EDITOR'S CHOICE

Surgical Timing for Carpal Tunnel Syndrome: A Comparison of Health Care Delivery in the Veterans Administration and Private Sector

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Purpose The U.S. Department of Veterans Affairs (VA) health care system monitors time from referral to specialist visit. We compared wait times for carpal tunnel release (CTR) at a VA hospital and its academic affiliate.

Methods We selected patients who underwent CTR at a VA hospital and its academic affiliate (AA) (2010–2015). We analyzed time from primary care physician (PCP) referral to CTR, which was subdivided into PCP referral to surgical consultation and surgical consultation to CTR. Electrodiagnostic testing (EDS) was categorized in relation to surgical consultation (prereferral vs postreferral). Multivariable Cox proportional hazard models were used to examine associations between clinical variables and surgical location.

Results Between 2010 and 2015, VA patients had a shorter median time from PCP referral to CTR (VA: 168 days; AA: 410 days), shorter time from PCP referral to surgical consultation (VA: 43 days; AA: 191 days), but longer time from surgical consultation to CTR (VA: 98 days; AA: 55 days). Using multivariable models, the VA was associated with a 35% shorter time to CTR (AA hazard ratio [HR], 0.65; 95% confidence interval [CI], 0.52–0.82) and 75% shorter time to surgical consultation (AA HR, 0.25; 95% CI, 0.20–0.03). Receiving both prereferral and postreferral EDS was associated with almost a 2-fold prolonged time to CTR (AA HR, 0.49; 95% CI, 0.36–0.67).

Conclusions The VA was associated with shorter overall time to CTR compared with its AA. However, the VA policy of prioritizing time from referral to surgical consultation may not optimally incentivize time to surgery. Repeat EDS was associated with longer wait times in both systems.

Clinical Relevance Given differences in where delays occur in each health care system, initiatives to improve efficiency will require targeting the appropriate sources of preoperative delay. Judicious use of EDS may be one avenue to decrease wait times in both systems.

Key words Access to care, carpal tunnel syndrome, veterans administration.

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NATIONAL POLICIES IMPLEMENTED at the U.S. Department of Veterans Affairs (VA), including the Veterans Choice Program and recently the VA Maintaining Internal Systems and Strengthening Outside Networks (MISSION) Act, aim to provide efficient, timely, and quality care for veterans through offering the opportunity to seek care in the community. However, reliable data are limited for health care market comparisons of wait times between the VA and the private sector.[1] For subspecialty surgical care, wait times for an initial surgical consultation and the receipt of surgical intervention are poorly understood, with the timing of an initial consult visit often being the primary metric of access to surgical care. Furthermore, little is known regarding the factors leading to delays in care for veterans seeking subspecialty surgical care.

Carpal tunnel syndrome (CTS) is an excellent condition for a case study examining a VA hospital's response to this policy. CTS is one of the most common musculoskeletal disorders affecting approximately 1 in 10 individuals in their lifetime.[2] CTS symptoms can lead to substantial pain, hand weakness, and subsequent absenteeism from work.[3] CTS is primarily diagnosed by a constellation of symptoms and a physical examination, with the support of electrodiagnostic studies (EDS) in select cases. According to the American Academy of Orthopedic Surgery Clinical Practice Guidelines, EDS may be most valuable when the clinical diagnosis is unclear,[4] and currently there is no consensus as to which patients would benefit from EDS. However, previous studies have shown that EDS may be unnecessary for diagnosis for many CTS patients with classic symptoms and may lead to delays in surgical referral.[5–7] Given the functional deficits associated with CTS, timely diagnosis and treatment are essential to providing high-quality care and maximizing the potential for nerve recovery.[8,9]

Therefore, we sought to compare the timing of surgeon consultation and final surgical intervention for CTS in a VA medical center and its associated tertiary care academic center located within the same geographic region. Additionally, we aimed to understand the impact of diagnostic testing use, specifically EDS, in the time to surgical intervention for patients in both health systems. Findings from this study may help shed light on areas in need of improvement, with the goal of improving access to subspecialty surgical care for patients in both the VA and private sector.

