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Original Research

## Outcomes of Orthopedic Hand Surgeries in Minor Procedure Rooms at a Veterans Affairs Medical Center



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**Purpose:** There is a high demand for minor hand surgeries within the veteran population. The objective of this study was to compare clinical outcomes and resource use at a Veterans Affairs Medical Center (VAMC) of hand surgeries performed in minor procedure rooms (MPR) and operating rooms using local anesthesia with or without monitored anesthesia care.

**Methods:** We retrospectively evaluated all patients undergoing carpal tunnel release, de Quervain's release, foreign body removal, soft tissue mass excision, or A1 pulley release at a VAMC over a 5-year period. Data collected included demographic information, mental health comorbidities, presence of preoperative and postoperative pain, complications after surgery, time to surgery, number of personnel in surgery, turnover time between cases, and time spent in the postanesthesia care unit. Statistical analysis included Fisher exact or chi-square analysis to compare MPR versus operating room groups and Student *t* test or Mann-Whitney test to compare continuous variables.

**Results:** In this cohort of 331 cases, 123 and 208 patients underwent surgery in MPRs and operating rooms, respectively. Preoperative and postoperative pain were similar between the MPR and operating room groups. Complications were slightly lower in the MPR group versus the operating room group (0% MPR vs 2.9% operating room). Median time from surgical consult to surgery was 6 days less for MPR patients (15 vs 21). The MPR cases also used fewer personnel during surgery, averaging 4.76 versus 4.99 people. The MPR patients spent 9 minutes less in the postanesthesia care unit (median, 36 vs 45 minutes) and turnover time between cases was nearly 8 minutes faster in MPRs than in operating rooms (median, 20 vs 28 minutes).

**Conclusions:** Minor procedure rooms at a VAMC allow more veteran patients to be scheduled for minor hand surgeries within a shorter time frame, utilize less staff and postoperative monitoring, and maintain excellent outcomes with limited complications.

**Clinical relevance:** Minor hand surgeries in MPRs have outcomes equivalent to those of operating rooms with improved time savings and resource use.

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Minor procedure rooms (MPRs) are gaining popularity among hand surgeons globally. Designed as smaller spaces for shorter surgeries, MPRs provide less rigid environmental controls of ventilation and surfaces compared with operating rooms.<sup>1</sup> The shift

toward wide-awake, local anesthesia hand surgeries conducted in MPRs offers multiple advantages for the hospital system, providers, and patients.<sup>2–5</sup> Previous studies illustrated significant cost savings with offloaded demand for main operating rooms.<sup>6–13</sup> Furthermore, MPRs have the potential to shorten wait times, reduce patient costs, and maintain satisfaction with comparable outcomes to the performance of minor hand surgeries in operating rooms using general anesthesia or regional blocks.<sup>2,13–15</sup>

The US Veterans Affairs health care system depends on a fixed-cost business model to provide care to over 9 million veterans.<sup>16</sup> Continued demand for elective upper-extremity procedures has

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guided the exploration of alternative options for improving access to care of elective surgeries in government-run insurance plans.<sup>17–20</sup> There are sparsely distributed Veterans Affairs Medical Centers (VAMC) throughout the United States, a limited number of hand surgeons at these facilities, and a shortage at times of operating room availability.<sup>21</sup> As such, it is of utmost importance to consider cost-effectiveness and resource use for this population.<sup>19</sup>

The objective of this study was to compare time from consult to surgery, personnel use, time spent in the postanesthesia care unit (PACU), turnover time between cases, and overall complications of minor hand surgeries performed in operating rooms and MPRs at a VAMC. We specifically evaluated carpal tunnel release (CTR), de Quervain's release, foreign body removal, soft tissue mass excision, and A1 pulley release, cases that were established as appropriate for MPRs based on VAMC policies. We hypothesized that these procedures, performed under local anesthesia with or without monitored anesthesia care (MAC) in MPRs, would demonstrate outcomes similar to those of operating rooms but would result in shorter time to surgery and quicker turnover times. We also hypothesized that MPR cases would require fewer personnel during surgery and less monitoring by nursing staff after surgery.

