HHS Public Access

Author manuscript

J Hand Surg Am. Author manuscript; available in PMC 2016 August 01.

Published in final edited form as:

J Hand Surg Am. 2015 August ; 40(8): 1657–1662. doi:10.1016/j.jhsa.2015.04.023.

The Effect of Moving Carpal Tunnel Releases Out of Hospitals Can on Reducing U.S. Healthcare Charges

Christine Nguyen, BS[1,2,3], **Arnold Milstein, MD, MPH**[3], **Tina Hernandez-Boussard, PhD, MPH**[4], and **Catherine M. Curtin, MD**[5,6]

Christine Nguyen: christine.nguyen@stanford.edu; Arnold Milstein: amilstein@stanford.edu; Catherine M. Curtin: curtincatherine@yahoo.com

[1]Stanford University School of Medicine, Stanford, CA

[2]Department of Health Research and Policy, Stanford University School of Medicine, Stanford, CA

[3]Clinical Excellence Research Center, Stanford University School of Medicine, Stanford, CA

[4]Division of General Surgery, Stanford University School of Medicine, Stanford, CA

[5]Department of Surgery, Palo Alto Veterans Administration, Palo Alto, CA

[6]Division of Plastic Surgery, Stanford University School of Medicine, Stanford, CA

Abstract

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

Methods—We developed a cohort using ICD9-DM 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 impact costs including: patient characteristics, payor, surgical time, setting (hospital outpatient department “HOPD” vs. freestanding ambulatory surgery center “ASC”), 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—160,000 CTRs were performed in 2006. Nearly all patients were discharged home without adverse events. Mean charge across facilities was $2572 (SD $2331 to $2813). Patient complexity and intra-operative duration of surgery was similar across quintiles (approximately 13 minutes). Anesthesia techniques were not significantly associated with patient complexity, charges, and total perioperative time. HOPD setting was strongly associated with total charges,

CORRESPONDING AUTHOR: Catherine Curtin, MD, Division of Plastic and Reconstructive Surgery, Stanford University School of Medicine, 770 Welch Road, Suite 400, Palo Alto, California, 94304, Phone: 650.723.6796, Fax: 650.721.3422, curtincatherine@yahoo.com.

with $500 higher charge per CTR. Half of all CTRs were performed in HOPDs. Facilities in the lowest quintile charge group were ASCs.

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.

Type of Study—Economic and Decision Analysis

Level of Evidence—Level II Retrospective Study

Keywords

carpal tunnel release; charge reduction; healthcare innovation

INTRODUCTION

Improving healthcare efficiency is critical to containing costs and thereby ensuring access to good care. There are 53 million U.S. surgical and non-surgical outpatient procedures performed annually, yet the cost drivers of outpatient procedures have not been well studied.[1,2] In response to this, the Center for Disease and Control developed the National Survey of Ambulatory Surgeries (NSAS) to improve our understanding of outpatient procedures and its costs.[3]

Carpal tunnel release (CTR) is well suited to studying the cost of outpatient procedures. CTR 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 U.S. and spending on carpal tunnel syndrome exceeds $2 billion.[6] Like most outpatient procedures, variations in perioperative processes could impact 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 a local to a 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.

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: one 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 (NCHS). The second is 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 payor.[10] Facility was the place that 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.[811–13]

Perioperative time was subdivided into surgery time, operating room (OR) time, postoperative (postop) time, total time. Perioperative time was defined as follows: surgery time (time surgery started and ended), OR time (time into and out of the operating room), postop time (time in the recovery room for postoperative care), 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. HOPD was defined using the Verispan, LLC definition: a facility that is physically connected to a main hospital.[9] The hospital universe included non-institutional hospitals exclusive of federal, military, and Department of Veterans Affairs hospitals located in the 50 states and the District of Columbia. The free standing facility universe included facilities regulated by the states or certified by the Centers for Medicare & Medicaid Services (CMS) for Medicare participation excluding facilities specializing in dentistry, podiatry, abortion, family planning, or birthing.[9]

CTRs performed in office-based minor procedure rooms were 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 (e.g. surgeon or anesthesiologist) fees. However, some may have included professional fees if a facility bills 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 ANOVA or Kruskal Wallis tests. For our model, we dichotomized facilities in the highest charge quintile (yes/no), setting (HOPD vs ASC) and anesthesia type (local vs non-local). 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 108 performed with the dependent variable being facilities within the highest charge quintiles 109 and accounted confounders, including age and anesthesia type. The correlation value was pseudo R2 value. A P-value of 0.05 was considered significant. This study was exempt from our institutional review board approval.

