

Comparison of Posterior Micro Laminoforaminotomy and Anterolateral Microforaminotomy Without Fusion for Treating Unilateral Spondylotic Cervical Radiculopathy

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ABSTRACT

Background data: Cervical radiculopathy caused by spondylotic foraminal stenosis may require surgical treatment. Surgical options include anterolateral cervical foraminotomy with and without fusion or posterior cervical laminoforaminotomy. Controversy remains regarding the preferable surgical approach. Therefore, treatment decisions are predominantly based on the individual surgeon's preference and skill.

Study objective: is to evaluate the efficacy, safety and complications of posterior laminoforaminotomy in comparison to anterolateral foraminotomy for the treatment of cervical spondylotic foraminal stenosis.

Study Design: A prospective clinical case study.

Patients and Methods: Between October 2011 and November 2016, twenty-eight patients with unilateral cervical spondylotic radiculopathy confirmed by clinical and radiological data, refractory to non-surgical measures for at least 6 months were assigned to posterior laminoforaminotomy or anterolateral foraminotomy; patients were operated upon at Ahmed Maher Educational Hospitals and Cairo University Hospitals. Major inclusion criteria are cervical spondylotic foraminal stenosis causing unilateral radiculopathy of C4, C5, C6 or C7 and requiring decompression of one or two neuroforaminae. Major exclusion criteria are central, cervical myelopathy, cervical instability, and bilateral radiculopathy. Follow up was done on 1 day, 4 weeks, and up to 36 months. Outcome of patients was categorized according to Odom's criteria.

Results: A total of 28 adult patients are allocated in a ratio of 1:1 into 2 groups. Fourteen patients (group A) underwent posterior cervical laminoforaminotomy and 14 patients (group B) underwent anterolateral cervical foraminotomy. The radiculopathy was the most predominant symptom in both the groups (100% in both groups) followed by neck pain 87% in group A and 78% in group B. The most common affected level was C5-6 in group A while C4-5 in group B. Excellent and good outcome among Group B (92.86%) was higher than that of Group A (85.7%) according to Odom's criteria.

Conclusion: Anterolateral cervical foraminotomy without fusion results in better clinical outcomes as compared to posterior cervical laminoforaminotomy for treating unilateral spondylotic cervical radiculopathy.

Keywords: Cervical foraminal stenosis, Cervical radiculopathy, Anterolateral cervical foraminotomy, Posterior laminoforaminotomy

INTRODUCTION

Cervical radiculopathy is a clinical diagnosis defined by the presence of sensory or motor deficits caused by mechanical compression of the corresponding cervical nerve root. Degenerative etiologies include disc herniation, spinal canal stenosis and spondylotic foraminal stenosis [1] (**Figure 1**). Cervical *radiculopathy* caused by posterolateral disc herniation can be managed by either an anterior or a posterior approach. The posterior approach was originally reported by Mixer and Barr [2]. The keyhole posterior foraminotomy was described by Spurling and Scoville [3].

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Figure 1. Preoperative T2-weighted sagittal MRI of a male patient 53 years old with right C5-6 foraminal stenosis (hard disc), straight cervical curve with the main complaint of right brachialgia, shoulder pain, neck pain, paresthesias, numbness.



Figure 2. Preoperative CT axial and T2-weighted axial MRI at C5-6 of the same patient.

radiculopathy of C4, C5, C6 or C7 and requiring decompression of one or two neuroforaminae. Patients were followed up on an outpatient basis for a period of three years. Outcome of patients was categorized according to Odom's criteria (**Figure 4**).

Surgical technique

All patients were operated under general anesthesia.

The posterior laminoforaminotomy preserves cervical range of motion minimizes adjacent segment disease [4]. The conventional anterior cervical approaches use the surgical plane between medially trachea and laterally great vessels (carotid and jugular vein); and view the spine almost in face. These approaches can be called as anteromedial approach. On the other hand, anterolateral cervical foraminotomy approach retracts the great vessels medially, uses a more lateral angle of view, and views the spine obliquely [2,5-8] (**Figures 2 and 3**).

