

Microscopic Anterior Cervical Oblique Corpectomy for Management of Cervical Spondylotic Myelopathy: A Retrospective Study

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Abstract

Background: Cervical spondylotic myelopathy (CSM) often requires surgical decompression. Traditional fusion techniques limit mobility and carry graft-related risks. Microscopic oblique corpectomy (MOC) offers a motion-preserving alternative.

Aim of Study: To assess clinical outcomes of microscopic anterior cervical oblique corpectomy (also known as oblique cervical corpectomy, OCC) in patients with CSM or myeloradiculopathy.

Patients and Methods: A retrospective analysis was performed on 30 patients with CSM or CSM with radiculopathy who were refractory to ≥ 6 months of conservative management. All had multilevel ventral compression with preserved alignment and underwent MOC at a single institution (2017–2024). Outcomes included the modified Japanese Orthopaedic Association (mJOA) score, Nurick grade, Visual Analog Scale (VAS) for neck pain, Neck Disability Index (NDI), complication rates, and radiographic stability over 6 months. Statistical analysis employed paired *t*-tests and Fisher's exact test (SPSS v25, significance $p < 0.05$).

Results: Mean age was 55.3 ± 7.8 years (Male: Female = 1.5:1). Significant postoperative improvements were observed: mJOA increased from 10.33 ± 2.4 to 16.0 ± 2.04 ($p < 0.001$, mean recovery rate 74.4%), VAS decreased from 7.2 ± 1.1 to 3.1 ± 0.9 ($p < 0.001$), and NDI improved from $68.5\% \pm 6.7\%$ to $28.3\% \pm 5.2\%$ ($p < 0.001$). Excellent or good outcomes were achieved in 83.3% of patients. The most frequently decompressed level was C5–C6 (41.2%). Complications occurred in 13.3% ($n=4$): compressive hematoma (1, evacuated), transient Horner's syndrome (1), dural tear (1, repaired intraoperatively), and de-

layed instability (1, later requiring fusion). Radiographic stability was maintained in 96.7% of patients at 6 months.

Conclusion: MOC is a safe, effective, and motion-preserving technique for cervical spondylotic myelopathy. It achieves anterior decompression without fusion or instrumentation, maintaining spinal stability while minimizing complications. MOC offers favorable outcomes in appropriately selected patients with a short recovery period, though it requires microsurgical expertise and careful anatomical dissection due to technical complexity.

Key Words: Cervical spondylotic myelopathy – Oblique corpectomy – Motion preservation – Anterolateral approach – Anterior decompression – Surgical outcome – Complication – Spinal stability.

Introduction

CERVICAL spondylotic myelopathy (CSM) is the leading non-traumatic cause of spinal cord dysfunction in individuals over 55 years old, resulting from chronic compression due to degenerative disc disease and osteophyte formation [1]. Clinical presentation includes gait disturbance, limb weakness, hand clumsiness, sensory loss, and sphincter dysfunction [2]. Radiculopathy, by contrast, involves nerve root compression presenting with localized neck and arm symptoms without long tract signs [3]. MRI is the diagnostic modality of choice, supported by CT and radiographs for detailed structural assessment [4].

Surgical decompression is the mainstay of treatment for moderate-to-severe or progressive CSM. Traditional approaches involving anterior cervical discectomy and fusion (ACDF), anterior corpectomy with grafting, or posterior decompression techniques like laminectomy or laminoplasty [5].

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While effective, fusion procedures are associated with graft-related complications and permanently sacrifice motion segments. Posterior approaches, although suitable in certain cases, may be less effective in kyphotic alignment and require extensive muscle dissection, leading to more postoperative pain and longer recovery [6].

Microscopic oblique corpectomy (MOC), also referred to as oblique cervical corpectomy (OCC), has emerged as a motion-preserving alternative that allows anterior multilevel decompression without the need for grafts or instrumentation. Using an anterolateral corridor, MOC enables resection of pathological osteophytes and disc material while preserving posterior elements to maintain stability [7]. Prior studies have demonstrated favorable outcomes in selected patients, particularly those with multilevel anterior compression and preserved cervical alignment [8].