RESULTS

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 payor mix between ASCs and HOPDs. The mean charge across all quintiles was $2572/median $2411. Mean charges in the lowest quintile was $1850 and $3109 in the highest quintile. Operative time was similar for all settings (about 13 minutes). Setting was the variable most strongly associated with total charges. Surgeries in HOPDs were associated with higher mean charge ($2868) and median charge ($2856) than surgeries performed in ASCs mean ($2309) and median ($2359). Nearly half of CTRs were performed in HOPDs. All facilities in the lowest charge quintile were ASCs. We found no difference in patient complexity (i.e. age, sex, Charlson score), operative time or postop time between facilities in the lowest and highest charge quintiles. The 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).

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 (e.g. revision surgery or fragile patients such as patients with severe cardiac disease or high oxygen requirements). However, we found that on average the HOPD patients had a similar Charlson scores. It is therefore unlikely that most of the 48% of all CTR’s in the HOPD required this more expensive care setting except in rural areas lacking ASCs. MAC anesthesia was associated with higher charges although MAC is not a more intensive form of anesthesia. In fact, MAC anesthesia is not more costly than regional anesthesia and can also reduce postoperative time.[14,15] Our finding that MAC anesthesia was used more frequently in the HOPD settings suggests that MAC anesthesia’s higher mean charge 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.

CTRs performed in HOPDs represent a large opportunity to reduce charges by routine use of ASCs in non-rural 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 avoid frequent emergency cases slowing patient flow.[1116–18] One obstacle to this shift is that ASC's may not be readily accessible or available. However strategies to have existing HOPDS run some more like an ASC could be implemented. For example, the HOPD could have dedicated preoperative and postoperative areas for the outpatient patients to prevent the 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 would suggest a reduction in surgery charges could be from 60–80 million dollars annually in the US healthcare system. We predict that further analyses of many other outpatient surgeries that can be done safely for most patients in an ASC (e.g. 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 a possible influx of newly insured patients who can now afford to treat long neglected problems like carpal tunnel syndrome.

Although 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 (i.e. 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] Though 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. $3469) between CTRs performed in a procedure room compared to those done in an operating room.[12] Similarly at our institution, the costs for CTR are $899 in a procedure room and $3359 in the operating room. If the United States performs 70% CTRs in the procedure room instead of the hospital operating room, the healthcare system can save $450M – $560M per year or 22% to 28% of $2B in the cost of CTRs.

There are limitations to this study. The data is from 2006 and practices may have changed over time, although a 2012 survey of AAHS members found a similar rate of straight local anesthesia, suggesting 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 healthcare providers. However, hospitals use a cost-to-charge ratio to estimate the hospitals' cost of care. Therefore, the used of charges to estimate costs and calculated the projected annual savings may better represent the savings from the perspective of the US healthcare system. In addition, our method of accounting for patient risk differences lacked the fidelity to distinguish facilities that may have included professional charges. While the dataset did not capture differences in professional charges between HOPDs and ASCs, the NSAS did attempt to get 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 healthcare has taken on increasing urgency due to insurance expansion under the Affordable Care Act. Greater attention needs to be directed towards improving the effectiveness and cost-effectiveness of US healthcare. Carpal tunnel release is a common operation offering a large safe reduction in U.S. healthcare 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 ASC of minor procedure rooms, as in 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.

Acknowledgments

Christine Nguyen is grateful for the support of grants from both the Stanford University School of Medicine MedScholars Grant and the NIH-CATS-CTSA TL1 TR001084. The content is solely the responsibility of the authors and does not necessarily represent the official views of Stanford University, Veteran Affairs, or the National Institute of Health. The authors thank Steven Goodman, MD, PhD for his insight into the analysis of this study. The authors also thank the Clinical Excellence Research Center (CERC), especially Kimberly Brayton, MD, JD, MS, Maziyar Kalani, MD, and Feryal Erhun, PhD for their insights to the discussion of this study.

