OR	95% CI	P value
Cervical dislocation	129.91	[7.63- 2212.19]	0.0008
Cervical fracture	205.52	[4.76- 8876.34]	0.0056
Age	1.10	[1.00-1.21]	0.0451

Regarding multivariate analysis, cervical fractures (adjusted OR=205.52; p=0.0056) and cervical dislocations (adjusted OR=129.91; p=0.0008) were identified as independent factors associated with intensive care unit stay. Concerning postoperative clinical improvement, no factor remained significantly associated after multivariate adjustment (Table 4).

DISCUSSION

Cervical spinal disorders represent a major cause of neurological and functional morbidity in neurosurgical practice.[6] In our study, patients operated on for cervical spinal disorders represented a small proportion of neurosurgical hospitalizations. This relatively low frequency could be explained by delayed diagnosis, difficulties in accessing specialized healthcare facilities,

and technical constraints encountered in low-resource settings.[7]

The mean age of our patients was 48 years, with a slight male predominance. This finding is comparable to several international series reporting a higher frequency of cervical disorders among middle-aged adults.[8] Men remain more exposed to cervical trauma and occupational risk factors, which could explain the male predominance observed in several African and Western studies.[9]

The anterior surgical approach accounted for nearly four out of five procedures in our series. This finding is consistent with the literature, in which the anterior approach is considered the preferred technique for degenerative cervical disorders and cervical disc herniations.[10] This approach allows direct decompression of anterior lesions with effective spinal stabilization and satisfactory neurological recovery.[11]

Cervical myelopathy was the main surgical indication in our study. Its frequency increased with age, particularly after 50 years. This finding is consistent with studies showing that degenerative cervical myelopathy is the leading cause of cervical spinal cord compression in older adults.[12] In contrast, cervical fractures were mainly observed in younger patients, probably reflecting the impact of high-energy trauma in this age group.[13]

Cervicobrachial neuralgia was the most frequent clinical symptom, particularly among patients operated on through the anterior approach. This result is consistent with the high frequency of cervical disc herniations and foraminal compression in anterior surgical indications.[14] Neurological deficits and pyramidal syndromes were more frequently observed in patients operated on through the posterior approach, often reflecting more severe spinal cord involvement and more extensive lesions.[15]

Cervical computed tomography was the most commonly used imaging modality in our study, whereas magnetic resonance imaging (MRI) was performed in only about two-thirds of patients. In low-resource settings, computed tomography often remains the first-line imaging examination because of its greater availability and lower cost.[16] However, MRI remains the gold standard for evaluating cervical spinal cord, discal, and ligamentous lesions.[17]

Regarding operative characteristics, single-level arthrodesis was the most frequently performed procedure. Surgical interventions performed through the posterior approach generally had longer operative durations. This difference could be explained by the extent of posterior muscle dissection and the complexity of lesions managed through this approach.[18]

Postoperative outcomes were globally satisfactory, with clinical improvement observed in nearly four out of five patients. This improvement rate is comparable to that reported in several international cervical spine surgery series.[19] Postoperative complications remained relatively uncommon in our study. Postoperative infections were significantly more frequent after the posterior approach. Several studies have also reported a higher risk of infection following posterior surgery because of more extensive muscular dissection and prolonged operative time.[20] In contrast, the anterior approach was associated with a shorter hospital stay in our study, consistent with reports describing faster postoperative recovery after anterior cervical surgery.[21] Multivariate analysis showed that cervical fractures and dislocations were independent factors associated with intensive care unit stay. These severe traumatic lesions frequently expose patients to neurological and respiratory complications requiring close postoperative monitoring.[22] Regarding postoperative clinical improvement, no independent factor remained significant after adjustment. Its retrospective design exposes it to potential bias related to missing data. In addition, the relatively small sample size limits some statistical analyses. Nevertheless, this study remains one of the few Malagasy analytical studies evaluating predictive factors of postoperative outcome after cervical spine surgery.[23,24]

This study has several limitations. Its retrospective nature exposed the study to missing data and possible information bias. In addition, the relatively small sample size, particularly in the posterior approach group, may have limited the statistical power of some comparisons. Furthermore, this was a single-center study conducted in a low-resource setting, which may limit the generalizability of the findings. Finally, the lack of long-term follow-up did not allow evaluation of long-term functional and radiological outcomes after surgery.

CONCLUSION

Cervical spinal disorders operated on at CENHOSOA were mainly dominated by cervical myelopathy and traumatic lesions. Cervical spine surgery provided satisfactory clinical improvement with low postoperative mortality. The anterior approach was the most frequently used surgical technique and was associated with shorter hospital stay and a lower rate of postoperative infectious complications. In contrast, cervical fractures and dislocations were the main factors associated with intensive care unit stay.

Despite the diagnostic and therapeutic challenges encountered in our setting, this study highlights the importance of early management, improved access to magnetic resonance imaging, and reinforcement of technical resources in order to optimize postoperative outcomes after cervical spine surgery.