However, MOC is technically demanding and requires microsurgical expertise due to proximity to critical neurovascular structures (e.g. carotid artery, esophagus, vertebral artery) [9]. At our institution, we employ MOC in selected CSM cases where preserving motion and avoiding fusion are primary goals.

Aim of the work: This study aims to evaluate the safety, effectiveness, and clinical outcomes of MOC in CSM, thereby contributing to the growing evidence supporting its role as a viable alternative to conventional fusion-based techniques in appropriately selected patients.

Patients and Methods

This retrospective study included 30 patients with cervical spondylotic myelopathy (CSM) or combined myeloradiculopathy who underwent microscopic anterior cervical oblique corpectomy (MOC) at Cairo University Hospitals between 2017 and 2024. Inclusion criteria were clinical and radiological confirmation of CSM (with or without radiculopathy) and failure of conservative treatment for at least six months.

Exclusion criteria: Included isolated single-level radiculopathy without myelopathy, central soft disc herniation (without spondylotic ridge), cervical instability (dynamic listhesis >2mm), or any contraindication to anterior surgery. All procedures were performed by the same neurosurgical team using a standardized microscopic anterolateral approach.

Preoperative assessment:

Included a detailed neurological evaluation using the modified Japanese Orthopaedic Association (mJOA) score for myelopathy grading and the Nurick grade for gait dysfunction. Pain was assessed via the Visual Analog Scale (VAS) for neck/arm pain, and functional status via the Neck Disability Index (NDI). Imaging studies (MRI for cord compression, CT for bony changes, and dynamic X-rays) were obtained to evaluate the level and laterality of compression, alignment, and stability. Surgical planning took into account the side of predominant compression and the course of the vertebral artery. Patients with prior anterior surgery or symptoms of dysphonia were evaluated for recurrent laryngeal nerve function preoperatively.

Surgical technique:

Under general anesthesia, patients were placed supine with slight neck extension and the head rotated ~20° to the contralateral side. A transverse skin incision was made along the anterior border of the sternocleidomastoid muscle. Through a carefully dissected anterolateral cervical corridor, approximately 50% of the involved vertebral body (uncovertebral joint and adjacent disc material) was obliquely drilled away to decompress the spinal cord and ipsilateral nerve root. The contralateral side of the vertebral body, including the posterior longitudinal ligament (PLL) on the opposite side, was preserved to maintain stability. No instrumentation or fusion was performed. Key steps included avoiding excessive retraction of neurovascular structures (carotid sheath laterally, tracheoesophageal complex medially) and meticulous hemostasis. The microscopic oblique corpectomy approach was originally described by Verbiest [10] and later refined by Hakuba [11] and others [7,12]. In our series, foraminotomy was performed on the ipsilateral side and indirect decompression of the contralateral side was achieved via angled drilling. Patients were monitored postoperatively for airway compromise and neurological status, with early mobilization encouraged.

Outcome measures: Follow-up clinical assessments were conducted at 1, 3, and 6 months postoperatively, including mJOA score, Nurick grade, VAS, and NDI. Radiographic stability was evaluated at 6 months with flexion-extension X-rays to check for any new instability. Follow-up MRI was obtained in select cases to confirm adequate decompression. Primary outcomes of interest were improvement in neurological function (mJOA and Nurick), preservation of spinal stability (absence of new instability on imaging), and pain relief. Sec-

ondary outcomes included improvement in NDI and any complications.

Statistical analysis: Pre- and postoperative continuous outcomes (mJOA, VAS, NDI) were compared using paired *t*-tests. Categorical outcomes were analyzed with Fisher's exact test. A *p*-value <0.05 was considered statistically significant. Statistical analysis was performed using SPSS version 25.