PATIENTS AND METHODS

This is a prospective clinical case study conducted on twenty-eight patients with unilateral cervical spondylotic radiculopathy confirmed by clinical and radiological data, refractory to non-surgical measures for at least 6 months were assigned to posterior laminoforaminotomy or anterolateral foraminotomy. Patients are allocated in a ratio of 1:1 into 2 groups, 14 patients (group A) underwent posterior cervical laminoforaminotomy and 14 patients (group B) underwent anterolateral cervical foraminotomy. Patients were operated upon at Ahmed Maher Educational Hospitals and Cairo University Hospitals between October 2011 and November 2016, Major inclusion criteria are cervical spondylotic foraminal stenosis causing unilateral

Posterior cervical laminoforaminotomy

The patient is placed in a prone position with head fixed on a skull pin head fixator in slightly flexed position. A midline skin incision is made extending across the cervical level of interest and the correct level is confirmed using a lateral fluoroscopic imaging. Unilaterally, the neck muscles are subperiosteally dissected from the bone to expose the lamina and a retractor system is applied at side of radiculopathy. Once the facet joint complex is exposed, a Kerrison punch is used to remove some of the medial superior and inferior lamina to access the spinal canal.

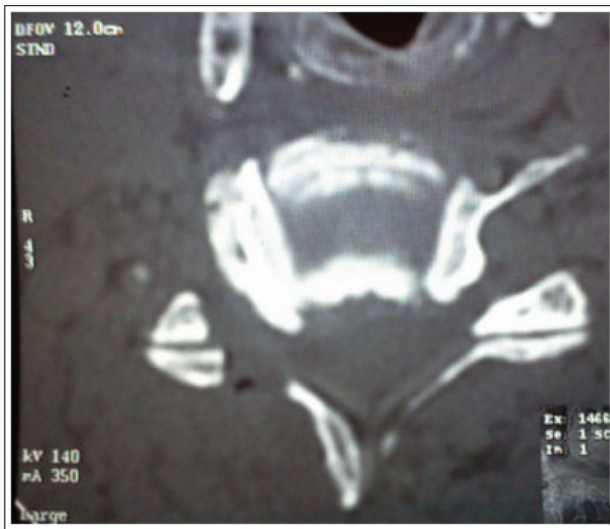


Figure 3. Postoperative axial CT scans of the same patient shows RT posterior laminoforaminotomy at C5-6 with foraminal decompression.



Figure 4. Preoperative T2-weighted sagittal MRI of a female patient 49 years old with left C6-7 foraminal stenosis (hard disc), straight cervical curve with the main complaint of left brachialgia, neck pain, numbness.

microscope is used for improved illumination and visualization. A high-speed drill is then used to thin the medial facet, centered over the joint. The remaining bone overlying the nerve root is removed using angled curettes and small Kerrison instruments. The nerve hook is passed laterally out through the foramen to confirm adequate neural decompression (**Figure 5**).

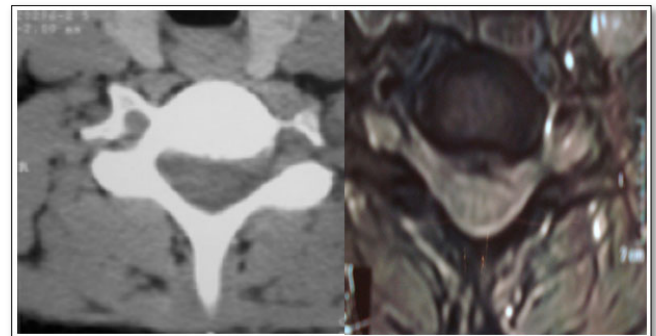


Figure 5. Preoperative CT axial and T2-weighted axial MRI at C6-7 of the second patient show left foraminal stenosis at C6-7.