## Materials and Methods

We conducted a retrospective chart review of consecutive hand surgeries performed in MPRs or operating rooms by one fellowship-trained orthopedic hand surgeon from 2015 to 2020 at a single-site VAMC. Inclusion criteria were patients aged greater than 18 years who underwent CTR, de Quervain's release, foreign body removal, soft tissue mass excision, or A1 pulley release. Patients were excluded if they underwent a procedure not previously listed in either an operating room or MPR. Exempt status determination and waiver of consent was granted from our state's institutional review board before we started research.

Referral to the hand clinic was made by the primary care provider. Any advanced imaging, diagnostic tests, and/or corticosteroid injections were performed by the orthopedic hand surgeon before surgery. Patients with noteworthy medical comorbidities were evaluated before surgery by an anesthesiology provider. Scheduling cases depended on the patient's chosen day of the week and corresponding room availability. No patient was excluded from MPRs based on comorbidities. Shared decision-making guided whether the patient underwent wide-awake, local anesthesia versus local with MAC. If the patient's medical history was concerning or the patient requested a sedative, an anesthesiology provider was available for MAC on the day of surgery to ensure the safety of the patient throughout the procedure. The MPRs offered enough space and equipment for anesthesiology staff.

Local anesthesia was injected at the planned surgical field in the preoperative area. The volume of injection depended on the site, consisting of 1% lidocaine with 1:100,000 epinephrine buffered with 8.4% sodium bicarbonate in a 10:1 ratio.<sup>5,22</sup> This was done at least 25 minutes before the incision to achieve the full vasoconstrictive effects of epinephrine.<sup>4</sup> The patient was transferred to the MPR or operating room on a gurney and positioned supine with a hand table. Sterile technique was used for all procedures. Personnel could include the staff surgeon, an orthopedic surgery resident, an anesthesiologist, an anesthesiology assistant, a circulating nurse and/or a surgical technician. Surgical cases booked as local-only anesthesia did not include staffing from the anesthesiology team. If bleeding inhibited the view of the surgical site, either a single-use sterile forearm tourniquet or a sterile finger tourniquet was used at the discretion of the operative surgeon. After surgery, patients were brought to either phase I or phase II of PACU based on a clinical

determination by the anesthesiologist. Typically, if no sedation was given, they were taken straight to phase II. All were monitored by nursing staff until they were deemed safe to discharge home and provided with discharge instructions.

We collected demographic data including age at the time of surgery, sex, race, and medical comorbidities, specifically diabetes, obesity, and hypothyroidism.<sup>23</sup> We defined prior diagnoses of anxiety, depression, bipolar disorder, and/or posttraumatic stress disorder as mental health comorbidities. The presence of pain during preoperative and final postoperative clinic appointment was noted. The period from the date of the clinic visit, when the patient decided on surgery, to the date of surgery was calculated. Variables on the day of surgery included the American Society of Anesthesiologists (ASA) physical status classification system score given by the surgeon or the anesthesiologist, time in the PACU before discharge home, and turnover time. Additional data included square footage of each MPR and operating room, as well as number of personnel present in each case. Postoperative complications were characterized by the presence of superficial or deep infection and/or the need to return to the operating room within 6 weeks.

Descriptive statistics were produced for MPR and operating room groups. We analyzed categorical data with chi-square or Fisher exact tests when appropriate. Normality of continuous data was assessed using the Shapiro-Wilk test and histograms. Normal data were analyzed using Student or Welch's *t* test between groups. Mann-Whitney U test was used for nonnormal data presented with median and interquartile ranges (IQRs). Simple logistic regression was used to model the effects of categorical variables on the likelihood of MPR. Multiple logistic regression was used to determine whether mental health and surgery location predicted the likelihood of local or MAC anesthesia. We performed statistical analysis with Stata software (version 14.2, College Station, TX).

