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# The effect of minimally invasive posterior cervical approaches versus open anterior approaches on neck pain and disability

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## Abstract

**Background:** The choice of surgical approach to the cervical spine may have an influence on patient outcome, particularly with respect to future neck pain and disability. Some surgeons suggest that patients with myelopathy or radiculopathy and significant axial pain should be treated with an anterior interbody fusion because a posterior decompression alone may exacerbate the patients' neck pain. To date, the effect of a minimally invasive posterior cervical decompression approach (miPCD) on neck pain has not been compared with that of an anterior cervical diskectomy or corpectomy with interbody fusion (ACF).

**Methods:** A retrospective review was undertaken of 63 patients undergoing either an miPCD (n = 35) or ACF (n = 28) for treatment of myelopathy or radiculopathy who had achieved a minimum of 6 months' follow-up. Clinical outcomes were assessed by a patient-derived neck visual analog scale (VAS) score and the neck disability index (NDI). Outcomes were analyzed by use of (1) a threshold in which outcomes were classified as success (NDI $< 40$, VAS score $< 4.0$) or failure (NDI $> 40$, VAS score $> 4.0$) and (2) perioperative change in which outcomes were classified as success ($\Delta$NDI $\geq -15$, $\Delta$VAS score $\geq -2.0$) or failure ($\Delta$NDI $< -15$, $\Delta$VAS score $< -2.0$). Groups were compared by use of $\chi^2$ tests with significance taken at $P < .05$.

**Results:** At last follow-up, the percentages of patients classified as successful using the perioperative change criteria were as follows: 42% for miPCD group versus 63% for ACF group based on neck VAS score ($P$ = not significant [NS]) and 33% for miPCD group versus 50% for ACF group based on NDI ($P < .05$). At last follow-up, the percentages of patients classified as successful using the threshold criteria were as follows: 71% for miPCD group versus 82% for ACF group based on neck VAS score ($P$ = NS) and 69% for miPCD group versus 68% for ACF group based on NDI ($P$ = NS).

**Conclusions:** In this small retrospective analysis, miPCD was associated with similar neck pain and disability to ACF. Given the avoidance of cervical instrumentation and interbody fusion in the miPCD group, these results suggest that further comparative effectiveness study is warranted.



*Keywords:* Cervical spine; Fusion; Minimally invasive; Neck pain; Outcome; Spine

The choice of surgical approach to the cervical spine may have an influence on patient outcome, particularly with respect to neck pain and disability. Some surgeons suggest that patients with myelopathy or radiculopathy and significant axial pain should be treated with an anterior interbody fusion, because a posterior decompression alone may exacerbate the patients' neck pain. The basis for such a recommendation may be predicated on expert opinion or low-evidence studies and not an analysis of comparative clinical outcomes. Indeed, large evidence-based reviews have not been able to conclude that either a dorsal or ventral approach is superior to the other with respect to clinical outcome.[1–3] These reviews have also underscored the need for improved comparative outcome information regarding techniques used to surgically address cervical spinal pathology. Moreover, these reviews have specifically suggested the use of validated patient-reported outcome questionnaires, which have been largely lacking in the literature.[4] To date, no study has been published that has compared the effect of a minimally invasive dorsal approach with that of a ventral approach. This study presents the senior author's experience.

## Methods

This study was approved by the Institutional Review Board of Albany Medical Center, Albany, New York. It is

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Table 1
Demographics

| | miPCD (n = 35) | ACF (n = 28) | Statistical significance |
|---|---|---|---|
| Sex | 24 M and 11 F | 14 M and 14 F | $P$ = NS |
| Age (mean ± SD) (y) | 53. 4 ± 14.9 | 50.2 ± 8.1 | $P$ = NS |
| BMI (mean ± SD) ($kg/m^2$) | 27.9 ± 4.0 | 30.1 ± 5.78 | $P$ = NS |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; BMI, body mass index; F, female; M, male; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

a retrospective chart review of 63 patients who underwent surgery for cervical myelopathy or cervical radiculopathy and had a minimum of 6 months of clinical follow-up. The indication for surgical intervention was based on the presence and severity of myelopathy and/or radiculopathy. No patient underwent surgery specifically for neck pain. The following data were abstracted from the medical records:

1. Demographics: age (in years), sex (male or female), weight (in pounds), height (in inches), and body mass index (in kilograms per square meter)
2. Medical factors: indication for surgery (radiculopathy or myelopathy), self-reported medical comorbidities (type), number of medical comorbidities, Charlson index, type of surgery (description), and preadmission medications (type and dose)
3. Social factors: tobacco use (yes/no), alcohol use (daily, weekly, monthly, annually, never), highest educational degree (none, high school, undergraduate, graduate), and work status (employed, unemployed, retired, disabled)
4. Psychiatric factors: self-reported psychiatric comorbidities (name), number of psychiatric comorbidities, and use of psychiatric medication (yes/no, type)
5. Surgical factors: date of surgery, type of surgery (description), tube length (in centimeters), tube diameter (in millimeters), level of decompression (C1–C7), number of levels decompressed, side (right, left, bilateral), foraminotomy (yes/no), estimated blood loss (in milliliters), blood transfusion (yes/no), intraoperative fluids (in milliliters), intraoperative urine output (in milliliters), and operative time (in hours)

Table 2
Work status

| | miPCD (n = 35) | ACF (n = 28) | Statistical significance |
|---|---|---|---|
| Employed (n) | 16 (46%) | 13 (46%) | $P$ = NS |
| Not employed (n) | 5 (14%) | 8 (29%) | $P$ = NS |
| Disabled (n) | 7 (20%) | 3 (11%) | $P$ = NS |
| Retired (n) | 7 (20%) | 4 (14%) | $P$ = NS |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

Table 3
Medical history

| | miPCD (n = 35) | ACF (n = 28) | Statistical significance |
|---|---|---|---|
| No. of comorbidities (mean ± SD) | 2.9 ± 2.6 | 2.7 ± 1.6 | $P$ = NS |
| Charlson index (mean ± SD) | 1.9 ± 1.9 | 1.6 ± 1.3 | $P$ = NS |
| Depression (n) | 6 (17%) | 9 (32%) | $P$ = NS |
| Anxiety (n) | 3 (8.5%) | 2 (7%) | $P$ = NS |
| Other psychiatric illness (n) | 2 (6%) | 1 (3.5%) | $P$ = NS |
| Tobacco use (n) | 14 (40%) | 10 (36%) | $P$ = NS |
| Ethanol use (n) | 18 (51%) | 9 (32%) | $P$ = NS |
| Drug allergies (n) | 11 (31%) | 9 (43%) | $P$ = NS |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

6. Complications: length of stay (in days), disposition (home, inpatient rehabilitation, long-term nursing facility), neurologic deficit (yes/no, type), cerebrospinal fluid leak (yes/no), wound complication (yes/no), medical complication (name), need for readmission (yes/no, reason), and need for further surgery (yes/no, reason)
7. Patient-derived clinical outcome measures (measured preoperatively and postoperatively): neck disability index (NDI) (0–100), neck visual analog scale (VAS) score (0–10), Short Form 12 physical component scale (SF-12 PCS) (0–60), Short Form 12 mental component scale (SF-12 MCS) (0–60), Prolo scale (0–5), and patient satisfaction index (1–5)

### *Analysis of clinical outcomes*

The primary outcome measures of this analysis are neck VAS score and NDI. The datasets were analyzed by 1 of 2 methods: a threshold analysis and a change analysis.

In the threshold method the outcome measures at 6 months, 12 months, and last contact were dichotomized as either success or failure for both neck VAS score (success, $<4.0$; failure, $\geq 4.1$) and NDI (success, $<40.0$; failure,

Table 4
Medications

| | miPCD (n = 35) | ACF (n = 28) | Statistical significance |
|---|---|---|---|
| Narcotics (n) | 9 (26%) | 6 (21%) | $P$ = NS |
| NSAIDs (n) | 21 (60%) | 18 (64%) | $P$ = NS |
| Acetaminophen (n) | 7 (20%) | 3 (11%) | $P$ = NS |
| Muscle relaxants (n) | 7 (20%) | 8 (29%) | $P$ = NS |
| Anticonvulsants (n) | 4 (11%) | 6 (20%) | $P$ = NS |
| Psychiatric medications (n) | 10 (29%) | 11 (39%) | $P$ = NS |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant; NSAIDs, nonsteroidal anti-inflammatory drugs.