MATERIALS AND METHODS

Study cohort

This study received institutional review board approval at both the academic tertiary care center and the local VA. We conducted a retrospective cohort study using administrative data from a single academic tertiary care center (academic center) and an associated VA hospital from 2010 to 2015. Data from the VA were obtained using the Veterans Health Administration Corporate Data Warehouse, a national VA health care database. The study cohorts from both the VA and the academic center included patients aged 18 years and older with CTS who subsequently underwent carpal tunnel release (CTR) without any major concomitant procedures. To establish a homogenous cohort, we ensured that all patients' primary care physicians were located at the academic center or the associated VA hospital within the same geographic region. This enabled us to evaluate a patient population with similar geographic constraints. Additionally, we excluded any VA patients who were referred to the private sector, to create a similar sample of patients within the academic center and the VA. A recent study of veterans receiving mixed care, defined as VA and private sector care, revealed that each referral indication into the private sector (eg, diagnostic testing, nonsurgical treatment, hand therapy, surgery) led to increasing delays to definitive surgical intervention. Therefore, to minimize heterogeneity of the sample and potential bias, we did not include veterans who were referred to the private sector for their CTS-related care. Thus, all veterans received their initial surgical consultation and surgery within the VA. We identified patients using *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9) diagnoses codes and *Current Procedural Terminology* codes (Appendix A, available online on the *Journal's* website at www.jhandsurg.org). During the study period, the academic center had 4–8 hand surgeons, and the associated VA hospital had 2–3 hand surgeons. One hand surgeon at the VA was a full-time federal employee. The other hand surgeons at the VA worked at both the VA and academic center. However, the academic center had approximately 5 other hand surgeons who were full-time without any affiliation with the VA. Given the overlap of surgeons within the VA and the academic affiliate, we expect the use of nonsurgical treatment and diagnostic testing to be similar. Moreover, neither the VA nor the academic affiliate dictates how long nonsurgical treatment should be attempted before offering

surgery. Patients were excluded if they had an additional hand condition apart from CTS (eg, inflammatory or crystalline arthropathy, infection, or fracture) or a history of CTS before the inclusion period.

Explanatory variables

Predictor variables of interest included age, sex, race, and ethnicity. For patients treated at the academic center, insurance type was also recorded (private insurance, Medicare, Medicaid, worker's compensation, self-pay, and other insurance types). The Charlson Comorbidity Index was used as a proxy for patient health status using ICD-9 diagnosis codes.[10,11] We also captured the timing and use of EDS. Neither the VA nor the academic center contain an institutional care pathway indicating when EDS should be used and what patients benefit from EDS. EDS timing was categorized in relation to the patient's initial hand surgery consultation as prereferral testing, postreferral testing, repeat testing (both prereferral and postreferral testing performed), and no testing. Prereferral testing occurred before the first hand surgery consultation. Postreferral testing occurred between the initial hand surgery consultation and surgery.

Outcomes

Our primary outcome and measure of access to surgical care was time from primary care physician (PCP) referral to CTR, measured in days. Additionally, we subdivided total time to access surgical care into 2 periods: (1) the time from PCP referral to the first hand surgeon consultation and (2) the time from the first hand surgeon consultation to CTR.

Data analysis

We calculated descriptive statistics of demographic variables stratified by location: academic center and VA hospital. We then evaluated unadjusted associations using a χ^2 test for categorical variables, Wilcoxon rank sum for continuous variables, and log-rank comparisons for Kaplan-Meier analysis.

For our time-to-event analysis, multivariable Cox proportional hazard models were then used to examine the relationships between treatment location and the 3 outcomes (time from PCP referral to CTR, time from PCP referral to hand surgeon consultation, time from hand surgeon consultation to CTR). The model was adjusted for age, Charlson Comorbidity Index, race, ethnicity, an interaction term between race and ethnicity, and timing of EDS. There were too few women at the VA site to assess sex as a predictor. We generated hazard ratios (HRs) from the multivariable Cox model. With a reference value of 1, HRs greater than 1 signify shorter time-to-event (eg, hand surgeon consultation or CTR), and HRs less than 1 indicate longer time-to-event. The proportional hazards assumption was satisfied for all multivariable models. The significance level was set at $P < .05$.