## Results

A total of 331 eligible cases were included with 123 cases in the MPR and 208 in the operating room group (Table 1). We found a statistically significant difference ( $P = .002$ ) in the median age, at 66 years for the MPR group and 61 years for the operating room group. Race and sex were not significantly associated with MPR or operating room groups. Procedure types were similar between the MPR and operating room groups, with the exception of soft tissue mass excisions. These occurred at a significantly higher frequency in the operating room group ( $n = 62$  [29.8%] vs  $n = 12$  [9.8%];  $P = .001$ ). Anesthesia method was strongly associated with MPR and operating room status; 29 patients used MAC in addition to local anesthesia in the MPR group (23.5%) compared with 150 in the operating room group (72.1%;  $P = .001$ ).

We used the ASA score as a surrogate for medical comorbidities; it was similar between the MPR and operating room groups (2.46 MPR vs 2.31 operating room;  $P = .055$ ) (Table 2). Among patients in the MPR group, 25 had diabetes (20.3%), 26 were obese (21.1%), and 11 had hypothyroidism (8.9%). In the operating room group, 39 had diabetes (18.8%), 25 were obese (12%), and 14 had hypothyroidism (6.7%). Mental health comorbidities were similar between MPR and operating room groups (MPR:  $n = 64$  [52.4%] vs operating room:  $n = 102$  [49.1%];  $P = .154$ ).

The presence of preoperative pain was similar between MPR and operating room groups. Postoperative pain was slightly higher in the MPR group but not statistically significant ( $n = 20$  [16.3%] vs  $n = 23$  [11.1%];  $P = .191$ ) (Table 2). Postoperative infection was extremely low and similar between groups, with no infections in the MPR group and only 5 cases in the operating room group. Complications were slightly lower in the MPR group than the operating

**Table 1**  
Minor Procedure Rooms Versus Operating Rooms: Patient Demographics, Procedures, and Anesthesia Methods

Characteristics	MPR (n = 123)	Operating Room (n = 208)	P < .05
Age, y (median [IQR])	66 (16)	61 (19)	<b>.002</b>
Male sex (%)	82	86	.277
Race/ethnicity			
White	96	152	.276
Black	9	18	
Hispanic	9	28	
Other	9	10	
Procedure			
Carpal tunnel release	68	91	<b>.001</b>
de Quervain's release	2	2	
Foreign body removal	6	8	
Soft tissue mass excision	12	62	
Trigger finger release	35	45	
Anesthesia type			
Local/MAC	29	150	<b>.001</b>
Wide-awake, local anesthesia	94	58	

Bold font indicates statistical significance with a *P* < .05.

**Table 2**  
Clinical Characteristics and Outcomes

Clinical Characteristics	MPR (n = 123)	Operating Room (n = 208)	P < .05
Preoperative pain (% yes)	67.5	67.8	.954
Postoperative pain (% yes)	16.3	11.1	.191
Infection (% yes)	0	2.4	.142
American Society of Anesthesiologists score, mean (SD)	2.46 (0.62)	2.31 (0.67)	.055
Mental health Comorbidity (% yes)	52.4	49.1	.154
Minutes in PACU, median (IQR)	36 (22)	45 (40)	<b>.001</b>
Turnover time, min	20.5 (8.1)	28.2 (23.1)	<b>.001</b>
Consult to surgery in days, median (IQR)	15 (14)	21 (18)	<b>.004</b>
Complications (% yes)	0	2.9	<b>.045</b>
Personnel, mean (SD)	4.76 (0.77)	4.99 (0.81)	<b>.015</b>

Bold font indicates statistical significance with a *P* < .05.