Table 5
Preoperative outcome index scores

| | miPCD | ACF | Statistical significance |
|---|---|---|---|
| NDI (mean ± SD) | 42.70 ± 21.34 (n = 27) | 47.32 ± 16.68 (n = 22) | $P$ = NS |
| Neck VAS score (mean ± SD) | 4.93 ± 2.98 (n = 24) | 5.24 ± 2.32 (n = 19) | $P$ = NS |
| SF-12 PCS (mean ± SD) | 32.33 ± 8.73 (n = 23) | 31.85 ± 7.91 (n = 15) | $P$ = NS |
| SF-12 MCS (mean ± SD) | 43.38 ± 12.71 (n = 23) | 41.90 ± 11.66 (n = 15) | $P$ = NS |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

≥41.0). The percentage of patients achieving success was then compared between the groups. In the change method the outcome measures at 6 months, 12 months, and last contact were dichotomized as either success or failure for both neck VAS score (success, ≥2.1; failure, <2.0) and NDI (success, ≥21; failure, <20). The percentage of patients achieving success was then compared between the groups.

Secondary outcome measures were also noted for SF-12 PCS (0–60), SF-12 MCS (0–60), Prolo scale (0–5), and patient satisfaction index (1–5). In this analysis means ± standard deviations are reported and compared.

### *Statistical methods*

All data are reported as means ± standard deviations as well as percentages. Categorical variables were compared by use of $\chi^2$ tests, and continuous variables were compared by use of $t$ tests. Statistical significance was taken at $P < .05$.

## Results

### *Baseline characteristics*

Data regarding demographics, work status, medical history, and medications are presented in Tables 1 through 4. No statistically significant differences were identified at baseline. Preoperative outcome scores are shown in Table 5, with no statistical differences identified between the groups.

### *Surgical factors, length of stay, and disposition*

Surgical factors are summarized in Table 6. The results showed anticipated statistical differences with respect to the number of levels decompressed, the use of fusion, the use of foraminotomy, and the use of spinal instrumentation. It should be noted that the patient who received a blood transfusion did so on the basis of a low preoperative hematocrit level and a history of coronary artery disease, not on the basis of intraoperative blood loss. Whereas length of stay did not differ significantly between the groups (Table 7), the percentage of patients requiring inpatient rehabilitation was statistically higher in the group undergoing the minimally invasive posterior cervical decompression approach, likely because of a greater number of patients with moderate and severe myelopathy at baseline (data not shown).

### *Analysis of clinical outcomes*

The clinical outcomes are summarized in Table 5 and Tables 8 through 14. Baseline VAS, NDI, SF-12 PCS, and SF-12 MCS scores were statistically similar between the 2 groups (Table 5). The results of the threshold analysis are summarized in Tables 9 and 11. A statistical difference was

Table 6
Operative data

| | miPCD (n = 35) | ACF (n = 28) | Statistical significance |
|---|---|---|---|
| No. of levels decompressed (mean ± SD) | 2.1 ± 0.9 | 1.5 ± 0.8 | $P$ <.05 |
| Fusion (n) | 1 (3.0%) | 28 (100%) | $P$ <.05 |
| Foraminotomy (n) | 14 (40%) | 17 (61%) | $P$ = NS |
| Instrumentation (n) | 1 (3.0%) | 27 (96%) | $P$ <.05 |
| IVF (mean ± SD) (mL) | 2377 ± 693 | 2330 ± 724 | $P$ = NS |
| Urine output (mean ± SD) (mL) | 384 ± 243 | 400 ± 309 | $P$ = NS |
| Estimated blood loss (mean ± SD) (mL) | 98 ± 131 | 103 ± 127 | $P$ = NS |
| Blood transfusion (n) | 1 (3.0%) | 0 (0.0%) | $P$ = NS |
| CSF leak (n) | 0 (0.0%) | 0 (0.0%) | $P$ = NS |
| Procedure time (mean ± SD) (min) | 187 ± 80 (n = 32) | 164 ± 56 (n = 27) | $P$ = NS |
| Case time (mean ± SD) (min) | 270 ± 85 (n = 32) | 243 ± 59 (n = 27) | $P$ = NS |
| Wound complications (n) | 0 (0.0%) | 1 (3.5%) | $P$ = NS |
| Need for further surgery (n) | 0 (0.0%) | 2 (7.0%) | $P$ = NS |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; CSF, cerebrospinal fluid; IVF, intravenous fluid; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

