Outcomes and Costs Associated with Cervical Spinal Fusion Surgery

Daryll C. Dykes[1], Jill W. Ruppenkamp[2], Katherine A. Corso[1], Chantal E. Holy[2], Caroline E. Smith[1], Michelle Costa[1]
1: Johnson & Johnson, Raynham, MA, USA;
2: Johnson & Johnson, New Brunswick, NJ, USA

BACKGROUND

- A 2007 meta-analysis of cervical fusion outcomes reported fusion rates of 89.5%[1].
- Using real-world data, it has been estimated that the two-year reoperation/subsequent surgery rate after anterior or posterior cervical fusion can range from 3% to 14% [2 3].
- Despite innovation, there is no evidence to suggest improved fusion rates since that study.

OBJECTIVES

- Our study evaluated the two-year healthcare utilization associated with cervical fusion surgery using contemporary data.

METHODS

Study Design: Retrospective, noncomparative cohort study of patients that had cervical only fusion procedure.
Data Source: Merative MarketScan Commercial Claims database, covering>100 million lives, October 1, 2015 to October 31, 2020.
Study Population:
- ***Inclusion:*** Adult (18 to 64 years) that had cervical only fusion (identified with ICD-10 codes) and ≥ two years continuous enrollment post-surgery, 180 days of healthcare enrollment prior to fusion.
- ***Exclusion:*** Patients with fusions of other anatomies.

Two-year outcomes:
- Cervical reoperations
- Infection, defined as presence of deep infection or spinal infection
- Pseudarthrosis
- Healthcare costs associated with pseudarthrosis, infection, reoperation

Statistical Analysis:
- Descriptive analytics were conducted for all cervical reoperation, infection and pseudarthrosis.
- Costs were inflation adjusted to 2022.
- Generalized linear models (GLM) with log link and gamma distribution and marginal analysis was used for costs.

References:
1. Frasier J et al. Anterior approaches to fusion of the cervical spine: a metaanalysis of fusion rates. JNS 2007; 6(4):298-303.
2. Yoo P et al. Clinical outcomes following one-, two-, three-, and four-level anterior cervical discectomy and fusion: a national database study. Spine J 2022;22(4):542-548.
3. Bajouri Z et al. Comparison of Surgical Outcomes Between Anterior and Posterior Cervical Fusions Stratified by Levels Decompressed. Clin Spine Surg 2023; 36(5):E206-E211.

RESULTS

- The patient, provider and procedure characteristics of the cohort are presented in **Table 1**
  - 28,674 patients with average age 51, including 53% females, were included in the analysis.
  - Half of all patients were treated in the inpatient setting, 40% in outpatient, and 10% in ambulatory surgical care.
  - The average Elixhauser index patient comorbidity score was 1.6 (standard deviation (SD): 1.5) and nearly 24% patients had ≥ 3 comorbidities.
  - Degenerative disc disease (DDD) and deformity were diagnosed in 87% and 8% cases, respectively.
  - 58% cases had two or more levels fused.

Table 1. Baseline characteristics of the study cohort

Variable	Cervical only
n	28,674
Age (mean (SD))	51.02 (7.89)
Gender = male n (%)	13,492 (47.1)
Discharge year n (%)	
2015	2,519 (8.8)
2016	7,268 (25.3)
2017	5,574 (19.4)
2018	5,172 (18.0)
2019	4,894 (17.1)
2020	3,247 (11.3)
Place of service code description n (%)	
ASC	2,755 (9.6)
ED	13 (0.0)
HOPD	11,541 (40.2)
Inpatient	14,321 (49.9)
OTHER	44 (0.2)
Elixhauser Index (mean (SD))	1.59 (1.54)
Elixhauser Index Categorical n (%)	
0	7,962 (27.8)
1-2	14,071 (49.1)
3-4	5,252 (18.3)
5+	1,389 (4.8)
Diabetes n (%)	4,597 (16.0)
Obesity n(%)	3,931 (13.7)
Tobacco use n (%)	4,527 (15.8)
Osteoporosis/Osteopenia n (%)	381 (1.3)
Stenosis diagnosis n (%)	23,552 (82.1)
Degenerative diagnosis n (%)	25,014 (87.2)
Spinal cancer diagnosis n (%)	150 (0.5)
Deformity diagnosis n (%)	2,323 (8.1)
Adolescent idiopathic scoliosis n (%)	16 (0.1)
Pseudarthrosis diagnosis n (%)	624 (2.2)
Spine trauma diagnosis n (%)	1,432 (5.0)
Index spine infection diagnosis n (%)	77 (0.3)
Index surgical site infection (SSI) n (%)	26 (0.1)
Index radiculopathy diagnosis n (%)	11,714 (40.9)
Anterior approach n (%)	27,086 (94.5)
Posterolateral approach n (%)	1,421 (5.0)
Posterior interbody approach n (%)	282 (1.0)
Posterior unspecified approach n (%)	2,013 (7.0)
Interbody cage use n (%)	19,874 (69.3)
Corpectomy at index n (%)	2,186 (7.6)
Posterior instrumentation used n (%)	1,547 (5.4)
Cervical Fusion level-ICD10+CPT n (%)	
1	12,030 (42.0)
2plus	16,644 (58.0)
Physician specialty code-Neurosurgeon n (%)	12,882 (44.9)
Physician specialty code-Orthopaedic n (%)	10,241 (35.7)
Physician specialty code-Other n (%)	6,035 (21.0)
Length of Stay (mean (SD))	1.94 (2.51)