RESULTS

The study cohort included 664 patients who underwent a CTR between 2010 and 2015. Of that cohort, 504 patients (76%) had a CTR performed at the academic center and 160 (24%) had a CTR at the VA. The study cohort's demographic and clinical characteristics, stratified by surgical location, are described in Table 1. Patients at the VA were primarily male (90% male at the VA vs 34% at the academic center, $P < .001$) and were older compared with patients at the academic center (VA: 28% $\geq$ 65 years vs academic center: 23% $\geq$ 65 years, $P < .001$). At the VA, 71% of patients underwent prereferral EDS, 9% underwent postreferral EDS, 8% underwent prereferral and postreferral testing, and 10% did not undergo any testing. In contrast, at the academic center, 53% of patients underwent prereferral EDS, 17% underwent postreferral EDS, 11% underwent prereferral and postreferral testing, and 19% did not undergo any testing ($P < .001$).

The median time from PCP referral to CTR for all patients in the cohort was 306 days (interquartile range [IQR], 120−1002). At the VA, the median time from PCP referral to CTR was 168 days (IQR, 99−464) compared to 410 days at the academic center (IQR, 132−1216) (Table 2). Figure 1 shows the time from PCP referral to CTR at the VA and the academic center. The VA patients had significantly shorter wait time from PCP referral to hand surgeon consultation (VA: 43 days vs academic center: 191 days, $P < .001$). However, the wait time from hand surgeon consultation to CTR was shorter at the academic center (academic center: 55 days vs VA: 98 days, $P < .001$).

After controlling for potential confounders, receiving care at the VA versus the academic center was associated with a 35% reduction in wait time from PCP referral to CTR (academic center HR, 0.65; 95% confidence interval [CI], 0.52−0.82) (Table 3). Care at the VA was associated with an even greater reduction in time from PCP referral to hand surgeon consultation (academic center HR, 0.25; 95% CI, 0.20−0.32). However, patients at the VA had significantly longer times from hand surgery

TABLE 1. Demographic and Clinical Characteristics of Patients Undergoing CTR (2010–2015)

Characteristic	Total	Academic Center No. (%)	VA No. (%)	*P* Value*
Total	664	504 (76)	160 (24)	
Sex				<.001
Male	316 (48)	172 (34)	144 (90)	
Female	348 (52)	332 (66)	16 (10)	
Age				<.001
18–34	60 (9)	52 (10)	8 (5)	
35–44	96 (15)	83 (16)	13 (8)	
45–54	172 (26)	137 (27)	35 (22)	
55–64	177 (27)	118 (23)	59 (37)	
≥65	159 (24)	114 (23)	45 (28)	
Race				<.001
White	557 (84)	441 (88)	116 (73)	
Black	38 (6)	32 (6)	6 (4)	
Asian	15 (2)	15 (3)	0 (0)	
Native American/Pacific Islander	6 (1)	3 (1)	3 (2)	
Unknown	48 (7)	13 (3)	35 (22)	
Ethnicity				<.001
Hispanic	6 (1)	5 (1)	1 (1)	
Not Hispanic	442 (67)	296 (59)	146 (91)	
Unknown	216 (33)	203 (40)	13 (8)	
Charlson Comorbidity index				<.001
0	360 (54)	249 (50)	111 (69)	
1	168 (25)	149 (30)	19 (11)	
≥2	136 (21)	106 (21)	30 (19)	
Insurance type				
Private		341 (68)	n/a	
Medicare		88 (18)	n/a	
Medicaid		35 (7)	n/a	
Self-pay		4 (1)	n/a	
Worker's compensation		8 (2)	n/a	
Other		23 (5)	n/a	
Unknown		5 (1)	n/a	
Electrodiagnostic testing				<.001
Prereferral	381 (57)	268 (53)	113 (71)	
Postreferral	100 (15)	85 (17)	15 (9)	
Prereferral and postreferral	67 (10)	55 (11)	12 (8)	
No test	112 (17)	96 (19)	16 (10)	
Unknown	4 (1)	0 (0)	4 (3)	

n/a, not applicable, VA, U.S. Department of Veterans Affairs.
*χ^2 test used for categorical variables.