Table 7
Length of stay and disposition

| | miPCD (n = 35) | ACF (n = 28) | Statistical significance |
|---|---|---|---|
| Length of stay (mean ± SD) (d) | 2.0 ± 1.7 | 1.9 ± 1.2 | $P$ = NS |
| Discharge home (n) | 24 (68.5%) | 26 (93%) | $P < .05$ |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

noted between the groups with respect to 2-year NDI outcome. The results of the perioperative change analysis are summarized in Tables 8 and 10. A statistical difference was noted between the groups with respect to 2-year NDI outcomes. No statistically significant differences were noted between the groups with respect to patient satisfaction, SF-12 PCS score, or SF-12 MCS score.

## Discussion

### *Study limitations*

This analysis is a small retrospective analysis from a single surgeon's experience and suffers from all the traditional shortcomings of such studies. The cohort is nonrandomized, includes patients with both radiculopathy and myelopathy, and has incomplete follow-up and incomplete patient-derived outcome data. Despite these limitations, the study does use appropriate patient-derived outcome measures as recommended by evidence-based reviews[4] and attempts to address a deficiency within the literature by comparing outcomes for patients having 2 different surgical approaches to their cervical spine pathology.[1–3] At baseline, the groups were well matched especially with respect to depression, which may have a significant effect on patient-reported outcome.[5]

Table 9
Threshold analysis for NDI

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 21 | 18 | |
| NDI (mean ± SD) | 26.47 ± 24.56 | 27.55 ± 17.29 | |
| Success rate | 71% | 72% | |
| 1 y | | | $P$ = NS |
| No. of patients | 28 | 18 | |
| NDI (mean ± SD) | 34.28 ± 24.22 | 35.00 ± 21.50 | |
| Success rate | 61% | 61% | |
| ≥2 y | | | $P < .05$ |
| No. of patients | 15 | 13 | |
| NDI (mean ± SD) | 41.06 ± 21.26 | 20.61 ± 14.77 | |
| Length (mean ± SD) (y) | 2.6 ± 1.1 | 2.5 ± 0.8 | |
| Success rate | 60% | 92% | |
| Last | | | $P$ = NS |
| No. of patients | 35 | 28 | |
| NDI (mean ± SD) | 32.48 ± 21.06 | 31.51 ± 21.18 | |
| Length (mean ± SD) (y) | 1.7 ± 1.2 | 1.7 ± 1.0 | |
| Success rate | 69% | 68% | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

### *Does fusion help improve neck pain?*

Many surgeons suggest that patients with myelopathy or radiculopathy and significant axial pain should be treated

Table 8
Perioperative change in NDI

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 18 | 13 | |
| Change in NDI (mean ± SD) | −15.10 ± 14.90 | −11.76 ± 16.73 | |
| Success rate | 44% | 31% | |
| 1 y | | | $P$ = NS |
| No. of patients | 21 | 13 | |
| Change in NDI (mean ± SD) | −9.42 ± 15.96 | −10.69 ± 18.98 | |
| Success rate | 38% | 31% | |
| ≥2 y | | | $P < .05$ |
| No. of patients | 12 | 11 | |
| Change in NDI (mean ± SD) | −10.41 ± 14.65 | −24.36 ± 15.76 | |
| Length (mean ± SD) (y) | 2.9 ± 1.0 | 2.4 ± 0.7 | |
| Success rate | 42% | 72% | |
| Last | | | $P$ = NS |
| No. of patients | 27 | 22 | |
| Change in NDI (mean ± SD) | −9.22 ± 13.45 | −14.77 ± 18.57 | |
| Length (mean ± SD) (y) | 1.8 ± 1.2 | 1.7 ± 1.0 | |
| Success rate | 33% | 50% | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