\* Unknown in 4 MPR and 3 operating room patients.

room group (MPR: n = 0 vs operating room: n = 6 [2.9%]; *P* = .045). Examples of complications included superficial surgical site infection necessitating oral antibiotics (n = 3), deep surgical site infection leading to return to the operating room for irrigation and debridement (n = 2), and prolonged pain with concern for retained foreign body leading to surgical wound exploration and scar excision (n = 1).

Median time between surgical consult and surgery was 6 days less for patients in the MPR group (15 days [IQR, 14 days] vs 21 days [IQR, 18 days]; *P* = .004) (Table 2). The MPR patients also required fewer personnel during surgery, averaging 4.76 people (SD, 0.77 people) compared with 4.99 people (SD, 0.81 people; *P* = .015). Patients undergoing surgery in MPRs spent 9 minutes less in the PACU (median, 36 vs 45 minutes; *P* = .001). Turnover time was nearly 8 minutes faster in MPRs than in operating rooms (20.5 vs 28.2 minutes; *P* < .001).

We implemented simple logistic regression to model the likelihood of MPR use based on procedure. Soft tissue mass excision was 74% less likely to occur in the MPR (odds ratio of 0.26, 95% confidence interval [CI], 0.13–0.52; *P* = .001) (Table 3). Carpal tunnel release, A1 pulley release, foreign body removal, and de Quervain's release were not predictive of MPR use. When anesthesia was included as a predictive variable, local anesthesia alone was 8.4 times more likely to occur in the MPR (odds ratio of 8.4, 95% CI, 5.0–14.0; *P* = .001) (Table 2).

**Table 3**  
Simple Logistic Regression Evaluating MPR Use by Procedure Type and Anesthesia Type

Procedure	Odds Ratio	95% CI	P Value
Carpal tunnel release	1.00	Reference	–
de Quervain's release	1.34	0.18–9.74	.774
Foreign body removal	1.00	0.33–3.02	.995
Soft tissue mass excision	0.26	0.13–0.52	<b>.001</b>
Trigger finger release	1.04	0.61–1.79	.885
Anesthesia			
Local/MAC	1.00	Reference	–
Wide-awake, local anesthesia	8.4	5.0–14.0	<b>.001</b>

Bold font indicates statistical significance with a *P* < .05.

Multivariable logistic regression was used to model the likelihood of local with MAC use in the presence of mental health comorbidity and MPR or operating room use. Patients with a mental health comorbidity were 80% more likely to undergo local anesthesia with MAC (odds ratio of 1.8, 95% CI, 1.09–2.96; *P* = .022) (Table 4). Operating room patients were 8.8 times more likely to undergo local anesthesia with MAC (odds ratio of 8.84, 95% CI, 5.23–14.9; *P* = .001). Procedure type including CTR, trigger finger release, soft tissue excision, and de Quervain release were not significantly predictive of local anesthesia with MAC use. Foreign body removal was significantly associated with wide-awake, local anesthesia use, and the impact on the model was minimal (3 cases in local anesthesia with MAC and 11 cases in wide-awake, local anesthesia).

## Discussion

There is a high demand for hand surgeries within the veteran population, but because of limited resources, veterans may experience a delay in surgical care.<sup>25</sup> We questioned whether MPRs offer similar outcomes but improved resource use (for CTR, de Quervain's release, foreign body removal, soft tissue mass excision, and A1 pulley release) compared with operating rooms at a VAMC. We observed similar rates of infection and postoperative pain between groups. Our hypothesis that MPRs would provide a shorter time to surgery and quicker turnover time was supported by the results. Furthermore, MPRs used fewer personnel during surgery and less monitoring by nursing staff in the PACU.

