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SURGICAL NEUROLOGY INTERNATIONAL
SNI: Spine
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Editor: Nancy E. Epstein, MD Winthrop Hospital, Mineola, NY, USA

Original Article

Treatment of cervical radiculopathy: A review of the evolution and economics

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Received: 25 November 17 Accepted: 06 December 17 Published: 14 February 18

Abstract

Background: The surgical treatment of cervical radiculopathy has centered around anterior cervical discectomy and fusion (ACDF). Alternatively, the posterior cervical laminoforaminotomy/microdiscectomy (PCF/PCM), which results in comparable outcomes and is more cost-effective, has been underutilized.

Methods: Here, we compared the direct/indirect costs, reoperation rates, and outcome for ACDF and PCF vs. PCM using PubMed, Medline, and Embase databases.

Results: There were no significant differences between the re-operative rates of PCF/PCM (2% to 9.8%) versus ACDF (2% to 8%). Direct costs of ACDF were also significantly higher; the 1-year cost-utility analysis demonstrated that ACDF had $131,951/QALY while PCM had $79,856/QALY.

Conclusion: PCF/PCM for radiculopathy are safe and more cost-effective vs. ACDF, and have similar clinical outcomes.

Key Words: Cervical degenerative disc disease, cervical disc herniation, cost-effectiveness, posterior approach, posterior cervical microdiscectomy, quality of life

Access this article online
Website: www.surgicalneurologyint.com
DOI: 10.4103/sni.sni_441_17
Quick Response Code:

INTRODUCTION

Although posterior cervical laminoforaminotomy/microdiscectomy (PCM/PCF) are only infrequently performed, studies have shown no significant difference in outcomes and suggested improved cost-effectiveness for these procedures vs. anterior cervical discectomy/fusion (ACDF).[5,6,10] Nevertheless, due to lack of training of younger surgeons in this technique, the PCM/PCF procedure is now underutilized.

MATERIALS AND METHODS

Indications

The PCF/PCM procedure is highly effective in treating patients with cervical radiculopathy due to degenerative lateral/foraminal disease that affects the exiting nerve root.[2,3] A major benefit of this procedure, particularly in younger patients with disc herniations, is the avoidance of fusion and a reduction in the risk of future adjacent segment disease.

How to cite this article: Ament JD, Karnati T, Kulubya E, Kim KD, Johnson JP. Treatment of cervical radiculopathy: A review of the evolution and economics. Surg Neurol Int 2018;9:35.
http://surgicalneurologyint.com/Treatment-of-cervical-radiculopathy:-A-review-of-the-evolution-and-economics/

Benefits of open laminoforaminotomy for lateral/foraminal diskectomy/spur excision

The open cervical laminoforaminotomy offers excellent direct exposure of the foraminally exiting nerve root and full maneuverability with a down-biting curette/microdissectors for the excision of lateral/foraminal discs/spurs. Alternatively, although the mini-open microsurgical or tubular minimally invasive approach theoretically limits soft tissue manipulation, there is also more limited visualization and field of operative dissection, increasing the risk of retained foraminal disc/spur and/or neurological injury.

Technical points for mini-open laminoforaminotomy/microdiscectomy

After obtaining baseline somatosensory evoked (SEP), motor evoked potential (MEP), and electromyographic (EMG) potentials/monitoring, an awake nasotracheal fiberoptic or glide scope intubation (with appropriate local anesthetics) are performed. Using a local anesthetic, a Mayfield 3-pin head holder is applied and the patients are placed prone on bilateral chest rolls. Next, for an open procedure, the midline incision is followed by subperiosteal dissection carried out from the midline to the facet joint. For the tubular MIS, a paramedian incision (approximately 2 cm from the midline) may alternatively be utilized. (e.g., two-thirds covering the interlaminar space; one-third covering the facet joint). Performing an adequate medial facetectomy/foraminotomy, with shaved-down/angled Kerrison rongeurs, allows the excision of disc material and/or osteophytes using down-biting curettes and microdissectors. If these latter maneuvers are hampered by the limited exposure provided by the tubular MIS approach, conversion to an open procedure for better visualization/maneuverability is essential to avoid neural/other injuries.

Reoperation rates

Although some studies document higher revision rates for PCF/PCM vs. ACDF, most show similar outcomes for both groups.[4,5,8,10] In a study by Wirth *et al*. involving 72 patients with radiculopathy, there was a 28% reoperation rate for ACDF group vs. 27% for PCF/PCM (60 months of follow-up).[10] Liu *et al*.[4] described a reoperation rate of 4% for ACDF group vs. 6% for PCF/PCM group [$P > 0.05$; OR 0.74 (0.36, 1.52)] [Table 1]. In a recent investigation looking at both Medicare and private insurance databases, the overall risk of reoperation after single-level PCF was 8.3%, 9.8%, and 10.5% within 1, 2, and 4 years after surgery, respectively. This appears comparable to previously published studies [Table 2].[7]

Cost-effectiveness

Although data vary, PCF/PCM often appear more cost-effective compared to ACDF. In a study by Mansfield *et al*., the direct costs of ACDF were 89–182% greater vs. PCF/PCM.[6,9] A more recent retrospective 1-year study demonstrated $131,951/QALY for ACDF vs. $79,856/QALY for PCF/PCM; they concluded PCF/PCM as the cost-effective option, falling below the willingness-to-pay threshold of $100,000 per QALY.[1]

Table 1: Reoperation rates of ACDF vs. PCF/PCM

Author	ACDF reoperation rate	PCF reoperation rate	Odds ratio
Lubelski *et al*.	4.8%	6.4%	0.73 (0.28, 1.89)
Ruetten *et al*.	4.7%	6.7%	0.67 (0.18, 2.48)
Selvanathan *et al*.	2%	2%	1.02 (0.10, 10.03)
Wirth *et al*.	24%	27%	-

Table 2: Reoperation rates of PCF/PCM only

Author	PCF/PCM reoperation rate
Bydon *et al*.	9.9% ($n=151$, 2.4-year mean follow-up)
Sayari *et al*.	9.8% ($n=2287$, 2-year mean follow-up)
Davis *et al*.	6% ($n=170$, 15-year mean follow-up)
Wang *et al*.	5% ($n=178$, 2.6-year mean follow-up)

CONCLUSION

In the cervical spine, PCM/PCF offers a safer and more cost-effective lateral/foraminal nerve root decompression without the need for fusion as with ACDF. Unfortunately, we have entire generations of spine surgeons who are relatively uncomfortable with the PCF/PCM procedure, and, it is essential to recover this "*lost art*."

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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