Anterolateral cervical foraminotomy

The patient is placed in the supine position. A small pillow is then placed between the shoulders to allow for extension of the neck. A transverse skin incision is made ipsilateral to the lesion. The platysma is divided along the line of the incision, and the dissection is deepened using both sharp and blunt dissection to retract the great vessels medially, use a more lateral angle to view the spine obliquely. The prevertebral fascia is opened, and the correct level is confirmed using a lateral fluoroscopic imaging. The ipsilateral longus colli is stripped laterally to expose the medial half of the transverse process above and below the disc space. The contralateral longus colli is dissected from the vertebral body approximately 2 to 3mm laterally (just enough for insertion of a self-retaining retractor blade beneath it). The teeth of the self-retaining retractor blades are then placed beneath the dissected longus colli muscles.

Starting drilling at the most lateral 8mm of the intervertebral disc, and inferior 5mm portion of the upper level vertebral body (The anterior portion of the uncinat process is not removed). The drill bit is changed to a diamond drill as one advance. The uncovertebral junction not entered in the anterior two-thirds of the foraminotomy tract. The transverse diameter of the hole is approximately 8-9mm, and the vertical diameter of the hole varies with the height of the disc spaces in different vertebral levels (approximately 10mm). At the posterior one-third of the foraminotomy hole, the uncovertebral junction is entered and the posterior portion of the lateral uncinat process, which often represents the pathological element compressing the nerve root, is removed. The rostral and caudal lips of the posterior uncovertebral junction are also removed. Final removal of the compressive uncovertebral osteophytes is done using a 1mm footplate Kerrison. Identification of the lateral border of the posterior longitudinal ligament shows that the posterior border of the uncinat process is reached its lateral border must be excised, preferably using a micro hook and a 1mm footplate Kerrison to expose the lateral border of the ipsilateral spinal cord (**Figure 6**).



Figure 6. Post-operative 3D CT scan of the second patient show left anterolateral cervical foraminotomy at C6-7.

Postoperative follow up

Clinical follow up: Patients were routinely seen immediate postoperatively before discharge and at regular follow-up intervals of 2 weeks and then 3, 6 and 12 months and subsequently every 6 months. Outcome was determined for

recording at least two year post operatively. Outcome of patients was categorized according to Odom's criteria in both groups (**Figure 7**).

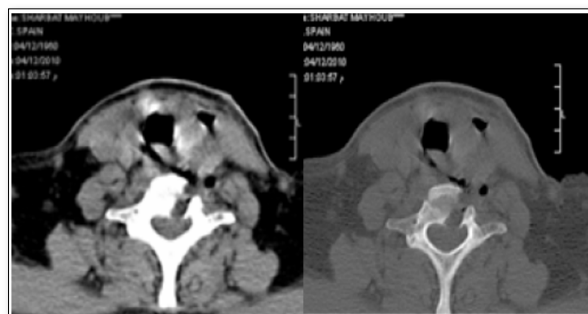


Figure 7. Post-operative CT scan (Axial, soft and bone window) of the second patient show left anterolateral cervical foraminotomy at C6-7.

RESULTS

The demographic and clinical parameters of patients in both the groups (age, sex, symptomatology, signs, common operated level, mean operative time, follow up, excellent outcome, and postoperative axial neck pain) (**Table 1**).

Table 1. The demographic and clinical parameters of patients in both the groups.

