The Effect of Moving Carpal Tunnel Releases Out of Hospitals on Reducing United States Health Care Charges

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Purpose To better understand how perioperative care affects charges for carpal tunnel release (CTR).

Methods We developed a cohort using ICD9-CM procedure code 04.43 for CTR in the National Survey of Ambulatory Surgery 2006 to test perioperative factors potentially associated with CTR costs. We examined factors that might affect costs, including patient characteristics, payer, surgical time, setting (hospital outpatient department vs. freestanding ambulatory surgery center), anesthesia type, anesthesia provider, discharge status, and adverse events. Records were grouped by facility to reduce the impact of surgeon and patient heterogeneity. Facilities were divided into quintiles based on average total facility charges per CTR. This division allowed comparison of factors associated with the lowest and highest quintile of facilities based on average charge per CTR.

Results A total of 160,000 CTRs were performed in 2006. Nearly all patients were discharged home without adverse events. Mean charge across facilities was $2,572 (SD, $2,331−$2,813). Patient complexity and intraoperative duration of surgery was similar across quintiles (approximately 13 min). Anesthesia techniques were not significantly associated with patient complexity, charges, and total perioperative time. Hospital outpatient department setting was strongly associated with total charges, with $500 higher charge per CTR. Half of all CTRs were performed in hospital outpatient departments. Facilities in the lowest quintile charge group were freestanding ambulatory surgery centers.

Conclusions Examination of charges for CTR suggests that surgical setting is a large cost driver with the potential opportunity to lower charges for CTRs by approximately 30% if performed in ASCs. *(J Hand Surg Am. 2015;40(8):1657−1662. Copyright © 2015 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Economic/decision analysis II.

Key words Carpal tunnel release, charge reduction, health care innovation.

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IMPROVING HEALTH CARE EFFICIENCY is critical to containing costs and thus ensuring access to good care. There are 53 million United States (US) surgical and nonsurgical outpatient procedures performed annually, yet the cost drivers of outpatient procedures have not been well studied.[1,2] In response to this, the Centers for Disease Control and Prevention developed the National Survey of Ambulatory Surgeries (NSAS) to improve our understanding of outpatient procedures and their costs.[3]

Carpal tunnel release (CTR) is well-suited to studying the cost of outpatient procedures. Carpal tunnel

release has clear indications, a highly standardized surgical technique, and a low complication rate.[4,5] Approximately 500,000 CTRs are performed each year in the US and spending on carpal tunnel syndrome exceeds $2 billion.[6] Like most outpatient procedures, variations in perioperative processes could affect costs. For example, CTR can be safely performed in a variety of surgical settings: a procedure room, an ambulatory surgery center (ASC), or a hospital outpatient department (HOPD). Anesthesia type for CTR varies from local to general.[1] These variations in setting and anesthesia type are seldom driven by quality considerations. Rather they are primarily attributed to surgeon preference or institutional policy.[7]

Previous studies have shown an increase in the number of CTRs performed every year, with variations in anesthesia care and surgical setting.[8] This observational study investigated the impact of these potentially mutable features of care (anesthesia type and surgical setting) on CTR charges.

MATERIALS AND METHODS

Data source

We performed a national cross-sectional study of charges for outpatient CTRs using the NSAS 2006. The NSAS is maintained by the National Center for Health Statistics. Data are collected through 2 systems: (1) a manual system in which data are abstracted by the hospital staff or by staff of the US Census Bureau on behalf of the National Center for Health Statistics; and (2) an automated system using purchased electronic medical record data from commercial organizations, state data systems, hospital, or hospital associations. Approximately 45% of respondent hospitals provided data through the automated system. The overall response rate for HOPDs and ASCs was 74%. The NSAS sample was weighted to give national estimates and compare hospital types on a national scale.[9]

Cohort

We constructed our cohort by using ICD9-CM procedure code 04.43. We excluded records with additional procedure codes to avoid confounding procedures.