This study received institutional ethical approval from the Cairo University Faculty of Medicine Review Board (No. N-133-2025). Patient consent and confidentiality were maintained throughout the study.

Results

Demographics: A total of 30 patients (18 males, 12 females) were included, with a mean age of 55.3 ± 7.8 years. The average duration of symptoms before surgery was 14.9 ± 3.2 months. All patients had radiological evidence of multilevel cervical spondylosis with anterior cord compression; the most commonly affected level was C5–C6 (41.2% of decompressed levels). In total, 51 cervical levels were decompressed in 30 patients. Preoperatively, 13.3% of patients (4/30) had segmental cervical kyphosis, though none had frank instability on dynamic imaging (Table 1).

Table (1): Patients demographics and clinical characteristics.

Parameter	Value
Patients (n)	30
Age (years)	55.3 ± 7.8
Sex (M:F)	18 : 12
Symptom Duration (months)	14.9 ± 3.2
Operated Levels	51
Most common Level	C5 - C6 (41.2%)
preoperative segmental kyphosis	4 (13.3%)

Clinical outcomes: The majority (83%) of patients presented with progressive gait disturbance and hand clumsiness. Other findings included motor weakness (in 60% of patients), sensory deficits (50%), hyperreflexia (45%), and a positive Hoffman sign (30%). The mean preoperative mJOA score was 10.33 ± 2.4 , indicating moderate myelopathy. This improved significantly to 16.0 ± 2.0 at final follow-up ($p < 0.001$), with a mean recovery rate of 74.4%. Based on standard outcome criteria, 83.3% of patients achieved good or excellent outcomes. Notably, patients with symptom duration ≤ 12 months showed a trend toward better neurological recovery than those with longer-standing

myelopathy. Pain and functional disability also improved markedly: VAS scores for neck/arm pain decreased by over 50% (from 7.2 ± 1.1 to 3.1 ± 0.9 , $p < 0.001$), and NDI scores improved by more than 50% (from 68.5% to 28.3%, $p < 0.001$), reflecting substantially reduced disability (Table 2).

Table (2): Clinical outcomes.

Outcome measure	Pre-operative	Post-operative	Improvement	<i>p</i> -value
mJOA	10.33 ± 2.4	16.0 ± 2.04	74.4%	<0.001
VAS	7.2 ± 1.1	3.1 ± 0.9	57%	<0.001
NDI (%)	68.5 ± 6.7	28.3 ± 5.2	59%	<0.001

Radiological outcomes: Follow-up flexion-extension radiographs at 6 months demonstrated maintained cervical alignment in 96.7% of cases. Only one patient (3.3%) developed postoperative segmental instability (at the index level), which manifested as new listhesis on dynamic X-rays. That patient, who had predisposing factors (preoperative focal kyphosis and extensive bone removal), eventually required a secondary anterior fusion for stabilization. No cases of instrumented fusion were planned as part of the initial surgery. Importantly, there were no vertebral artery injuries and no instances of new permanent recurrent laryngeal nerve palsy in this series, underscoring the safety of the approach when carefully executed. Follow-up imaging also showed no evidence of segmental collapse or adjacent-segment degeneration in the short term.

Complications: The overall complication rate was 13.3% (4 out of 30 patients). There was one case (3.3%) of acute postoperative compressive epidural hematoma causing neurological worsening; this was promptly evacuated, and the patient had no residual deficit. One patient (3.3%) developed a transient Horner's syndrome (ipsilateral ptosis and miosis), which resolved spontaneously over several weeks. There was one intraoperative dural tear (3.3%) which was repaired primarily without issue; this patient did not develop a cerebrospinal fluid leak or pseudomeningocele postoperatively. As noted, one patient (3.3%) experienced delayed cervical instability, necessitating a fusion surgery at 3 months. All complications were managed successfully without long-term morbidity. There were no infections, and no other approach-related complications were observed (Table 3).