Comparison points	Group A (Posterior cervical laminoforaminotomy) NO=14	Group B (Anterolateral cervical foraminotomy) NO=14
Average age	44.1 years	44.3 years
Sex (male: female ratio)	1:1.8	2.5:1
Duration of symptoms	12.8 months	12.5 months
Radiculopathy	100%	100%
Neck pain	87%	78%
Mean follow up period	24.5 months	26.5 months
Common sign	Hyporeflexia (87%)	Motor weakness (42.2%)
Common operated level	C5-6	C4-5
Mean operative time	68.8 minutes	52.5 minutes
Excellent, good outcomes	85.7%	92.86%
Postoperative axial pain	21%	7.1%

The radiculopathy was the most predominant symptom in both the groups (100% in both groups) followed by neck pain 87% in group A and 78% in group B. The most common affected level was C5-6 in group A while C4-5 in group B. Postoperatively, 3 cases had axial neck pain in group A was higher than that of group B (one case) that are shown in **Table 1**. P value (0.4226) between transient axial neck pain and fair outcome in posterior laminoforaminotomy

is considered to be not statistically significant **Table 2**. Excellent and good outcome among Group B (92.86%) was higher than that of Group A (85.7%) according to Odom's criteria (**Tables 3 and 4**).

DISCUSSION

Posterolateral disc herniation, though are more commonly managed by an anterior approach, can also be effectively

Table 2. Association between postoperative axial neck pain and fair outcome in posterior laminoforaminotomy group.

Axial neck Pain	Cases with excellent and good outcome	Cases with fair outcome	Total	P value
present	1	1	2	0.4226
absent	11	1	12	
Total	12	2	14	

Table 3. Outcome of anterolateral cervical foraminotomy (N=14) according to odom' s criteria.

Outcome	NO (14)	%
Excellent	11	78.57
Good	2	14.28
Fair	1	7.14
poor	0	0

Table 4. Outcome of posterior cervical laminoforaminotomy (N=14) according to odom' s criteria.

Outcome	NO	%
Excellent	10	71.418
Good	2	14.28
Fair	2	14.28
Poor	0	0

managed by posterior approach. Posterior approaches offer several distinct advantages as compared to an anterior approach like preserving motion and thus reducing of adjacent segment disease [4,9,10].

In our study male to female ratio was 1:1.8 in group A and 2.5:1 in group B. Average age was 44.1 years in group A and 44.3 years in group B. The average duration of symptoms was 12.5 months in group B and 12.8 months in group A and the most common symptom beside radicular pain (100%) in both the groups was neck pain (78.6%) in group B and 87% in group A.

Choi et al. [11] in 2007 noted in their 20 patients, a prospective case series operated for cervical radiculopathy by anterior cervical foraminotomy. They reported a male predominance with a male to female ratio of 3:1 with an age average of 48.7 years (range 37-74 years). The average duration of symptoms was 19.8 months (range 0.5-96 months) and also the most common symptom beside radicular pain (100%) was neck pain (80%).

In our study, excellent and good outcome among Group B (92.86%) was higher than that of Group A (85.7%) according odom' s criteria. Postoperative axial neck pain in posterior laminoforaminotomy group (21%) was higher than that of anterolateral foraminotomy group (7.1) but P value (0.4226) between postoperative axial neck pain and fair outcome in posterior laminoforaminotomy group is considered to be not statistically significant.

Subramanian et al. [12] in 2015 noted in their 14 patients which has posterolateral cervical disc that randomly assigned to either open cervical laminoforaminotomy (7cases) or minimally invasive laminoforaminotomy (7 cases); Visual analog scale for postoperative axial neck pain was significant higher in open laminoforaminotomy group at six weeks follow up as compared to minimally invasive laminoforaminotomy group.

Park et al. [13,14] in 2013 reported a 89% of patients (NO=44) had excellent and good results operated for radiculopathy by anterolateral foraminotomy at 60 months

follow-up while reported a 86.4% of patients had excellent and good results operated for radiculopathy by posterior foraminotomy at 24-66 months follow up [4].

CONCLUSION

Anterolateral cervical foraminotomy without fusion results in better clinical outcomes as compared to posterior cervical laminoforaminotomy for treating unilateral spondylotic cervical radiculopathy in terms of excellent and good outcome of anterolateral foraminotomy (92.86%) was higher than that of posterior cervical laminoforaminotomy (85.7%) according to odom's criteria, lesser incidence of postoperative axial neck pain, and lesser analgesic requirements.

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