Study variables

Patient factors examined included: age (in years), sex, number of comorbidities (mean Charlson score), and primary payer.[10] Facility was the place in which the procedure occurred. Facility factors examined included total charges, perioperative times, setting, anesthesia type, discharge status, and adverse events. These variables were defined in the NSAS dataset and were chosen based on the published literature with additional confirmation from expert opinion and anecdotal experience.[8,11–13]

Perioperative time was subdivided into surgery time, operating room time, postoperative time, and total time. Perioperative time was defined as follows: surgery time (time surgery started and ended), operating room time (time into and out of the operating room), postoperative time (time in the recovery room for postoperative care), and total time (time in the operating room, time in postoperative care, and transport time between the operating room and the recovery room). Setting was based on facility type: HOPD or ASC. Hospital outpatient department was defined using the Verispan, LLC (Yardley, PA) definition: a facility that is physically connected to a main hospital.[9] The hospital universe included noninstitutional hospitals exclusive of federal, military, and Department of Veterans Affairs hospitals located in the 50 states and the District of Columbia. The freestanding facility universe included facilities regulated by the states or certified by the Centers for Medicare and Medicaid Services for Medicare participation excluding facilities specializing in dentistry, podiatry, abortion, family planning, or birthing.[9]

Carpal tunnel release performed in office-based minor procedure rooms was not captured in the NSAS dataset. Anesthesia type included local, monitored anesthesia care, regional, or general. Some records had more than one anesthesia type coded. If records had more than one type coded, they were assigned to the more intensive anesthesia category. We rated general anesthesia as the most intensive.

Total charges included all facility-reported charges for the procedure performed. In most cases, charges excluded any professional (eg, surgeon or anesthesiologist) fees. However, some may have included professional fees if a facility billed for professional services.

Statistical analysis

Records were grouped at the facility level to minimize surgeon heterogeneity. Facilities were assigned to quintiles based on their average total charge per CTR. Patient and facility factors were also compared for facilities in lowest and highest total charge quintiles. Statistical comparisons of facilities in each of these 2 quintiles were performed using analysis of variance or Kruskal-Wallis test. For our model, we dichotomized facilities in the highest charge quintile (yes/no), setting

TABLE 1. Perioperative Factors for Isolated CTRs in Facilities Performing CTRs in Lowest and Highest Charge Quintiles in Centers for Disease Control and Prevention Population in 2006

CTR	Overall	Lowest 20% Charges by Facility	Highest 20% Charges by Facility	*P* Value
Total volume	160,000			
Setting (%)				
Hospital based	48	0	78	
ASC	52	100	22	
Female (%)	67	54	52	.25
Mean age, y	56	55	61	.62
Mean Charlson score	0	0	0	1.00
Payer (%)				
Medicare	27	20	51	.80
Private	64	72	43	.76
Self-pay	< 1	0	1	.86
Other	8	8	5	.90
Median charges	$2,411	$1,825	$3,156	.00
Median perioperative times, min				
Surgery	13	14 (SD, 4.7)	13 (SD, 22.8)	.34
Operating room	33	31 (SD, 8.2)	41 (SD, 23.2)	.00
After surgery	51	45 (SD, 16.6)	65 (SD, 21.6)	.30
Total	84	80 (SD, 18.9)	114 (SD, 35.4)	.02
Anesthesia type (%)				
Local	17	17	13	.16
MAC	31	35	40	.02
Regional	37	56	34	.52
Intravenous sedation	37	19	21	.49
General	13	3	12	.19
Anesthesia provider (%)				
Anesthesiologist	61	63	51	.60
Certified registered nurse anesthetist	41	37	58	.30
Surgeon	10	< 1	12	.64

(HOPD vs ASC), and anesthesia type (local vs nonlocal). Setting was a categorical variable and was included in our model as a series of indicator variables: 1 indicated ASC and 2 indicated HOPD. Age was a continuous variable. Logistic regression was performed with the dependent variable being facilities within the highest charge quintiles and accounted confounders, including age and anesthesia type. The correlation value was provided by the pseudo R-squared value. A *P* value of .05 was considered significant. This study was exempt from our institutional review board approval.