Previous studies focused on outcomes related to infection to demonstrate the safety of MPRs.<sup>12,14,15,24</sup> Operating rooms have strict infection control guidelines for environmental cleaning and disinfection, sterilization of instruments, air handling, and personnel management. A systematic review reported low surgical site infection rates in office-based MPRs.<sup>24</sup> However, the authors argued that the results may not be generalizable due to differences in sterilization standards. For example, in the United Kingdom, there must be 25 air changes per hour (ACPH) in an inpatient operating room, compared with 15 ACPHs in an outpatient surgical suite and 10 ACPHs in a clinic treatment room.<sup>25</sup> In the United States, the Facility Guidelines Institute (FGI) recommends 20 ACPHs in an inpatient operating room and 15 ACPHs in an MPR, although not all states have adopted these recommendations.<sup>1</sup> LeBlanc et al<sup>14</sup> evaluated the infection rate of CTR performed in MPRs with only field sterility. Of the 1,504 CTRs, they found a superficial infection rate of 0.4% and a deep infection rate of 0%, which is comparable to previous studies of CTR performed in the operating room. Rhee et al<sup>18</sup> reported a surgical site infection of 1% among wide-awake, local anesthesia surgeries using field sterility in a clinic setting. Our findings of infection rate support previously published results with a surgical site infection rate of 0% in the MPR group and 2.4% in the operating room group. Although field sterility, as demonstrated

**Table 4**  
Multivariate Logistic Regression Evaluating Local/MAC Use After Adjusting for MPR and Mental Health Disorder

Characteristic	Odds Ratio	95% CI	P Value
MPR	1.00	Reference	
Operating room	8.84	5.23, 14.90	<b>.001</b>
Mental health disorder			
No	1.00	Reference	
Yes	1.80	1.09, 2.96	<b>.022</b>

Bold font indicates statistical significance with a  $P < .05$ .

in this report, yielded low infection rates, we continue to practice main operating room sterility in both MPRs and operating rooms.

Expedited access to hand surgery can be achieved for the veteran population with MPRs.<sup>17</sup> We found a statistically significant difference in time to surgery between MPRs and operating rooms. On average, patients were able to undergo surgery about 6 days earlier. During the data collection period, the VAMC moved to a new building with the addition of MPRs. An increased number of available rooms may have allowed more patients to undergo surgery sooner. The use of MPRs for CTR, de Quervain's release, foreign body removal, and A1 pulley release was equivalent, all of which are typically done after trialing nonsurgical management. On the other hand, soft tissue mass excisions were about 74% less likely to occur in MPRs based on our study's results (Table 3). This is directly related to the VAMC's policy of performing soft tissue mass excision of a size greater than 5 cm in the operating room. Although patient preference can influence the time frame for surgical scheduling, our finding that patients waited on average 6 days less for procedures in MPRs suggests that MPRs have the potential to expedite veteran access to care.

VAMCs could benefit from substantial cost savings. Rhee et al<sup>19</sup> demonstrated a 70% to 85% cost savings for a military health care system in the United States by performing CTR, de Quervain's release, and A1 pulley release in a clinic setting without anesthesiology or PACU staff present.<sup>19</sup> In this study, we found MPR cases required significantly fewer staff than operating rooms, although the clinical significance of this finding is unclear when the average difference was 0.25 people. Furthermore, selection bias related to data collected from an older VAMC without dedicated MPRs combined with data collected from the current VAMC may have inflated the number of personnel for operating room cases. Otherwise, the difference may be related to a reduction in the number of anesthesiology staff needed, because patients were 8.4 times more likely to undergo wide-awake, local anesthesia in MPRs. Our VAMC is a teaching facility with the presence of trainees. Findings would likely have been altered if learners were not included in the documentation of personnel during surgery.

Additional space savings may be gained by transitioning more surgical cases to MPRs, based on their reduced size requirements. The size of MPRs is recommended to be 160 ft<sup>2</sup> to accommodate anesthesiology staff. The recommended size of an outpatient operating room with is 270 ft<sup>2</sup>, whereas an inpatient operating room should be about 400 ft<sup>2</sup>.<sup>1</sup> We found that MPRs were on average 231.1 ft<sup>2</sup> and operating rooms averaged 523.6 ft<sup>2</sup> at our facility. Therefore, about 2 MPRs can be built for every single operating room. Furthermore, we found turnover time between cases to be about 8 minutes shorter for MPRs than operating rooms. The difference may be based on the size of the space and regulations for how each space is sanitized before the next case. Thus, there can be a greater variability in time between cases when operating in the operating room. Because the 5 procedures in this study are typically less than 30 minutes long, a difference of 8 minutes can greatly affect the ability to schedule more cases.

