Posterior Laminoforaminotomy For Unilateral Cervical Radiculopathy: Preliminary Experience

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Citation

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Abstract

Background
Although presently anterior cervical discectomy and fusion is the procedure of choice for many surgeons, posterior cervical foraminotomy can provide excellent results in appropriately selected patients with foraminal stenosis in either soft disc prolapse or osteophyte. We share our preliminary experience of the outcome of minimally invasive posterior cervical foraminotomy through a key-hole incision with muscle dilators.
Material and methods
We studied prospectively 20 consecutive patients with unilateral cervical radiculopathy without myelopathy operated by minimal invasive posterior cervical laminoforaminotomy and followed up for 2 years postoperatively.
Results
There were 12 male and 8 female with mean age 45.4+4.6 years (32-65 ys). The mean duration of complaint was 11.9+3.4 months (6-17 months). There were 5 patients had C5, 6 patients had C6, 5 patients had C7 and 1 patient had C8 symptomatology while double level was found in 1 patient at C5/6 and C6/7. The mean operation duration was 74.9+25.9 minutes (45-120 minutes) with no postoperative complication. Outcome was categorized into satisfactory and unsatisfactory. Satisfactory outcome was found in 19 (95%) patients and unsatisfactory in 1 (5%) patient.
Conclusion
Minimally invasive posterior cervical foraminotomy for cervical radiculopathy is an effective option in well selected patients as postero-lateral foraminal stenosis in either soft disc prolapse or osteophyte for root decompression.

INTRODUCTION

Although presently anterior cervical discectomy and fusion is the procedure of choice for many surgeons, posterior cervical foraminotomy can provide excellent results in appropriately selected patients [?16]. Posterior cervical foraminotomy was described a long time ago and widely accepted as a safe and efficacious method for the surgical treatment of cervical radiculopathy [?13, ?18].

This technique has several advantages over anterior cervical discectomy such as preservation of cervical motion, no need for internal or external bracing, and eliminates the risk of swallowing or voice-related complications postoperatively [?15, ?21]. One of the drawbacks of conventionally performed posterior cervical foraminotomy is the nerve root injury, significant muscle stripping and retraction that performed to expose the spine which may result in a significant postoperative pain, and impaired muscle function [?14].

In this manuscript we detail our preliminary experience of the outcome of minimally invasive posterior cervical foraminotomy through a key-hole incision with muscle dilators.

PATIENTS AND METHODS

We prospectively studied 20 consecutive patients with unilateral cervical radiculopathy without myelopathy admitted in the neurosurgery department at the period from January 2009 till January 2010; operated by minimal invasive posterior cervical laminoforaminotomy and followed up for 2 years postoperatively.

The indication for surgery was made after detailed examination and at least 6 months conservative management and physiotherapy with mean duration 11.9$\pm$3.4 months. The inclusion criteria included; single or double level lateral

foraminal disc herniation or foraminal stenosis by osteophyte. Exclusion criteria included; severe degenerative spine disease, previous cervical surgery, instability, trauma, infection, tumour, and associated major co-morbidity.

All patients were reviewed by age,sex, diagnosis, duration of complaints, and clinically examined forneck pain,brachialgia, muscle power gradingincluding (shoulder abduction, adduction, Elbow flexion, extension, Wrist flexion, extension, Finger abduction, adduction) , Reflexes including (Biceps, Brachioradialis, Triceps), and sensory deficit. The lower limb examination showed no detected anomalies.

All patients underwent detailed radiological investigation (including X-Ray, CT, MRI, and EMG when needed) demonstrating lateral foraminal disc herniation or foraminal stenosis by osteophyte. The radiological investigations were corresponding to the patients