- At 2-year follow-up, new cervical operations affected 11.6% cases, but only one third of those cases had a diagnosis of spinal fusion complication at the time of the new procedure (Figure 1).
- Pseudarthrosis was reported in 3.9% cases, and infection in 2.2% cases (Figure 1).
- Healthcare costs associated with pseudoarthrosis or infection, without reoperation, averaged $33,055 (95% confidence interval (CI): $24,514-$41,596) and $108,173 (95%CI: $86,890-$129,455), respectively (Figure 2).
- When reoperations were performed, costs increased by $49,354 (95%CI: $39,113-$59,596) (Figure 2).

Figure 1. Two-year incidence proportion with 95% confidence interval of reoperation, pseudarthrosis and infection after cervical fusion procedures

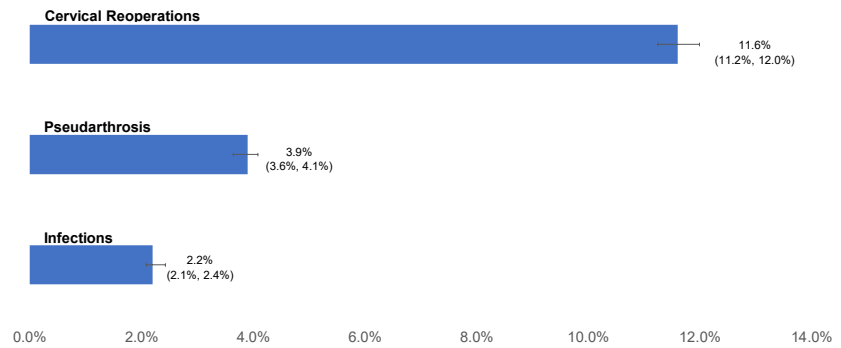
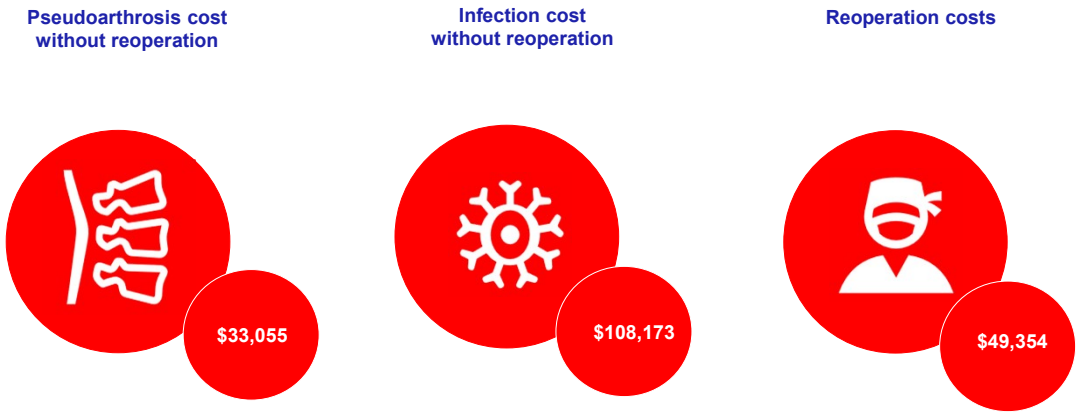


Figure 2. Incremental healthcare costs associated with pseudarthrosis, infection and reoperation



CONCLUSIONS

- By 2-year post-operative, 12% patients with cervical fusion underwent additional cervical surgery, suggesting outcomes consistent with those reported in the 2007 meta-analysis.

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