Table (3): Complications.

Complications	n	Management
Compressive hematoma	1	Evacuation
Transient Horner’s syndrome	1	Resolved Spontaneously
Dural tear	1	Intraoperative repair
Delayed instability	1	Anterior fusion

Table (1) summarizes the baseline demographic and clinical characteristics of the patients. Table (2) presents the key clinical outcome measures pre- and post-surgery. Table (3) details the observed complications and their management.



Fig. (1): Preoperative T2-weighted MRI scans (sagittal view top, axial view at C4–5 bottom) of a 60-year-old female patient with CSM. The patient presented with left arm pain (brachialgia), C5–C6 sensorimotor deficits, hyperreflexia, and bladder dysfunction. The images demonstrate multilevel cord compression at C4–5 and C5–6 with significant spinal cord signal change (edema) and a straightened cervical alignment.



Fig. (2): Postoperative CT scans of the same patient after a left C5 oblique corpectomy and left C5–C6 foraminotomy. Left: Sagittal reformat (soft-tissue window) showing the oblique corpectomy defect with adequate decompression of the spinal canal. Right: Axial CT (bone window) at the C5 level showing the trough of bone removal and preserved contralateral cortex. The patient’s brachialgia improved immediately after surgery, and she was discharged on postoperative day 3 without complications.

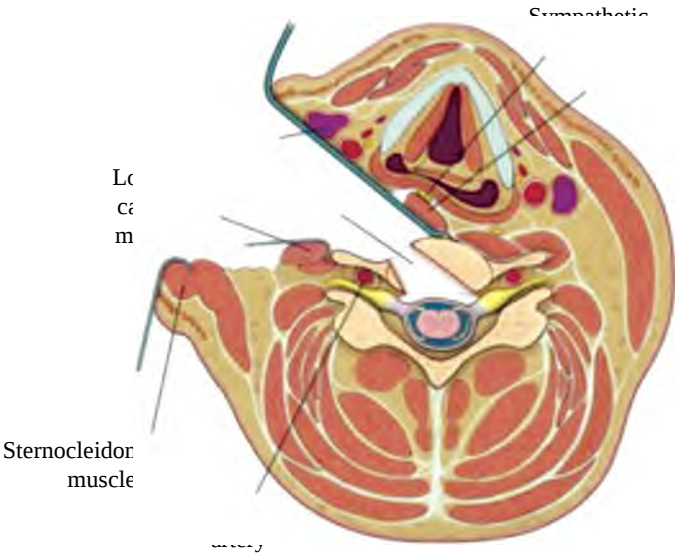


Fig. (3): Artist’s illustration of the oblique corpectomy approach [21], depicting the anterolateral surgical corridor and the oblique trajectory of bone resection (shaded area) used to decompress the cervical spinal cord and nerve root while preserving the opposite side of the vertebral body. (This illustration highlights how approximately the ipsilateral half of the vertebra is removed to achieve decompression, while the contralateral structures remain intact, thereby maintaining stability).

Discussion

Cervical spondylotic myelopathy (CSM) frequently necessitates surgical intervention to prevent progressive neurological decline [4]. Both anterior and posterior decompression techniques are well-established, but each has distinct limitations. [5]. Anterior approaches (ACDF or corpectomy with fusion) directly address ventral cord compression but require fusion, thereby sacrificing motion segments and risking graft-related complications [7]. Posterior approaches (laminectomy or laminoplasty), although suitable in selected cases, are less effective in kyphotic spines, require extensive muscle dissection, and are linked to more postoperative pain and longer recovery [6].

Microscopic oblique corpectomy (MOC), also known as oblique cervical corpectomy (OCC), offers a motion-preserving alternative that allows direct anterior decompression without the need for fusion or instrumentation [7]. In our series of 30 patients (mean age ~55 years), MOC led to a mean modified Japanese Orthopaedic Association (mJOA) recovery rate of 74.4%, with 83.3% achieving good-to-excellent outcomes-comparable or superior to fusion-based approaches such as ACDF (reported recovery: 56.7–60.1%) [13].

