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# Trends in open and endoscopic carpal tunnel release utilization in the Medicare patient population

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## ABSTRACT

**Background:** Surgical management of carpal tunnel syndrome (CTS) is performed with an open or endoscopic approach. Current literature suggests that the endoscopic approach is associated with higher costs and a steeper learning curve. This study evaluated the billing and utilization trends of both approaches.

**Methods:** A retrospective review of a Medicare database within the PearlDiver Supercomputer (Warsaw, IN) was performed for patients undergoing open carpal tunnel release (OCTR) or endoscopic carpal tunnel release (ECTR) from 2005-2012. Annual utilization, charges, reimbursement, demographic data, and compound annual growth rate (CAGR) were evaluated.

**Results:** Our query returned 1,500,603 carpal tunnel syndrome patients, of which 507,924 (33.8%) and 68,768 (4.6%) were surgically managed with OCTR and ECTR respectively (remainder treated conservatively). Compound annual growth rate was significantly higher in ECTR (5%) than OCTR (0.9%;  $P < 0.001$ ). Average charges were higher in OCTR (\$3820) than ECTR (\$2952), whereas reimbursements were higher in ECTR (mean \$1643) than OCTR (mean \$1312). Both were performed most commonly in the age range of 65-69 y, females, and southern geographic region.

**Conclusions:** ECTR is growing faster than OCTR in the Medicare population. Contrary to previous literature, our study shows that ECTR had lower charges and reimbursed at a higher rate than OCTR.

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## Introduction

Carpal tunnel syndrome is the most commonly diagnosed peripheral neuropathy in the United States, accounting for approximately 1-3 cases per 1000 patients per year.<sup>1-3</sup> Nonsurgical management is typically employed; however, many patients fail conservative therapy and require surgery. Therefore, carpal tunnel release (CTR) represents one of the

most commonly performed surgical procedures, with more than 600,000 cases reported annually.<sup>1</sup>

CTR can be performed with an open approach, originally described by Learmonth in 1933, or a more recent endoscopic approach, first described by Okutsu et al. in 1989.<sup>2-5</sup> Current literature suggests the open approach is performed more frequently, despite similar complication rates.<sup>2,3</sup> Moreover, a recent randomized control trial with a mean follow-up of

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12.8 y following surgery concluded no significant differences in outcomes between open and endoscopic approaches for CTR.<sup>6</sup>

There is an increasing focus on value, and as such, a critical understanding of health care resource utilization for carpal tunnel syndrome (CTS) is important. The purpose of this retrospective study was to evaluate the billing and utilization trends of open and endoscopic approaches for decompression of the median nerve within the Medicare patient population.

## Methods

A retrospective review of a Medicare database within the PearlDiver Supercomputer (Warsaw, IN) was performed for patients undergoing open carpal tunnel release (OCTR) or endoscopic carpal tunnel release (ECTR) from 2005-2012. The PearlDiver database is a publicly available Health Insurance Portability and Accountability Act-compliant national database compiled from a collection of private payer records. This database contains current procedural terminology (CPT) and *International Classification of Diseases, Ninth Revision (ICD-9)* codes.

Patients who underwent OCTR were identified by Current Procedural Terminology (CPT) code 64721 and International Classification of Disease ICD-9 code 04.43. ECTR was identified by CPT code 29848. CTS was identified by ICD-9 code 354.0.

Statistical analysis was primarily descriptive. The data were initially evaluated for normality through the Shapiro-Wilk test. Normally distributed data were analyzed through independent sample t-testing. Annual utilization, charges, reimbursement, demographic data, regression analysis, geographic region, and compound annual growth rate (CAGR) were also evaluated.

Geographic regions follow the US Census Bureau definition:

Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

## Results

Our query returned 1,500,603 CTS patients, of which 507,924 (33.8%) and 68,768 (4.6%) were managed surgically with OCTR and ECTR, respectively, (the remainder were treated conservatively). CAGR was significantly higher in ECTR (5%) than OCTR (0.9%) ( $P < 0.001$ ). The mean number of procedures

**Table 1 – Annual open and endoscopic release.**

Year	CTS	OCTR	Growth, %	ECTR	Growth, %
2005	174,087	62,161		7757	
2006	182,047	65,471	5.3	8157	5.2
2007	180,979	64,328	-1.7	7527	-7.7
2008	179,617	61,832	-3.9	7355	-2.3
2009	180,829	61,458	-0.6	7703	4.7
2010	186,295	62,416	1.6	9168	19.0
2011	202,728	64,099	2.7	10,170	10.9
2012	214,021	66,159	3.2	10,931	7.5
Total	1,500,603	507,924		68,768	
CAGR	3.0%	0.9%		5.0%	

done annually was significantly lower in the ECTR group ( $P < 0.001$ ). **Table 1** shows the annual utilization, annual growth, and the CAGR of OCTR and ECTR.