RESULTS

Table 1

Demographic data

Data							
Age	45.4±4.6 (min32, max 65 ys)						
Sex	12 M, 8 F						
Diagnosis	C5	C6	C7	C8	C5,C6	C6,C7	RT 11 Lt 9
	5	6	5	2	1	1	
Duration	11.9±3.4 m (6-17 m)						
CP							
				Mild	**mod**	**severe**	**worst**
Neck pain				2	3	15	0
Brachialgia				0	0	10	10
Ms power	Grade			**3**	**4-**	**4+**	**5**
				6	12	4	0
	Shoulder abduction			0	2	4	14
	Shoulder adduction			0	0	6	14
	Elbow flexion			0	6	7	7
	Elbow extension			3	3	8	6
	Wrist flexion			0	1	10	9
	Wrist extension			1	6	6	7
	Finger abduction			0	2	0	18
	Finger adduction			0	0	2	18
Reflex				**Normal**		**Hyporeflexia**	
	Biceps			13		7	
	Brachioradialis			14		6	
	Triceps			13		7	
Investigation							
	C4/5	C5/6	C6/7	C7/T1	C4/5& C5/6	C5/6& C6/7	
MRI	5	6	5	2	1	1	
CT	5	6	5	2	1	1	
EMG (**4 pts**)	2	0	0	0	1	1	
Op duration	74.9±25.9 (45, 120 min)						
Complication	Superficial wound infection 1 *(managed by daily dressing and healed)*						

Our patients were 12 male and 8 female with age ranged from 32- 65 years old and mean age 45.4±4.6 years. The duration of complaint was ranged from 6-17 months and mean duration was 11.9±3.4 months.

The clinical diagnosis wasC5 in 5 patients, C6 in 6 patients, C7 in 5 patients, and C8 in 1 patient while double level was found in 1 patient at C5/6 and C6/7.

By clinical examination neck pain was mild in 2 patients, moderate in 3 patients, and sever in 15 patients while brachialgia was sever in 10 patients and worst in the other 10 patients. The motor power was grade 3 in 6 patients, grade 4- in 12 patients, and grade 4+ in 4 patients. Reflexes were examined in all patients and showed hyporeflexia in 7 patients with biceps reflex, 6 patients with Brachioradialis reflex, and 7 patients with Triceps reflex. Motor skill, sensation, and reflexes of the lower limb, trunk, and bladder had no disability in all patients.

Radiological investigation was done to all patients including cervical X-Ray, MRI, CT, and sometimes EMG when needed to confirm the diagnosis. X-Ray was non conclusive in 6 patients while it showed cervical foraminal stenosis in 4 patients and osteophyte in 10 patients. MRI and CT showed foraminal stenosis in 5 patients at C4/5, in 6 patients at C5/6, in 5 patients at C6/7, in 2 patients at C7/T1, in I patient at C4/5& C5/6, and in 1 patient at C5/6& C6/7.Eleven patients were on the left side and 9 on the right side. Cervical spondylosis was found in 14 patients while soft disc was found in6 patients. Electromyography was done in 4 patients and found C4/5 in 2 patients, C4/5& C5/6 in 1 patient, and C5/6& C6/7 in 1 patient.

All patients were operated by micro-invasive posterior cervical laminoforaminotomy in prone position. The duration of surgery ranged from 45-120 minutes with mean duration 74.9±25.9 minutes. We had only 1 patient with postoperative complication in the form of Superficial wound infection which was managed.

Different outcome measures were used for all patients at the early postoperative period, 6 months, 1 year, and 2 years. The final outcome at 2 years was excellent in 15 (75%) patients, good in 5 (25%) patients, and fair in 1 patient (5%) by Odom

DISCUSSION

Although the anterior approach for the treatment of cervical disc prolapse and spondylotic cervical canal stenosis is more commonly performed and studied by many authors [?3, ?4, ?5, ?7, ?19, ?23]. The advantage of posterior cervical

laminoforaminotomy over anterior approach in selected cases for decompression of the nerve root in postero-lateral disc and foraminal stenosis has been well documented by many other authors because it avoids many hazards of the anterior exposure as recurrent laryngeal nerve, trachea, oesophagus, carotid sheath, and thoracic duct injury, moreover it avoid the adjacent segment syndrome due to the unnecessary fusion [?20, ?24] and it may provide better exposure for decompression of the exiting root and for removal of lateral osteophytes and discs [?27, ?28]. The limited popularity of this technique may be due to the limited surgical view, difficulty in osteophyte and disc resection moreover it has undesired side effects such as instability by extensive facet resection, nerve root injury, and severe neck pain due to muscle stripping and retraction [2, ?12, ?16, ?22, ?25, ?28,?31]. For these reasons, the development of minimally invasive posterior cervical laminoforaminotomy by tubular retractors represents an important advancement in the field of spine surgery. Moreover; there is no need for total disc resection or implantation of prosthesis or anterior fixation as in ACDF in this technique.