The Effect of Moving Carpal Tunnel Releases Out of Hospitals Can on Reducing U.S. Healthcare Charges

References

1. Leinberry CF, Rivlin M, Maltenfort M, et al. Treatment of carpal tunnel syndrome by members of the American Society for Surgery of the Hand: a 25-year perspective. J Hand Surg Am. 2012; 37(10):1997–2003.e3.10.1016/j.jhsa.2012.07.016 [PubMed: 23021173]
2. Hollingsworth J, Krein S, Ye Z, Kim H, Hollenbeck B. Opening of ambulatory surgery centers and procedure use in elderly patients: Data from florida. Arch Surg. 2011; 146(2):187–193. http://dx.doi.org/10.1001/archsurg.2010.335. [PubMed: 21339431]
3. McLemore T, Lawrence L. National Center for Health Statistics. Plan and Operation of the National Survey of Ambulatory Surgery. Vital Heal Stat. 1997; 1(37)
4. Maggard MA, Harness NG, Chang WT, Parikh JA, Asch SM, Nuckols TK. Indications for performing carpal tunnel surgery: Clinical quality measures. Plast Reconstr Surg. 2010; 126(1): 169–179.10.1097/PRS.0b013e3181da8685 [PubMed: 20595866]
5. American Association for Accreditation of Ambulatory Surgery Facilities Inc. Medicare Standards and Checklist for Accreditation of Ambulatory Surgery Facilities. Gurnee, IL: American Association for Accreditation of Ambulatory Surgery Facilities, Inc; 2014.
6. Palmer D, Hanrahan L. Social and economic costs of carpal tunnel surgery. Instr Course Lect. 1995; 44:167–172. [PubMed: 7797856]
7. LeBlanc MR, Lalonde DH, Thoma A, et al. Is main operating room sterility really necessary in carpal tunnel surgery? A multicenter prospective study of minor procedure room field sterility surgery. Hand. 2011; 6(1):60–63. [PubMed: 22379440]
8. Fajardo M, Kim SH, Szabo RM. Incidence of carpal tunnel release: trends and implications within the United States ambulatory care setting. J Hand Surg Am. 2012; 37(8):1599–1605.10.1016/j.jhsa.2012.04.035 [PubMed: 22727925]

9. Cullen KA, Hall MJ, Golosinskiy A. Ambulatory Surgery in the United States, 2006. Natl Health Stat Report. 2009 Jan 28.(11):1–25. [PubMed: 19294964]
10. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chron Dis. 1987; 40:373–83. [PubMed: 3558716]
11. Munnich EL, Parente ST. Procedures Take Less Time At Ambulatory Surgery Centers, Keeping Costs Down And Ability To Meet Demand Up. Heal Aff. 2014; 33(5):764–769.10.1377/hlthaff.2013.1281
12. Chatterjee A, McCarthy JE, Montagne SA, Leong K, Kerrigan CL. A cost, profit, and efficiency analysis of performing Carpal tunnel surgery in the operating room versus the clinic setting in the United States. Ann Plast Surg. 2011; 66(3):245–248.10.1097/SAP.0b013e3181db7784 [PubMed: 21042185]
13. Leblanc MR, Lalonde J, Lalonde DH. A detailed cost and efficiency analysis of performing carpal tunnel surgery in the main operating room versus the ambulatory setting in Canada. Hand. 2007; 2(4):173–178.10.1007/s11552-007-9043-5 [PubMed: 18780048]
14. Brooks DM, Hand WR Jr. A cost analysis: General endotracheal versus regional versus monitored anesthesia care. Mil Med. 1999; 164(4):303–305. [PubMed: 10226461]
15. Snyder SK, Roberson CR, Cummings CC, Rajab MH. Local anesthesia with monitored anesthesia care vs general anesthesia in thyroidectomy: A randomized study. Arch Surg. 2006; 141(2):167–173.10.1001/archsurg.141.2.167 [PubMed: 16490894]
16. Leung GM. Hospitals must become “focused factories”. Br Med J. 2000; 320(7239):942–943. http://www.scopus.com/inward/record.url?eid=2-s2.0-0034176908&partnerID=40&md5=78f62dd0a3ef2d134b44f029e8d35f66. [PubMed: 10742021]
17. Garber AM, Skinner J. Is American Health Care Uniquely Inefficient? J Econ Perspect. 2008; 22(4):27–50. [PubMed: 19305645]
18. Casalino LP, Devers KJ, Brewster LR. Focused Factories? Physician-Owned Specialty Facilities. Heal Aff. 2003; 22(6):56–67.10.1377/hlthaff.22.6.56
19. Board of Governors Committee on Ambulatory Surgical Care. Optimal Ambulatory Surgical Care and Office-Based Surgery. Chicago, IL: American College of Surgeons; 2000.
20. Shin E, Bachoura A, Jacoby S, Chen N, Osterman A. Treatment of carpal tunnel syndrome by members of the American Association for Hand Surgery. Hand. 2012; 7(4):351–356. http://www.scopus.com/inward/record.url?eid=2-s2.0-84870342429&partnerID=40&md5=1585d746607ac491f04d0f08aec31523. [PubMed: 24294152]