The MOC surgical technique uses an anterolateral trajectory to the cervical spine. In contrast to standard ACDF which approaches midline and requires discectomy/fusion at each level, the oblique corpectomy targets the compressive pathology from an off-midline angle. Approximately half of the vertebral body and the uncovertebral joint are removed on the symptomatic side, creating a generous decompressive window. By preserving the posterolateral bony pillar and contralateral structures, spinal stability can be maintained despite an extensive decompression. We intentionally avoided the use of distraction pins or interbody spacers to preserve the natural stabilizing structures. In our series, no intraoperative instrumentation was used, and the contralateral PLL and facet complex were left intact. This philosophy emphasizes stability preservation; accordingly, 96.7% of patients maintained alignment without needing fusion at 6 months. This approach enabled safe decompression of up to three levels through a single corridor, with C5–6 being the most commonly addressed level (41.2%).

The complication profile in our study was low and aligns with or improves upon rates in other reports of oblique corpectomy. Transient Horner's syndrome occurred in 3.3% of our patients, which is at the lower end of the reported range (~3–10%)

for this approach [14]. Our low incidence may be due to careful sympathetic chain handling (we did not perform deliberate sympathectomy; any sympathetic disturbance was likely from traction). Dural tear occurred in one case; dural ossification or adhesion can make the PLL dissection risky, and a small CSF leak was encountered and repaired primarily. This incidence (3.3%) is similar to that reported by Kiris et al. [15] (2.9% in 105 patients). Only one patient (3.3%) required a late fusion for instability, comparable to rates reported by Koc et al. [14] (who noted a few late fusions) and Rocchi et al. [16] (who reported none in 48 patients over long-term follow-up). Notably, there were no vertebral artery injuries or permanent nerve injuries in our cohort a critical safety finding, given the concern of proximity to these structures. Careful preoperative planning (including CT angiography to map the vertebral artery course) and microsurgical technique likely contributed to this outcome.

Radiological follow-up at 6 months confirmed spinal alignment preservation in 96.7% of patients, with no evidence of segmental collapse or adjacent segment degeneration in the short term. These findings are consistent with prior reports (e.g., Chacko et al.) [17]. Indicating that MOC, in appropriately selected patients, maintains spinal stability and avoids complications commonly associated with fusion procedures. While Rocchi et al. [16] reported no late instability requiring fusion in their 48-patient series, Koc et al. [14] documented a few cases, further supporting the importance of individualized risk assessment.

Patient selection is critical to success. MOC is most appropriate for patients with multilevel anterior compression, preserved or straight cervical alignment, and no signs of instability or deformity. It should be avoided in cases needing correction of kyphosis or extensive bilateral decompression [8]. Preoperative CT angiography is essential for delineating vertebral artery anatomy and ensuring a safe operative corridor [18].

While MOC has a steep learning curve, it offers substantial benefits. Meticulous microsurgical technique, particularly in preserving bony stability and ensuring hemostasis, is essential. Surgeons are advised to begin with one- or two-level cases before progressing to multilevel decompressions. Although we did not use intraoperative navigation, Lee et al. [19] demonstrated its utility in improving bone removal precision in multilevel OCC, suggesting it may enhance outcomes in complex cases.

Compared to traditional fusion, [13,20] OCC avoids graft-related complications, reduces operative time and blood loss, and preserves segmen-

tal motion. While a learning curve exists, careful technique and patient selection make MOC a safe,

effective, and motion-sparing option in the management of multilevel CSM (Table 4).

Table (4): Comparative outcomes VS literature.