In this series we found that the **mean age** of our patients was 45.4$\pm$4.6 years with age range from 32-65 years which matches the results documented in many other series which found the mean age range from 43.4-49.6 years [?10, ?11, ?16, ?17, ?22, ?29, ?35, ?36].

The distribution of **pathology** encountered in our work closely parallels that reported by other authors. Like the 80% (11 patients) which were commonly distributed at C4/5, C5/6, and C6/7 foraminal stenosis and poster-lateral cervical disc prolapse, Henderson et al [16] reported that 85% of their 846 cases of lateral disc herniation occurred at either C5/6 or C6/7. Krupp et al. [?22] similarly reported that 89% of their patients, and Fessler and Khoo [???10] found 79% of operated levels had abnormalities at these levels.

Foraminotomy is indicated only when a clear-cut radicular symptomatology is present; it is not indicated for non-segmental pain of the shoulder and neck [?9, ?27, ?31, ?32]. With a few exceptions, acute radicular pain, associated with neurological deficits in the shoulder/arm area, is caused by compression of one nerve root. For this reason, the exposure of only one nerve root is indicated in a high percentage of these cases [?9, ?22]. Henderson et al. [?16] reported that 99.4% of their 846 patients presented with radicular pain, 70% with neck pain, 68% with muscle weakness, and 85% with decreased sensation. Fessler and Khoo [10] found 96% with radicular pain, 64% with neck pain, 36% with muscle pain, and 80% with decreased sensation. We found parallel results of neck, radicular pain, motor, and reflex deficit in all our patients.

We operated all our patients in prone position by microsurgical approach using C-arm fluoroscopy to determine the level, microscope, tubular retractor, and high speed drill. From our experience we found that this position is comfortable and safe. The mean **operation time** in our series was 74.9$\pm$25.9 min with range from 45- 120 min. which was near the results reported by Takahashi et al [???33] who found 78.2$\pm$26.1 min. (range: 46~144 min.) and Williams 1983 who found one hour for a single level foraminotomy and blood loss rarely exceeded 100cc.

Different **outcome** measures were used in the present study to detect the prognosis of our selected patients. We found significant improvement in 95% of our patients after 2 years follow up. These results are comparable to the many previous series that demonstrate a success rate of 90-96% [?2, ?6, ?16, ?22, ?30, ?35, ?36]. Adamson [1] reported in a series of 100 patients significant improvement in 97% of patients and the complication rate was only 3%. Fessler and Khoo [10] reported in a series of 25 patients successful results in 92% of patients, the estimated blood loss was significantly lower (138 ml) in the minimally invasive procedure, and the mean operative time was 115 min. Holly et al [???18] reported in a series of 21 patients that 90% of patients had successful outcomes as their pain completely resolved after our procedure. Our results compared quite favourably to those previously reported results and indicated that this procedure could be successfully performed in a minimally invasive fashion for distinct patients. Furthermore, the hospital stays were significantly shorter and postoperative narcotic use was significantly low. From our experience and outcome results; we can confirm that the posterior cervical foraminotomy has been proven to be a successful method than that of the anterior cervical discectomy and fusion in a selected group of patients for treatment of cervical radiculopathy as it preserve the natural vertebral anatomy and range of motion, although there are patients who should not be considered as candidates for this procedure..

The risks of **mortality** and morbidity remain quite low in our work where only one patient had a postoperative superficial wound infection which was managed by daily dressing and healed within 2 weeks meaning that we have no postoperative complications. Fatal complications are

fortunately very rare; in many large series [?2, ?8, ?30, ?38]. Primary concern should be directed at limiting nerve root manipulation and avoiding any spinal cord manipulation [?8, ?16, ?32, ?34, ?36, ?38]. There is no risk of inducing segmental instability if 50% of the facet remains intact [1, ?26, ?37].

CONCLUSION

Minimally invasive posterior cervical foraminotomy for cervical radiculopathy is an effective and safe in well selected patients as postero-lateral foraminal stenosis in either soft disc prolapse or osteophyte for root decompression. It seems to have many advantages over ACDF such as the preservation of motion segments, limited bone exposure, and limited muscle-splitting dissection, which allow for a much less painful postoperative course and quicker return to full activity and work.

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