Table 10
Perioperative change in neck VAS score

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 16 | 10 | |
| Neck VAS score (mean ± SD) | −2.03 ± 2.64 | −2.29 ± 1.65 | |
| Success rate | 62.5% | 70% | |
| 1 y | | | $P$ = NS |
| No. of patients | 20 | 11 | |
| Neck VAS score (mean ± SD) | −1.93 ± 3.14 | −2.39 ± 3.14 | |
| Success rate | 45% | 45% | |
| ≥2 y | | | $P$ = NS |
| No. of patients | 11 | 7 | |
| Neck VAS score (mean ± SD) | −1.08 ± 3.73 | −3.68 ± 3.37 | |
| Length (mean ± SD) (y) | 2.8 ± 1.0 | 2.2 ± 0.4 | |
| Success rate | 45% | 85% | |
| Last | | | $P$ = NS |
| No. of patients | 24 | 19 | |
| Neck VAS score (mean ± SD) | −1.65 ± 3.11 | −2.67 ± 3.00 | |
| Length (mean ± SD) (y) | 1.8 ± 1.2 | 1.4 ± 0.8 | |
| Success rate | 42% | 63% | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

with an anterior interbody fusion, because a posterior decompression alone may exacerbate the patients' neck pain, yet there is little evidence-based literature on which to base this suggestion. Indeed, in a follow-up to the original article by Smith and Robinson,[6] it was noted, "There was no clear correlation after operation between absence of fusion at the interspaces and the clinical result."[7] The foundation for this suggestion is likely based on expert opinion or studies with a low level of evidence[3,8] rather than adequate analysis of clinical outcomes. Recent evidence-based reviews have provided no evidence to support or refute this suggestion. The reviews also note a paucity of comparative outcomes data,[1–3] especially given the number of cases performed each year in the United States. In our study no patient underwent surgery for axial complaints alone, and in all cases the patient manifested a neurologic concern as the indication for surgery.

This study suggests that a minimally invasive approach that largely preserves muscular and ligamentous attachments may result in similar clinical outcomes to an open anterior cervical approach that uses interbody fusion and instrumentation. Accordingly, our results suggest the need for further comparative effectiveness study. Indeed, we are in the process of extending our observations and collecting hospital resource use data to further address the question of comparative effectiveness.

Several studies have shown the effectiveness of a minimally invasive approach to posterior foraminotomy in providing relief of radiculopathy.[9,10] One study has compared the effectiveness of a minimally invasive approach for posterior foraminotomy with an open approach.[10] Using nonvalidated outcome measures, the authors suggested equivalent outcomes. Thus it appears that a minimally invasive approach to posterior cervical foraminotomy can provide relief from cervical radiculopathy.

Few studies have provided comparative data between an anterior cervical approach and a posterior cervical approach for the treatment of degenerative cervical spine disease. The 2 studies that have provided data for a comparison between anterior and posterior cervical surgery did not use a minimally invasive approach to foraminotomy, did not use validated outcome tools, and accordingly, were thought to represent class III data.[8,11] Our study, though retrospective, does use validated outcome tools and does make an attempt to compare 2 commonly applied surgical approaches in terms of their effect on neck disability and pain.

### *Future implications*

No surgical approach can replace sound clinical diagnosis and surgical decision making. Indeed, it is unlikely that the technical factors of surgery for cervical radiculopathy or myelopathy would contribute to clinical outcome more than the surgical decision-making process. Despite this caution,

Table 11
Threshold analysis for neck VAS score

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 20 | 17 | |
| Neck VAS score (mean ± SD) | 2.77 ± 2.98 | 2.23 ± 2.47 | |
| Success rate | 70% | 82% | |
| 1 y | | | $P$ = NS |
| No. of patients | 28 | 18 | |
| Neck VAS score (mean ± SD) | 2.70 ± 2.80 | 2.36 ± 2.37 | |
| Success rate | 75% | 78% | |
| ≥2 y | | | $P$ = NS |
| No. of patients | 15 | 12 | |
| Neck VAS score (mean ± SD) | 3.28 ± 3.15 | 1.37 ± 2.05 | |
| Length (mean ± SD) | 2.7 ± 0.9 y | 2.6 ± 0.8 y | |
| Success rate | 66% | 91% | |
| Last | | | $P$ = NS |
| No. of patients | 35 | 28 | |
| Neck VAS score (mean ± SD) | 2.62 ± 2.81 | 2.21 ± 2.46 | |
| Length (mean ± SD) | 1.7 ± 1.1 y | 1.6 ± 1.0 y | |
| Success rate | 71% | 82% | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