Table 1

Perioperative factors for Isolated Carpal Tunnel Releases (CTRs) in facilities performing CTRs in the lowest and highest charge quintiles in the CDC population in 2006.

Carpal Tunnel Release	Overall	Lowest 20% Charges by Facility	Highest 20% Charges by Facility	P-value
Total Volume	160000	-	-	-
Setting (%)				-
Hospital Based	48	0	78	-
ASC	52	100	22	-
Female (%)	67	54	52	0.25
Mean Age (yrs)	56	55	61	0.62
Mean Charlson Score	0	0	0	1.00
Payor (%)				
Medicare	27	20	51	0.80
Private	64	72	43	0.76
Self Pay	<1	0	1	0.86
Other	8	8	5	0.90
Median Charges	$2,411	$1,825	$3,156	0.00
Median Perioperative Times (min)				
Surgery Time	13	14 (SD 4.7)	13 (SD 22.8)	0.34
OR Time	33	31 (SD 8.2)	41 (SD 23.2)	0.00
Postop Time	51	45 (SD 16.6)	65 (SD 21.6)	0.30
Total Time	84	80 (SD 18.9)	114 (SD 35.4)	0.02
Anesthesia Type (%)				
Local	17	17	13	0.16
MAC	31	35	40	0.02
Regional	37	56	34	0.52
IV Sedation	37	19	21	0.49
General	13	3	12	0.19
Anesthesia Provider (%)				
Anesthesiologist	61	63	51	0.60
CRNA	41	37	58	0.30
Surgeon	10	<1	12	0.64

* ASC = ambulatory surgery center

* MAC = monitored anesthesia care

* CRNA = certified registered nurse anesthetist

Table 2

Perioperative factors for Isolated Carpal Tunnel Releases by anesthesia type in the CDC population in 2006.

Carpal Tunnel Release	Overall	Local	MAC	Regional	General	P-value
Total Volume (%)	160000	17	31	37	13	-
Setting (%)						
Hospital Based	48	29	67	38	42	-
ASC	52	71	33	62	58	-
Female (%)	67	47	70	66	88	0.33
Mean Age (yrs)	56	63	59	53	44	0.00
Mean Charlson Score	0	0	0	0	0	1.00
Payor (%)						
Medicare	27	40	37	16	4	0.26
Private	64	44	58	72	88	0.90
Self Pay	<1	0	0	1	0	1.00
Other	8	14	4	9	8	0.31
Median Charges	$2,411	$2,411	$2,753	$2,359	$2,359	0.02
HOPD	$2,856	$2,648	$2,796	$2,307	$3,056	1.00
ASC	$2,359	$2,411	$2,411	$2,359	$2,359	0.00
Median Perioperative Times (min)						
Surgery Time	13	17	12	11	14	0.00
OR Time	33	31	31	35	40	0.00
Postop Time	51	34	53	55	40	0.00
Total Time	84	70	87	86	80	0.00

* ASC = ambulatory surgery center

* MAC = monitored anesthesia care

* CRNA = certified registered nurse anesthetist

J Hand Surg Am. Author manuscript; available in PMC 2016 August 01.

Table 3

Logistic regression for factors associated with facilities in the highest charge quintile for Isolated Carpal Tunnel Releases in the CDC population in 2006. The model compares HOPDs to ASCs, older age to younger age, and local anesthesia to other anesthesia.

Highest Charge Facilities	OR	95% CI		P-value
HOPD	2.22	1.01	4.87	0.05
Age	0.99	0.97	1.02	0.42
Local Anesthesia	1.56	0.45	5.38	0.48

* OR = Odds Ratio

* CI = Confidence Interval