Trends in Inpatient versus Outpatient Anterior Cervical Discectomy and Fusion in the United States of America: An Epidemiologic and Economic Analysis

FJR Pencle¹, S Rosas¹, NT Britton¹, EA Hothem¹, KR Chin²,³,⁴, A Simela⁵

ABSTRACT

Objective: Neck pain is a leading cause of disability with an increased prevalence of up to 20% annually in some reports. Various studies have shown improvements in symptoms and quality of life in patients who underwent anterior cervical discectomy and fusion (ACDF) for symptomatic nerve root compression and spondylosis. With the increased prevalence of these aforementioned conditions, it is imperative to understand the national trends in the use of ACDF. The authors aim to report on the incidence of ACDF in the United States of America (USA) over a four-year period and the associated procedural reimbursement costs.

Methods: A query was performed for patients who underwent ACDF using the PearlDiver super-computer (Warsaw, IN) from 2011 to 2014. Patients were identified by current procedural terminology (CPT) Codes 22551 and 22552 and their demographics, location of surgery and reimbursement costs were later analysed.

Results: Our query returned a total of 13,143 ACDFs over the four-year study period of 2011 to 2014. The total number of procedures done in the outpatient setting increased significantly from 454 in 2011 to 815 in 2014 (p = 0.005); whereas those in the hospital setting did not from 1986 in 2011 to 2925 in 2014 (p = 0.118). Of the total amount of surgeries, 10,556 (80.4%) were performed in the hospital setting compared to 2587 performed in the ambulatory surgical centre [ACS: outpatient setting] (p < 0.001). The four-year mean reimbursement cost for ACDF done in the inpatient setting was $2407.75 compared to $5014 in the outpatient setting, which was not statistically significant (p = 0.36).

Conclusion: Over the four-year study period, the total number of ACDF performed in the outpatient setting increased significantly. There was no difference in the mean reimbursement according to the location where the surgery was performed (p = 0.36).

Keywords: Anterior cervical discectomy and fusion, cervical, economic analysis, epidemiology, national sample, neck pain

Tendencias en la discectomía y fusión cervical anterior ambulatoria frente a la intrahospitalaria en los Estados Unidos de América: un análisis epidemiológico y económico

FJR Pencle¹, S Rosas¹, NT Britton¹, EA Hothem¹, KR Chin²,³,⁴, A Simela⁵

RESUMEN

Objetivo: El dolor de cuello es la principal causa de discapacidad, con un aumento de su prevalencia de hasta un 20% anualmente según algunos reportes. Varios estudios han mostrado mejoras en los síntomas y la calidad de vida en pacientes sometidos a discectomía y fusión cervical anterior (DFCA) debido a espondilosis y compresión sintomática de la raíz del nervio. Con la mayor prevalencia de las condiciones mencionadas, resulta imperativo entender las tendencias nacionales en el uso de ACDF.

From: ¹Less Exposure Surgery (LES) Society, USA, ²Charles E Schmidt College of Medicine at Florida Atlantic University, USA, ³Herbert Wertheim College of Medicine at Florida International University, USA, ⁴Less Exposure Surgery Specialists Institute (LESS Institute), USA and ⁵Bronx-Lebanon Hospital Center, USA.

Correspondence: Dr K Chin, Less Exposure Surgery Specialists Institute (LESS Institute), 1100 W. Oakland Park Blvd. Suite #3, Fort Lauderdale, FL, 33311, USA. Email: kingsleychin@thelessinstitute.com

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INTRODUCTION

Anterior cervical discectomy and fusion (ACDF) has been a standard of practice in the United States of America (USA) since the early 1950s (1). This is a simple and safe procedure performed to achieve cervical nerve root and spinal cord decompression at a low complication rate, low postoperative morbidity, and high fusion rate (2). Various techniques (3, 4) have been developed to perform this procedure and as time evolves newer techniques and devices are employed in order to try to obtain better patient outcomes.