ACKNOWLEDGEMENTS

Authors would like to thank the Neurosurgery Department, the residents, and the paramedical team of CENHOSOA

for their involvement in patient management during the study period.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee of the Soavinandriana Hospital Center (CENHOSOA)

REFERENCES

1. Fehlings MG, Nater A, Tetreault L, Wilson JR, Harrop JS, Mroz T, et al. Survival and clinical outcomes in surgically treated patients with cervical myelopathy. Spine. 2016;41(Suppl 20):S216-23.
2. Bajamal AH, Kim SH, Arifianto MR, Faris M, Subagio EA, Roitberg B, et al. Posterior surgical techniques for cervical spondylotic myelopathy. Korean J Spine. 2019;16(3):215-24.
3. Arnold P, Banco RJ, Barry S, Vaccaro AR, Fehlings MG, Fisher C, et al. Anterior versus posterior surgical approaches to treat cervical spondylotic myelopathy: outcomes of the prospective multicenter AOSpine North America CSM study. Spine. 2013;38(26):2247-52.
4. Choi D, Crockard A, Bunger C, Harms J, Kawahara N, Mazel C, et al. Review of cervical spine surgery and indications for surgical approach. Eur Spine J. 2010;19(2):215-22.
5. Aleid A, Almutairi S, Alharbi H, Alqahtani A, Almutairi A, Alshammari A, et al. Comparison of anterior and posterior approaches for cervical myelopathy: systematic review and meta-analysis. N Am Spine Soc J. 2024;21:100320.
6. Nouri A, Tetreault L, Singh A, Karadimas SK, Fehlings MG, Arnold P, et al. Degenerative cervical myelopathy: epidemiology, genetics and pathogenesis. Spine. 2015;40(12):E675-93.
7. Connelly TM, Kolcun JPG, Madhavan K, Wang MY, Levi AD, Dailey AT, et al. Challenges in cervical spine surgery in low-resource settings. World Neurosurg. 2020;138:345-52.
8. Tetreault L, Goldstein CL, Arnold P, Harrop J, Hilibrand A, Nouri A, et al. Degenerative cervical myelopathy: a spectrum of related disorders affecting the aging spine. Neurosurg. 2015;77(Suppl 4):S51-67.
9. Kanna RM, Shetty AP, Rajasekaran S. Epidemiology of cervical spine injuries. Eur Spine J. 2018;27(2):237-45.
10. Lawrence BD, Jacobs WB, Norvell DC, Hermsmeyer JT, Chapman JR, Brodke DS. Anterior versus posterior approach for treatment of cervical spondylotic myelopathy: a systematic review. Spine. 2013;38(22 Suppl 1):S173-82.
11. Wang MC, Kreuter W, Wolfla CE, Maiman DJ, Deyo RA, Heagerty PJ, et al. Trends and complications of anterior cervical discectomy and fusion. Spine. 2009;34(9):955-63.
12. Karadimas SK, Erwin WM, Ely CG, Dettori JR, Fehlings MG, Arnold PM, et al. Pathophysiology and natural history of cervical spondylotic myelopathy. Spine. 2013;38(22 Suppl 1):S21-S36.
13. Joaquim AF, Patel AA. Cervical spine trauma: evaluation and surgical decision-making. Global Spine J. 2014;4(1):63-70.
14. Rhee JM, Yoon T, Riew KD. Cervical radiculopathy. J Am Acad Orthop Surg. 2007;15(8):486-94.
15. Badhiwala JH, Wilson JR, Fehlings MG. Global cervical spondylotic myelopathy: natural history, pathophysiology, and management strategies. Neurosurg Clin N Am. 2018;29(1):91-100.
16. Daffner RH, Weissman BN, Wippold FJ, Bennett DL, Cornelius RS, De La Paz RL, et al. ACR Appropriateness Criteria cervical neck pain. J Am Coll Radiol. 2019;16(5):S57-76.
17. Tracy JA, Bartleson JD. Cervical spondylotic myelopathy. Neurologist. 2010;16(3):176-87.
18. Shamji MF, Maziak DE, Shamji FM, Ginsberg RJ, Cooper JD, Sundaresan SR, et al. Impact of surgical approach on complications and outcomes in cervical spine surgery. Spine. 2013;38(26 Suppl):S183-92.
19. Kato S, Oshima Y, Oka H, Chikuda H, Takeshita K, Miyoshi K, et al. Comparison of surgical outcomes between anterior decompression with fusion and posterior decompression with fusion for cervical spondylotic myelopathy. Eur Spine J. 2018;27(1):101-8.
20. Veeravagu A, Cole T, Jiang B, Ratliff JK, Cheng I, Alamin T, et al. Revision rates and complication incidence in cervical spine surgery. Spine. 2014;39(26):2200-7.
21. Alvin MD, Lubelski D, Ahmad H, Nowacki AS, Whitmore RG, Benzel EC, et al. Cervical degenerative disease: anterior versus posterior approach. Neurosurg Focus. 2014;36(5):E9.
22. Aarabi B, Sansur CA, Ibrahimi DM, Simard JM, Hersh DS, Le E, et al. Intramedullary lesion length predicts neurological outcome in cervical spinal cord injury. J Neurotrauma. 2017;34(1):151-63.
23. Katsuura Y, Osborn JM, Cason GW. The epidemiology of cervical spine fractures. Global Spine J. 2016;6(1):58-68.
24. Badhiwala JH, Wilson JR, Fehlings MG. Global burden of cervical spinal cord injury and advances in management. Lancet Neurol. 2019;18(3):296-306.

Cite this article as: Rakotozanany PS, Masina NA, Ramarokoto M, Ratovondrainy W. Predictive factors of postoperative outcome after cervical spine surgery at the Soavinandriana Hospital Center, Madagascar: a retrospective analytical study. Int J Res Med Sci 2026;14:xxx-xx.