Mean annual charges were significantly higher in the OCTR group (\$3820) than ECTR (\$2952;  $P = 0.02$ ). Conversely, reimbursements were higher in ECTR (\$1643) than OCTR (\$1312;  $P < 0.01$ ). CAGR was higher in ECTR charges (8.7%), whereas patients in the OCTR cohort had a higher reimbursement CAGR at 4%. **Table 2** depicts the costs associated with OCTR and ECTR through annual charges and reimbursements.

Growth in reimbursement in both OCTR and ECTR did not always correlate with a growth in relative value unit (RVU) as growth rose steadily throughout the study period, whereas RVU remained the same in years 2005-2006, 2007-2009, and 2010-2012 (**Table 2**). Regression analysis showed a more linear growth in OCTR and ECTR reimbursement ( $R^2 = 0.94$ ,  $R^2 = 0.99$ ) compared with RVU growth ( $R^2 = 0.73$ ,  $R^2 = 0.71$ ).

Both procedures were performed most commonly in females (OCTR 60.7%, ECTR 60.6%) and in those aged 65-69 y (OCTR 20.1%, ECTR 22.1%; **Tables 3 and 4**). OCTR and ECTR were performed the most in the Southern region (36.1% and 37.6%) and the least in the Western region (12.9% and 14.7%). Reimbursement for OCTR was greatest in the Western region (\$1478), whereas ECTR was greatest in the Northeast region (\$1785; **Table 5**).

Our data found that OCTR performed in the clinic or office (\$260) setting is reimbursed at a higher rate than those performed in the inpatient hospital (\$186) setting and similar to those in the outpatient hospital (\$259) setting. ECTR reimbursement in the office (\$258) was similar to inpatient hospital (\$257) but lower than the outpatient hospital (\$310) setting. Reimbursements in both OCTR (\$348) and ECTR (\$652) were highest when performed in ambulatory surgery centers (**Table 6**).

## Discussion

Existing literature suggests that ECTR is associated with higher costs and a steeper learning curve.<sup>2,7-9</sup> The purpose of

**Table 2 – Average charges and reimbursements.**

Year	OCTR charges, \$	OCTR reimb, \$	RVU	ECTR charges, \$	ECTR reimb, \$	RVU
2005	2839	1109	4.28	2146	1438	5.43
2006	3048	1147	4.28	2361	1513	5.43
2007	3365	1218	4.84	2527	1569	6.24
2008	3448	1261	4.84	2793	1614	6.24
2009	3909	1370	4.84	3059	1702	6.24
2010	4456	1468	4.97	3338	1733	6.39
2011	4602	1460	4.97	3545	1766	6.39
2012	4893	1459	4.97	3847	1811	6.39
Average	3820	1312	4.75	2952	1643	6.09
CAGR	8.1%	4.0%	2.2%	8.7%	3.3%	2.4%

this study was to evaluate the billing and utilization trends associated with both OCTR and ECTR approaches within the Medicare patient population. The primary results of our study show that ECTR utilization is growing at a faster rate than OCTR while having lower charges but higher reimbursement.

Despite some studies showing similar outcomes and a steep learning curve for ECTR, the results of the present study show that ECTR is growing at a significantly higher rate than OCTR.<sup>2,8,10,11</sup> The results of our study are supported by the study by Smetana et al. who found an increasing trend over time (2003-2013) in overall ECTR utilization with a greater proportion and growth among hand fellowship trained surgeons.<sup>1</sup> This growth may be influenced by increasing patient preference as reported in a randomized trial of 52 patients where 34 (65.4%) preferred the ECTR technique over OCTR.<sup>8</sup> Although long-term outcomes have been shown to be the same, a meta-analysis found ECTR to have a reduction in scar tenderness and increase in grip and pinch strength compared to OCTR at a 12-wk follow-up.<sup>12</sup>