Time spent in the PACU also contributes to overall patient cost. On average, patients in the MPR group were discharged from the PACU 9 minutes sooner than the operating room group. Based on the 2018 Facility Guidelines Institute guidelines, each operating room requires one phase I and one phase II recovery room. By comparison, each procedure room requires only one phase II recovery room.<sup>1</sup> At our VAMC facility, patients who did not receive sedative intravenous medications were transferred directly to phase II, where they were evaluated by only one nurse before discharge. Patients receiving sedative intravenous medications, regardless of MPR or operating room, were monitored by a nurse in phase I and another nurse in phase II of the PACU. A staged prospective study of bilateral CTR, in which one hand was given only local anesthesia and the other hand received local anesthesia plus sedation, found the total time in the surgical facility to be approximately 26 minutes less with local-only anesthesia.<sup>7</sup> Alter et al<sup>8</sup> compared local-only CTR with sedated CTR in the operating room. The PACU times were significantly longer in the sedation group (84 minutes) compared with the wide-awake, local anesthesia group (7 minutes). They noted that each minute in the PACU costs \$12.16, leading to significant cost savings with decreased PACU monitoring.

Limitations of the current study warrant discussion. The study was performed at a single academic orthopedic practice within the Veterans Affairs Health Care System; a multicenter study of practices throughout the country may provide greater external validity. Furthermore, construction of a new VAMC hospital was completed in 2018 and orthopedic surgical care was transferred to that facility shortly afterward. Because the previous hospital did not include MPRs, all cases in the MPR group were conducted at the new VAMC hospital. Only 11.7% of cases in the operating room group were performed at the new hospital. Therefore, there is potential for selection bias owing to the lack of proper randomization. Our results indicate decreased use of operating rooms for CTR, de Quervain's release, foreign body removal, soft tissue mass excision, and A1 pulley release with the advent of MPRs. Although we would need more data from the current VAMC to assess this relationship, MPRs likely allow for increased operating room availability for invasive hand surgeries requiring anesthesia.

Second, this was a retrospective chart review lacking patient-specific outcome measures. Multiple studies have established high levels of patient satisfaction in clinic-based procedure rooms with wide-awake, local anesthesia.<sup>2,19</sup> Our study uniquely focused on veteran patients, a population with a high prevalence of depression, anxiety, bipolar disorder, and posttraumatic stress disorder.<sup>26</sup> Although there is concern that patients with psychiatric diagnoses might poorly tolerate wide-awake, local anesthesia, a study at a VAMC found no difference in requests for sedation, operative time, time in an operating room, or complications in patients with psychiatric diagnoses who underwent either awake or sedated CTR.<sup>27</sup> In our study, 52% of all patients were diagnosed with mental health comorbidities. A similar ratio of these patients underwent procedures in MPRs (52.4%) versus operating rooms (49.1%). However, they were more likely to undergo local or MAC rather than wide-awake, local anesthesia. It is unclear whether this was based on patient preference or availability of space. The perspective of veteran patients with psychiatric diagnoses on undergoing wide-awake procedures warrants further investigation.

Performing hand surgeries in MPRs at a VAMC maintains excellent outcomes with limited complications and decreased resource use. Patients can be scheduled for surgery within a shorter time whereas surgeons can schedule more surgeries owing to shorter turnover times. This allows more patients within the veteran population to be treated in a safe and effective manner.