consultation to CTR (academic center HR, 1.59; 95% CI, 1.28–1.96). Compared to patients not receiving EDS, patients who had prereferral and postreferral EDS waited a significantly longer time from PCP referral to CTR (HR, 0.49; 95% CI, 0.36–0.67) and from hand surgeon consultation to CTR (HR, 0.53; 95% CI, 0.39–0.73). Use of prereferral EDS was associated with a longer wait time from PCP referral to hand surgeon consultation (HR, 0.74; 95% CI, 0.59–0.92). No other patient-level factor was

TABLE 2. Timing of Access to Surgical Care (Days)

Timing	Academic Center	VA	*P* Value*
PCP referral to first surgeon consultation			<.001
Mean (SD)	570 (716)	68 (114)	
Median (IQR)	191 (63–899)	43 (19–80)	
First surgeon consultation to CTR			<.001
Mean (SD)	180 (363)	385 (779)	
Median (IQR)	55 (27–126)	98 (44–363)	
PCP referral to CTR			<.001
Mean (SD)	750 (772)	454 (810)	
Median (IQR)	410 (132–1216)	168 (99–464)	

CTR, carpal tunnel release; IQR, interquartile range; PCP, primary care physician; VA, U.S. Department of Veterans Affairs.
*Log-rank test for Kaplan-Meier analysis.

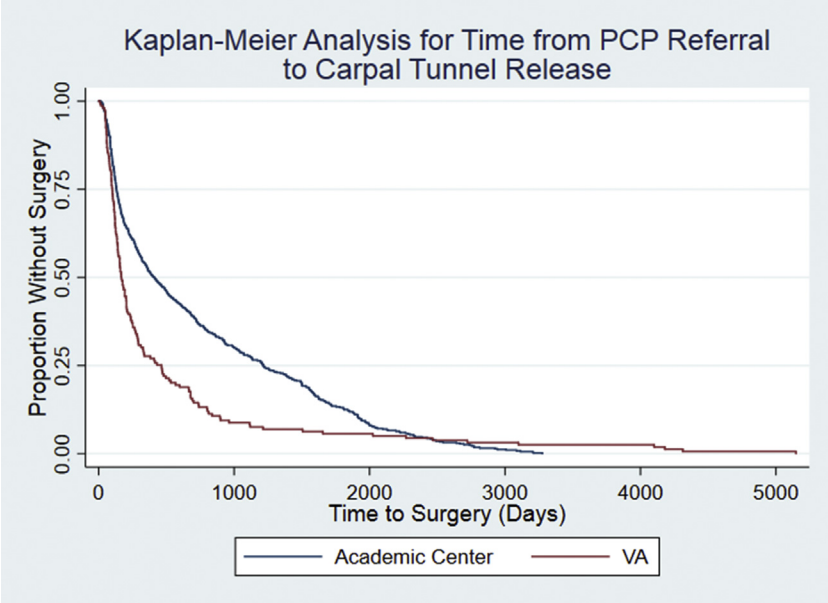

FIGURE 1: Kaplan-Meier analysis for time from PCP referral to CTR. Time from PCP referral to CTR at the VA and academic center are significantly different from one another using Cox proportional hazards test (log-rank test: $P < .001$).

significantly associated with time from PCP referral to hand surgeon consultation or time to CTR.