In addition, a financial factor may play a part in this growth. Our study found charges to be lower in ECTR while retaining a higher reimbursement than OCTR. Our results are supported in a prospective, randomized, multicenter trial of 192 hands. Trumble et al. found that the average cost of OCTR was \$3940 compared with \$3750 for ECTR by factoring surgeon fees, anesthesia fees, cost of equipment, and operating room

costs.<sup>13</sup> Furthermore, the authors found an average 7-min discrepancy favoring ECTR over OCTR from anesthesia induction to transport from the operating room (ECTR 42 min, OCTR 49 min).<sup>13</sup> In a recent study comparing the costs/profit margins of ECTR versus OCTR in the operating room versus clinic settings found greater profits in ECTR greater (clinic \$2710, operating room \$1139) than OCTR (clinic \$1186, operating room \$650).<sup>14</sup> A query of the Medicare physician fee schedule shows an average work RVU of 4.75 OCTR and 6.09 ECTR within our study years (2005-2012).<sup>15</sup> This may account for the higher reimbursement rate in ECTR procedures. However, we found that growth in annual reimbursements was more linear and did not always track relative to annual RVU growth. This disparity is likely attributed to inflation as comparison with the medical consumer price index yielded a similar growth rate (current study: OCTR 4%, ECTR 3.3% versus consumer price index: OCTR 4.3%, ECTR 3.3%).<sup>16</sup>

It is unclear how age influences utilization of OCTR versus ECTR, as no general consensus has been reached.<sup>17-20</sup> There is some evidence in the literature that favors ECTR in elderly patients. In a prospective study of 70 patients undergoing ECTR, 94% patients with preoperative symptoms of night pain or numbness had complete resolution.<sup>21</sup> In contrast, OCTR has been associated with decreased improvement of function and symptoms with increasing age. A prospective study of 87 consecutive OCTR patients that was subdivided into patients >60 y and <60 y, found that patients >60 presented with worse symptoms and lower improvement scores.<sup>22</sup>

This study is not without limitations. The PearlDiver database is reliant on accurate CPT or ICD coding, which creates the potential for a reporting bias. In addition, we

**Table 3 – Open and endoscopic release by age.**

Age (y)	CTS	OCTR	ECTR
Unknown	26,645	8299	926
<65	300,143	91,920	10,702
65-69	260,195	97,165	14,688
70-74	221,657	87,405	12,923
75-79	199,155	83,597	11,735
80-84	159,643	67,460	9171
>85	122,043	46,798	6196

**Table 4 – Open and endoscopic release by gender.**

Gender	CTS	OCTR	ECTR
Female	771,717	286,564	39,595
Male	426,530	177,100	24,837
Unknown	26,653	8300	926

**Table 5 – Open and endoscopic release by region.**

Region	OCTR	OCTR charges, \$	OCTR reimb, \$	ECTR	ECTR charges, \$	ECTR reimb, \$
Midwest	147,563	3335	1244	18,828	2680	1684
Northeast	91,999	3577	1365	12,193	2609	1785
South	169,294	4007	1281	24,497	3383	1557
West	60,676	4922	1478	9556	3332	1693

investigated charges and reimbursements rather than direct costs as this was not available within the PearlDiver database. Finally, patient comorbidities were not stratified within the scope of this study.

The primary strength of this study is the large patient population that was analyzed. In addition, our study adds a Medicare reimbursement comparison between ECTR and OCTR, as that has not been adequately studied previously.

In conclusion, ECTR is growing faster than OCTR in the Medicare population. Contrary to previous literature, our study shows that ECTR has lower charges and is reimbursed at a higher rate than OCTR.

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Authors' contributions: T.Y.L., S.R., Z.S.H., and L.O.C. conducted the study and wrote the manuscript. H.C. revised the manuscript and supervised the study.

### Disclosure

The authors reported no proprietary or commercial interest in any product mentioned or concept discussed in this article.

**Table 6 – Average charges and reimbursements by service location.**

Location	OCTR charges, \$	OCTR reimb, \$	ECTR charges, \$	ECTR reimb, \$
Office	1288	260	1615	258
Inpatient hospital	1345	186	1602	257
Outpatient hospital	1355	259	1929	310
Ambulatory surgical center	2323	348	3552	652
Average	1578	263	2175	369

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