The transition from patients being admitted to hospital (inpatient) ACDF procedures being performed on a same day (outpatient) setting over the past two decades has been on the increase due to many factors (5). Some factors of the transition towards the outpatient setting include, reducing costs, minimally invasive approach usage, and/or increasing allograft usage (6). There has also been decreased time in on-site facility locations, shorter return home times, advancement in outpatient surgical centres, and advancement in surgical techniques, which are methods favoured by physicians and patients (7).

Recent studies have shown that an inpatient ACDF procedure can cost anywhere from $6700 to $15 000, yielding $4000 to $8000 in savings by operating in an outpatient setting (7).

Various studies (2, 6, 8, 9), have stated that performing ACDF in the outpatient setting can provide satisfactory outcomes but currently, there is no study in the literature to the authors’ knowledge that analyses the trends of patient use in each location for ACDF in a national sample. The purpose of this study was to report on the incidence of ACDF, in the USA over a recent four-year period (2011–2014), the associated procedural reimbursement costs associated with the inpatient and the outpatient setting and the demographic distribution of the surgeries. We also intended to compare the groups of patients according to the location of surgery inpatient versus outpatient as to better understand which factors might be directing patients to the outpatient setting.

SUBJECTS AND METHODS

A survey was conducted of unidentified patient records within the PearlDiver Database (PearlDiver Inc, Warsaw, Indiana) for the years 2011 through 2014. The search was performed through the use of current procedural terminology (CPT) codes 22551 and 22552 for ACDF. Data were stratified to create two groups according to where the surgery was performed. The first group was that of those patients who underwent surgery in the inpatient setting and the second group was of those who were operated as in outpatient setting. The PearlDiver Database is a publicly available. Health Insurance Portability and Accountability Act (HIPAA)–compliant national database compiled from a collection of private insurer records. This query was performed within the Humana database, which holds more than two billion individual patients. The PearlDiver Supercomputer has been previously used in an array of studies and provides medical procedure data for analysis looking at outcomes, cost of procedures and reimbursements (10–12).

In addition to CPT and ICD-9 codes, demographic data such as; age and gender were also recorded and analysed. Data
The annual incidence of outpatient ACDF went from 0.007% in 2011 to 0.009% in 2014, which did not prove to be a statistically significant difference \((p = 0.119)\) (Table 4). When comparing costs, the average inpatient reimbursement for inpatient ACDF began at $2458 in 2011 and ended at $2380 in 2014. In contrast, for outpatient ACDF, the average reimbursement began at $4836 dollars in 2011 and ended at $5283 in 2014 (Table 5).

The four-year mean reimbursement cost for ACDF done in the inpatient setting was $2407.75 compared to $5014 in the outpatient setting, which was not statistically significant \((p = 0.36)\). Correlation analysis performed between reimbursements and number of procedures demonstrated no significance in both groups, \(R = 0.404, p = 0.596\) in the inpatient cohort and \(R = 0.652, p = 0.348\) in the outpatient cohort.

### Table 2: Regional distribution of surgeries

<table>
<thead>
<tr>
<th>Region</th>
<th>Inpatients</th>
<th>Outpatients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest</td>
<td>19.7%</td>
<td>23.26%</td>
</tr>
<tr>
<td>Northeast</td>
<td>1.6%</td>
<td>1.05%</td>
</tr>
<tr>
<td>South</td>
<td>69.1%</td>
<td>71.06%</td>
</tr>
<tr>
<td>West</td>
<td>9.6%</td>
<td>4.63%</td>
</tr>
</tbody>
</table>

### Table 3: Inpatient procedural utilization

<table>
<thead>
<tr>
<th>Year</th>
<th>Patients</th>
<th>Incidence</th>
<th>Incidence per 100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1986</td>
<td>0.030%</td>
<td>30.34878641</td>
</tr>
<tr>
<td>2012</td>
<td>2538</td>
<td>0.035%</td>
<td>35.18377631</td>
</tr>
<tr>
<td>2013</td>
<td>3107</td>
<td>0.039%</td>
<td>39.37388552</td>
</tr>
<tr>
<td>2014</td>
<td>2925</td>
<td>0.032%</td>
<td>31.95061625</td>
</tr>
</tbody>
</table>