DISCUSSION

In this study, comparing wait times to surgery between the VA and an affiliate academic medical center, we found that patients undergoing CTR at the VA had a shorter overall time from PCP referral to surgery, driven primarily by the faster time from PCP referral to hand surgeon consultation. Second, the use of EDS resulted in longer wait times to surgery, with repeat testing causing the greatest delays. New policies permitting veterans to seek community care may not provide the intended benefits, such as improving time to seeing a specialist or speeding their time to surgery overall. However, minimizing noncritical and repeat diagnostic testing can improve wait times for surgery in both health systems.

In 2018, the VA MISSION Act was passed to expand veterans' access to health care by offering veterans a choice in where they receive care.[12,13] More specifically, the VA MISSION Act increased veterans' eligibility for community care, aiming to improve wait times. The access standards for wait times for specialty care set by the VA MISSION Act

TABLE 3. Cox Proportional Hazard Models*

Characteristic	PCP Referral to CTR		PCP Referral to Hand Surgery Consultation		Hand Surgery Consultation to CTR	
	HR (95% CI)	*P* Value	HR (95% CI)	*P* Value	HR (95% CI)	*P* Value
Location						
Academic center	0.65 (0.52−0.82)	<.001	0.25 (0.20−0.32)	<.001	1.59 (1.28−1.96)	<.001
VA	1[Reference]		1[Reference]		1[Reference]	
Electrodiagnostic test						
Prereferral	0.76 (0.61−0.95)	.01	0.74 (0.59−0.92)	.006	0.93 (0.75−1.16)	.51
Postreferral	0.58 (0.44−0.77)	<.001	0.73 (0.55−0.97)	.03	0.55 (0.42−0.73)	<.001
Prereferral and postreferral	0.49 (0.36−0.67)	<.001	0.73 (0.54−1.00)	.05	0.53 (0.39−0.73)	<.001
No test	1 [Reference]		1[Reference]		1[Reference]	

CI, confidence interval; CTR, carpal tunnel release; HR, hazards ratio; PCP, primary care physician; VA, U.S. Department of Veterans Affairs.
*Covariates within the model included location, electrodiagnostic testing, race, Charlson Comorbidity Index, ethnicity, race × ethnicity, and quadratic age. No other patient-level covariate was significantly associated with PCP referral to CTR, PCP referral to hand surgery consultation, or hand surgery consultation to CTR.

include that a veteran must be provided with an appointment within 28 days from the date of request for specialty care or they are eligible to seek community care.[12] These metrics do not consider the time that it takes for patients to receive definitive surgical care. Previous studies comparing the VA and the private sector have shown that the wait time for primary care evaluation and medical specialty consultation were similar between the VA and the private sector.[14] More specifically, in 2017, the VA wait times for new appointments for primary care and medical subspecialty consultations were shorter than those in the private sector. Our study demonstrates similar findings, in that the affiliate academic medical center was associated with longer wait times for hand surgical consultation and longer overall wait times between referral and ultimate surgical intervention. These findings may be because of metrics within the VA aimed at promoting timely access to specialist consultation and the overall coordination of care within the VA integrated system. Thus, transitioning care from the VA to the local academic center would not improve wait times for this cohort seeking subspecialty surgical care, and doing so likely would have added administrative delays beyond the wait times experienced by patients in the private sector. In a recent population-based study of veterans undergoing CTR, 20% received some aspect of their CTS-related care within the private sector (eg, diagnostic testing, hand therapy/nonsurgical treatment, or surgery) with 3% of veterans undergoing surgery within the private sector. Nevertheless, each added service received within the private sector was associated with increased delays to ultimate surgical intervention. However, in this study, the academic center was faster at getting patients to surgery after they were seen by a hand surgeon, which may reflect differences in practice patterns for nonsurgical treatments or procedure/operating room availability between the VA and its academic affiliate. These findings highlight specific areas for improvement for both health care systems.