RESULTS

A total of 160,000 CTRs were performed with a wide variety of anesthesia types and settings (Table 1). Nearly all patients were discharged home with no perioperative adverse events in both settings. There was no statistically significant difference in payer mix between ASCs and HOPDs. Mean charge across all quintiles was $2,572 (median, $2,411). Mean charges in the lowest quintile was $1,850 and $3,109 in the highest quintile. Operative time was similar for all settings (about 13 min). Setting was the variable most strongly associated with total charges. Surgeries in HOPDs were associated with higher mean charge ($2,868) and median charge ($2,856) than surgeries performed in ASCs (mean, $2,309; median, $2,359). Nearly half of CTRs were performed in HOPDs. All facilities in the lowest charge quintile were ASCs. We found no difference in patient complexity (ie, age, sex, Charlson score), operative time, or postoperative time

TABLE 2. Perioperative Factors for Isolated CTRs by Anesthesia Type in Centers for Disease Control and Prevention Population in 2006

CTR	Overall	Local	MAC	Regional	General	*P* Value
Total volume (%)	160,000	17	31	37	13	
Setting (%)						
Hospital based	48	29	67	38	42	
ASC	52	71	33	62	58	
Female (%)	67	47	70	66	88	.33
Mean age, y	56	63	59	53	44	< .01
Mean Charlson score	0	0	0	0	0	1.00
Payer (%)						
Medicare	27	40	37	16	4	.26
Private	64	44	58	72	88	.90
Self-pay	< 1	0	0	1	0	1.00
Other	8	14	4	9	8	.31
Median charges	$2,411	$2,411	$2,753	$2,359	$2,359	.02
HOPD	$2,856	$2,648	$2,796	$2,307	$3,056	1.00
ASC	$2,359	$2,411	$2,411	$2,359	$2,359	< .01
Median perioperative times, min						
Surgery	13	17	12	11	14	< .01
Operating room	33	31	31	35	40	< .01
After surgery	51	34	53	55	40	< .01
Total	84	70	87	86	80	< .01

between facilities in the lowest and highest charge quintiles. Total operative time was lower in the lowest charge quintile. Monitored anesthesia care (MAC) was associated with HOPD, higher charges, and total duration of perioperative time (Table 2). No other anesthesia types were associated with the variables we examined, and there was no difference in the use of local anesthesia between centers. Logistic regression showed that HOPDs had 2.2 times increased odds of higher total charges than ASCs (Table 3).

TABLE 3. Logistic Regression for Factors Associated With Facilities in Highest Charge Quintile for Isolated CTRs in Centers for Disease Control and Prevention Population in 2006

Highest Charge Facilities	Odds Ratio	95% Confidence Interval	*P* Value
HOPD	2.22	1.01–4.87	.05
Age	0.99	0.97–1.02	.42
Local anesthesia	1.56	0.45–5.38	.48

The model compares HOPDs with ASCs, older with younger age, and local with other anesthesia.

DISCUSSION

We found that use of HOPDs for CTRs was associated with large differences in mean charges. More expensive HOPD settings may be appropriate for some unusual cases (eg, revision surgery or fragile patients such as those with severe cardiac disease or high oxygen requirements). However, we found that on average, HOPD patients had similar Charlson scores. It is therefore unlikely that most of the 48% of CTRs in the HOPD would have required this more expensive care setting except in rural areas lacking ASCs. Monitored anesthesia care was associated with higher charges although MAC is not a more intensive form of anesthesia. In fact, MAC is not more costly than regional anesthesia and can also reduce postoperative time.[14,15] Our finding that MAC was used more frequently in the HOPD settings suggests that the higher mean charge of MACs may be related its more frequent use in HOPD settings, because our model showed that HOPD setting was associated with higher charges when controlling for anesthesia type.