### Table 4: Outpatient procedural utilization

<table>
<thead>
<tr>
<th>Year</th>
<th>Patients</th>
<th>Incidence</th>
<th>Incidence per 100 000</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>454</td>
<td>0.00694%</td>
<td>6.937738685</td>
</tr>
<tr>
<td>2012</td>
<td>604</td>
<td>0.00837%</td>
<td>8.3731288</td>
</tr>
<tr>
<td>2013</td>
<td>714</td>
<td>0.00905%</td>
<td>9.048263361</td>
</tr>
<tr>
<td>2014</td>
<td>815</td>
<td>0.00890%</td>
<td>8.902479401</td>
</tr>
</tbody>
</table>

The annual incidence of outpatient ACDF went from 0.007% in 2011 to 0.009% in 2014, which did not prove to be a statistically significant difference \([p = 0.119]\) (Table 4).

When comparing costs, the average inpatient reimbursement for inpatient ACDF began at $2458 in 2011 and ended at $2380 in 2014. In contrast, for outpatient ACDF, the average reimbursement began at $4836 dollars in 2011 and ended at $5283 in 2014 (Table 5).

### Table 5: Average yearly mean reimbursement

<table>
<thead>
<tr>
<th>Year</th>
<th>Inpatient mean reimbursement</th>
<th>Outpatient mean reimbursement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>$2458</td>
<td>$4836</td>
</tr>
<tr>
<td>2012</td>
<td>$2363</td>
<td>$5091</td>
</tr>
<tr>
<td>2013</td>
<td>$2430</td>
<td>$4846</td>
</tr>
<tr>
<td>2014</td>
<td>$2380</td>
<td>$5283</td>
</tr>
<tr>
<td>Mean</td>
<td>$2407.75</td>
<td>$5014</td>
</tr>
</tbody>
</table>
DISCUSSION
The study aimed to determine the trend of ACDF as it relates to the total number of procedures performed nationally as well as the operative settings thereof. Overall, there was a statistical increase in the total number of procedures being performed in the outpatient setting. Based on analysis, the number of procedures performed in the inpatient and outpatient cohort is not directly correlated to reimbursements. This study showed higher reimbursements cost in the outpatient setting although no significance was demonstrated. However, this does not correlate to published data; a study by Silvers et al demonstrated the safety and efficacy of ACDF in the outpatient setting with an estimated $100 million annual economic savings (14). Other factors leading to increase in ACDF procedures being performed in the outpatient setting can be attributed to better outcomes and quality of life (2, 5, 15).

There has been a growing interest in spine surgery being performed in the outpatient setting. Currently, there is in excess of 6000 outpatient centres in operation in the USA (16). The literature is satiated with data on the epidemiology and outcomes of spine operation in a hospital-based setting (17–21).

Several studies have demonstrated good outcome, excellent safety levels of outpatient ACDF to inpatient ACDF and an approximated 2% complication rate (2, 6–9, 15). Additional, studies have also demonstrated the cost-effectiveness of ACDF (5, 14, 22, 23). Carreon et al demonstrated that ACDF had a favourable five-year cost per adjusted quality of life year (23). The associated improved outcomes and decreased cost to patient are factors leading to an increase trend in ACDF being performed in the outpatient setting.

Limitations
This study is not without limitations. The PearlDiver Database is reliant upon accurate CPT or international classification of diseases (ICD) coding which creates the potential for a reporting bias. The sample size based on database is only of insurance based users and would not include cash paying patients.

Strengths
One of the strengths of this study is the large patient population that was analysed. In addition, the study adds to the body of knowledge as it relates to outpatient ACDF, as it investigates the rate of surgery incidence in the outpatient setting and associated cost reimbursement, which has not been adequately studied previously.

CONCLUSION
The results of this study have shown a statistically significant increase in the amount of ACDF procedures being performed in the outpatient setting. The increase in outpatient procedures may be due to decreased complications and quicker return to activity. There was no significant difference in reimbursement cost on national average, demonstrating that financial gain was not a contributing factor to patient procedures being performed in the outpatient setting. The preferences for outpatient surgeries are on the rise not only by physicians, but also by patients due to social and economic advantage and short operational time.

AUTHORS’ NOTE
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REFERENCES