Additionally, the VA has metrics targeting the time taken from PCP referral to specialist consultation, incentivizing providers to see patients for an initial visit in a timely manner. Access metrics including wait times at the VA are often tied to provider performance pay, which helps encourage timely initial appointments. Similar metrics did not exist within the academic affiliate, which does not incentivize surgeons to see patients within 28 days from referral. However, metrics for wait time to definitive surgical intervention are not emphasized in the VA MISSION Act. Incentivizing the entire process of care (eg, time to surgical intervention in this scenario) may be one avenue to improve access in the totality of care. Moreover, transitioning care to the community for veterans may not result in the intended outcome of improving wait times, and may actually lead to longer times to ultimate surgical intervention. Thus, more research is needed at a national level to understand which veterans, geographic locations, and clinical conditions will most benefit from community care.

Recently, there has been a push for high-value health care with a focus on minimizing unnecessary diagnostic testing. For the diagnosis of CTS, controversy exists as to whether the use of EDS is required.[15] There is wide variation in the use of EDS for the diagnosis of CTS at both the hospital and surgeon level.[16,17] Studies have shown that in patients with a history and physical examination consistent with CTS that the use of EDS does not change the probability of diagnosis.[7] In a study by Fowler et al,[18] physical examinations, ultrasound, and EDS had similar sensitivities and specificities for diagnosis of CTS, questioning the routine use of EDS. In our study, 53% of patients at the academic center and 71% at the VA received prereferral EDS. The higher proportion of patients receiving prereferral EDS at the VA may contribute to the decreased wait times from PCP referral to hand surgeon evaluation, but additional investigation is needed to fully understand the impact of EDS timing on delays to ultimate surgical intervention. Additionally, 19% of patients at the academic center and 10% at the VA received repeat testing (prereferral and postreferral EDS). Repeat EDS resulted in significantly longer wait times for hand surgeon evaluation and CTR in both health care systems. These findings reveal an opportunity to reduce health care waste where providers should determine if EDS is truly necessary to minimize repeat diagnostic testing. More specifically, hand surgeons can determine which patients will benefit from prereferral EDS and provide more concrete guidance to referring providers. Institutional education should be provided to referring providers at both the VA and the academic center to explicitly state which patients benefit from EDS and when it should be used. This may be an area of quality improvement that will reduce wait times for hand surgical evaluation and ultimate surgical intervention.

Our study has several limitations. The cohort consists of patients from a single VA hospital and its associated academic center, which may not be representative of the entire VA health care system or private sector. More specifically, these centers are not in rural locations, where access to care may be a larger problem. Moreover, variation in wait times likely exists within types of hospitals. Additionally, in this study, we compared the VA to its academic affiliate and not to a geographically similar private practice, which may have different incentive structures for timely care, such as maintaining referral patterns. However, this study illustrates that the VA and the private sector could both benefit from improving wait times in different aspects of preoperative care and that a closer look is needed at the patient's entire journey to surgical care, not just the time to their first visit with a surgeon. Additionally, this study does not determine the appropriateness of EDS for diagnosis of CTS or rationale for repeat testing. We also restricted this study to a surgical cohort and cannot determine if wait times are different between the VA and academic center for time to hand surgical consultation and nonsurgical treatments including splinting or corticosteroid injections. Lastly, patient or provider preference, such as scheduling conflicts, may lead to delays in care, which could not be assessed in this study. However, we found an institutional difference, where patients treated at the VA had significantly shorter wait times to CTR than the academic center, reflecting the efficiency of the VA.

In this study we found that the wait times for patients undergoing surgical release for CTS at the VA medical center were significantly shorter than their affiliate academic center. Patients at the academic center had a significantly longer wait time to see a surgeon while those at the VA had a longer wait time from surgical consultation to surgery. Each system may require tailored solutions for improving efficiency and access to surgical care, given that the periods of greatest delay were different in each health care system. The VA policy of prioritizing time from referral to surgical consultation as an access metric may not optimally incentivize time to actual surgical intervention. Lastly, repeat diagnostic testing led to delays in care regardless of location. More judicious use of EDS for diagnosis of CTS, especially for those with classic symptoms, may lead to improved wait times for surgical intervention in all health care settings.

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