Table 12
Patient satisfaction index

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 17 | 16 | |
| Patient satisfaction index (mean ± SD) | 4.29 ± 0.98 | 4.0 ± 0.96 | |
| 1 y | | | $P$ = NS |
| No. of patients | 28 | 17 | |
| Patient satisfaction index (mean ± SD) | 3.80 ± 1.20 | 3.76 ± 1.25 | |
| ≥2 y | | | $P$ = NS |
| No. of patients | 14 | 12 | |
| Patient satisfaction index (mean ± SD) | 3.92 ± 1.49 | 4.25 ± 0.86 | |
| Length (mean ± SD) (y) | 2.7 ± 1.0 | 2.6 ± 0.8 | |
| Last | | | $P$ = NS |
| No. of patients | 35 | 28 | |
| Patient satisfaction index (mean ± SD) | 4.00 ± 1.18 | 3.82 ± 1.18 | |
| Length (mean ± SD) (y) | 1.7 ± 1.1 | 1.6 ± 1.0 | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

there is mounting evidence to suggest that minimally invasive surgery may have advantages over an open surgical alternative. These advantages may include a lower risk of infection,[12–14] a lower risk of symptomatic cerebrospinal fluid leak, a lower risk of new perioperative neurologic deficit,[15] and a lower overall complication rate.[16] These

Table 13
Perioperative change in SF-12 PCS

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 10 | 10 | |
| SF-12 PCS (mean ± SD) | 7.4 ± 9.9 | 3.6 ± 9.3 | |
| 1 y | | | $P$ = NS |
| No. of patients | 17 | 6 | |
| SF-12 PCS (mean ± SD) | 2.8 ± 10.7 | 6.3 ± 7.2 | |
| ≥2 y | | | $P$ = NS |
| No. of patients | 9 | 8 | |
| SF-12 PCS (mean ± SD) | 4.8 ± 8.4 | 5.0 ± 10.3 | |
| Length (mean ± SD) (y) | 2.9 ± 1.2 | 2.0 ± 0.8 | |
| Last | | | $P$ = NS |
| No. of patients | 23 | 15 | |
| Mean ± SD | 3.9 ± 9.3 | 5.7 ± 10.4 | |
| Length (mean ± SD) (y) | 1.7 ± 1.2 | 1.4 ± 0.9 | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

Table 14
Perioperative change in SF-12 MCS

| Follow-up period | miPCD | ACF | Statistical significance |
|---|---|---|---|
| 6 mo | | | $P$ = NS |
| No. of patients | 10 | 10 | |
| SF-12 MCS (mean ± SD) | 5.85 ± 14.72 | 2.34 ± 12.79 | |
| 1 y | | | $P$ = NS |
| No. of patients | 17 | 6 | |
| SF-12 MCS (mean ± SD) | 6.0 ± 11.07 | 5.48 ± 17.6 | |
| ≥2 y | | | $P$ = NS |
| No. of patients | 9 | 8 | |
| SF-12 MCS (mean ± SD) | 7.83 ± 11.25 | 10.28 ± 11.53 | |
| Length (mean ± SD) (y) | 2.9 ± 1.2 | 2.3 ± 0.4 | |
| Last | | | $P$ = NS |
| No. of patients | 23 | 15 | |
| SF-12 MCS (mean ± SD) | 5.14 ± 10.99 | 8.70 ± 12.11 | |
| Length (mean ± SD) (y) | 1.7 ± 1.3 | 1.5 ± 0.9 | |

Abbreviations: ACF, anterior cervical diskectomy or corpectomy with interbody fusion; miPCD, minimally invasive posterior cervical decompression; NS, not significant.

potential advantages do not necessarily guarantee similar short- or long-term clinical outcomes, and to date, there is little evidence to support the use of a minimally invasive approach over an open approach. Unfortunately, the approach recommended to the patient may rest more upon the comfort level of the treating surgeon or, more cynically, the financial motive of the treating surgeon, rather than clinical outcome data. Ideally, the decision should not be limited by either the surgeon's expertise or the associated reimbursement. The decision should be directed at affording the patient the best possible clinical outcome. If, however, 2 procedures can provide similar clinical outcomes, then the relative healthcare resource utilization and cost should be taken into account. At this juncture, the comparative effectiveness of the 2 techniques should be taken into account and the more effective technique applied as often as appropriate, thus also affording a potential societal benefit.

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