Technique	Success Rate	Complications	Motion Preservation	Reference
MOC (This Study)	83.3%	13.3%	Yes	—
ACDF	60-70%	18-25%	No	[13]
Laminoplasty	65-75%	15-20%	Partial	[20]

Limitations:

The retrospective design, single-center experience, modest sample size (n=30), and relatively short follow-up (6 months) limit generalizability and assessment of long-term stability. Larger prospective studies with extended follow-up are needed to confirm durability and identify optimal patient selection criteria.

Conclusion:

Microscopic oblique corpectomy (MOC) provides a viable motion-preserving alternative for the surgical management of cervical spondylotic myelopathy. This technique achieves effective anterior and foraminal decompression without the need for fusion or instrumentation, resulting in significant neurological improvement and pain relief while maintaining spinal stability in well-selected patients. Although technically demanding, MOC offers outcomes comparable or superior to traditional fusion techniques, with a favorable complication profile that avoids graft-related risks. In our experience, the benefits of MOC include preserved cervical mobility and a reduced incidence of complications associated with fusion. Long-term studies are warranted to confirm the sustained stability and clinical outcomes beyond the early follow-up period.

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الاستئصال المجهرى الأمامى المائل لجسم الفقرات العنقية لعلاج اعتلال النخاع العنقى : دراسة استيعادية

مقدمة: يُعد اعتلال النخاع العنقى التنكسى (CSM) من الحالات الشائعة التى غالباً ما تتطلب تدخلاً جراحياً لإزالة الضغط عن النخاع الشوكى. إلا أن التقنيات الجراحية التقليدية التى تعتمد على الالتحام (fusion) قد تؤدي إلى فقدان حركة الفقرات ومضاعفات مرتبطة بالطعوم. يُعد الاستئصال المجهرى الأمامى المائل لجسم الفقرات العنقية (Microscopic Oblique Corpectomy - MOC) تقنية بديلة تهدف إلى إزالة الضغط مع الحفاظ على حركة الفقرات.

الهدف: تقييم النتائج السريرية للاستئصال المجهرى الأمامى المائل لجسم الفقرات العنقية فى علاج اعتلال النخاع العنقى التنكسى.

الطرق: أُجريت دراسة استيعادية شملت ٣٠ مريضاً مصاباً باعتلال النخاع العنقى التنكسى المصحوب باعتلال جذور الأعصاب، لم يستجيبوا للعلاج التحفظى لمدة لا تقل عن ٦ أشهر. جميع المرضى أظهروا ضغطاً أمامياً متعدد المستويات مع استقامة جيدة للعمود الفقرى، وخضعوا لجراحة الاستئصال المجهرى الأمامى المائل لجسم الفقرات فى مستشفى واحد خلال الفترة من ٢٠١٧ إلى ٢٠٢٤.

النتائج: أظهرت النتائج تحسناً سريرياً ملحوظاً بعد الجراحة، حيث حقق ٨٣,٣٪ من المرضى نتائج جيدة إلى ممتازة. سُجلت مضاعفات فى ٤ حالات فقط (٣,٣٪)، وشملت: تجمع دموى ضاغط تم تفريغه (١ حالة)، متلازمة هورنر المؤقتة (١ حالة)، تمزق فى الأم الجافية أُصلح أثناء الجراحة (١ حالة)، وحالة تزحزح فقارى متأخر استدعت لاحقاً التثبيت الجراحى (١ حالة).

الخلاصة: يُعد الاستئصال المجهرى الأمامى المائل لجسم الفقرات تقنية آمنة وفعالة ومُحافظة على الحركة فى علاج اعتلال النخاع العنقى التنكسى. توفر هذه التقنية إزالة فعالة للضغط الأمامى دون الحاجة إلى تثبيت أو التحام، مع الحفاظ على الاستقرار وتقليل معدلات المضاعفات. تُظهر الدراسة نتائج سريرية واعدة فى المرضى المختارين بدقة، رغم أن هذا الإجراء يتطلب مهارة مجهرية وتشريحاً دقيقاً نظراً لتعقيده الفنى.