Carpal tunnel release performed in HOPDs represents a large opportunity to reduce charges by routine use of ASCs in nonrural settings. Lower charges in

ASCs may reflect lower overhead cost. It may also reflect greater use of a focused approach, characterized by standardized delivery of a limited set of procedures and avoiding frequent emergency cases slowing patient flow.[11,16–18] One obstacle to this shift is that ASCs may not be readily accessible or available. However strategies to running existing HOPDs more like an ASC could be implemented. For example, the HOPD could have dedicated preoperative and postoperative areas for outpatient patients to prevent potential delays when outpatient patients are mixed with patients with more complex problems who are having inpatient surgery.

If we routinely shifted most CTRs to ASCs, an estimated calculation suggests that a reduction in surgery charges would be from $60 to $80 million annually in the US health care system. We predict that further analyses of many other outpatient surgeries that can be done safely for most patients in an ASC (eg, trigger finger, cataract, skin cancer excision) will produce a similar opportunity. It could also expand the US health system's hospital capacity for complex treatments. Reducing spending for new hospital capacity will become increasingly important with the possible influx of newly insured patients who may now afford to treat long-neglected problems such as carpal tunnel syndrome.

This dataset did not capture CTRs performed in office-based minor procedure rooms, which is another area of interest and potential cost savings for CTR. Other countries safely perform many CTRs and other Class A procedures (ie, surgical procedures that may be performed under topical/local anesthesia) in such settings.[5,19] Similar to a dental visit, procedure room cases require fewer staff and less equipment.[13] More CTRs in Canada safely occur in procedure rooms.[1,7] Although most CTRs in the US are performed in an operating room, there is some US precedent for performing CTRs in minor procedure rooms.[1] In a single US institution, there was a large cost difference in the cost of care ($670 vs $3,469) between CTRs performed in a procedure room and those done in an operating room.[12] Similarly, at our institution, the costs for CTR are $899 in a procedure room and $3,359 in the operating room. If surgeons in the US perform 70% of CTRs in the procedure room instead of the hospital operating room, the health care system could save $450 to $560 million per year, or 22% to 28% of $2 billion in the cost of CTRs.

There are limitations to this study. The data are from 2006 and practices may have changed over time, although a 2012 survey of American Association for Hand Surgery members found a similar rate of straight local anesthesia, which suggests that the type of anesthesia used for CTR has not changed substantially.[20] Another limitation of this study was the use of charges as a proxy for costs. Charges do not reflect the cost of service delivery or payments to health care providers. However, hospitals use a cost-to-charge ratio to estimate hospitals' cost of care. Therefore, the use of charges to estimate costs and calculate projected annual savings may better represent savings from the perspective of the US health care system. In addition, our method of accounting for patient risk differences lacked the fidelity to distinguish facilities that may have included professional charges. Although the dataset did not capture differences in professional charges between HOPDs and ASCs, the NSAS attempted to obtain the most complete records for total charges. By NSAS design, any such inclusion or exclusion of professional fees should have affected the HOPD and ASC facility charge data equally, but this cannot be confirmed. This study did not distinguish endoscopic from open CTR. The model did not account for potential clustering within each facility. In addition, our method of accounting for patient risk differences was crude. Although office-based settings were not captured in this dataset, inclusion of this facility in future datasets would enable further research in cost savings opportunities for ambulatory procedures.

Improving the value of health care has taken on increasing urgency because of insurance expansion under the Affordable Care Act. Greater attention needs to be directed toward improving the effectiveness and cost-effectiveness of US health care. Carpal tunnel release is a common operation offering a large, safe reduction in US health care charges if performed in lower-cost settings. We believe that a major opportunity exists to shift a wide variety of ambulatory procedures, especially in orthopedics, ophthalmology, and gastroenterology, to minor procedure rooms in ASCs, as is already commonplace in Canada and the United Kingdom. Surgeons are in a position to be the leaders in executing cost savings and improving efficiency in surgical care.

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