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## References

- Langlands B. The 2018 FGI Guidelines: Proposed Revisions to Procedure, Operating and Imaging Room Requirements. Facility Guidelines Institute; 2018. Available at: [https://www.fgiguideines.org/wp-content/uploads/2017/11/E94\\_HCD2017\\_A\\_New\\_Class\\_Act.pdf](https://www.fgiguideines.org/wp-content/uploads/2017/11/E94_HCD2017_A_New_Class_Act.pdf). Accessed November 16, 2020.
- Van Demark RE Jr, Becker HA, Anderson MC, Smith VJS. Wide-awake anesthesia in the in-office procedure room: lessons learned. *Hand (N Y)*. 2018;13(4):481–485.
- Tang JB, Xing SG, Ayhan E, Hediger S, Huang S. Impact of wide-awake local anesthesia no tourniquet on departmental settings, cost, patient and surgeon satisfaction, and beyond. *Hand Clin*. 2019;35(1):29–34.
- McKee DE, Lalonde DH, Thoma A, Dickson L. Achieving the optimal epinephrine effect in wide awake hand surgery using local anesthesia without a tourniquet. *Hand (N Y)*. 2015;10(4):613–615.
- Lalonde D, Martin A. Epinephrine in local anesthesia in finger and hand surgery: the case for wide-awake anesthesia. *J Am Acad Orthop Surg*. 2013;21(8):443–447.
- Foster BD, Sivasundaram L, Heckmann N, et al. Surgical approach and anesthetic modality for carpal tunnel release: a nationwide database study with health care cost implications. *Hand (N Y)*. 2017;12(2):162–167.
- Via GG, Esterle AR, Awan HM, Jain SA, Goyal KS. Comparison of local-only anesthesia versus sedation in patients undergoing staged bilateral carpal tunnel release: a randomized trial [published online ahead of print March 17, 2019]. *Hand (N Y)*. <https://doi.org/10.1177/1558944719836237>.
- Alter TH, Warrender WJ, Liss FE, Ilyas AM. A cost analysis of carpal tunnel release surgery performed wide awake versus under sedation. *Plast Reconstr Surg*. 2018;142(6):1532–1538.
- Chatterjee EA, McCarthy AJ, Montagne LS, Leong LK, Kerrigan LC. A cost, profit, and efficiency analysis of performing carpal tunnel surgery in the operating room versus the clinic setting in the United States. *Ann Plastic Surg*. 2011;66(3):245–248.
- 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 (N Y)*. 2007;2(4):17–178.
- Nguyen C, Milstein A, Hernandez-Boussard T, Curtin CM. The effect of moving carpal tunnel releases out of hospitals on reducing United States health care charges. *J Hand Surg Am*. 2015;40(8):1657–1662.
- Yu AJ, Ji HT, Craig HM, McKee HD, Lalonde HD. Evidence-based sterility: the evolving role of field sterility in skin and minor hand surgery. *Plast Reconstr Surg Glob Open*. 2019;7(11). e2481–e2481.
- Wheelock M, Petropolis C, Lalonde DH. The Canadian model for instituting wide-awake hand surgery in our hospitals. *Hand Clin*. 2019;35(1):21–27.
- LeBlanc M, Lalonde D, 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 (N Y)*. 2011;6(1):60–63.
- Tulipan JE, Kim N, Abboudi J, et al. Open carpal tunnel release outcomes: performed wide awake versus with sedation. *J Hand Microsurg*. 2017;9(2):74–79.
- Duquette S, Nosrati N, Cohen A, Munshi I, Tholpady S. Decreased wait times after institution of office-based hand surgery in a veterans administration setting. *JAMA Surg*. 2015;150(2):182–183.
- Kazmers NH, Presson AP, Xu Y, Howenstein A, Tyser AR. Cost implications of varying the surgical technique, surgical setting, and anesthesia type for carpal tunnel release surgery. *J Hand Surg Am*. 2018;43(11). 971.e971–977.e971.
- Rhee PC, Fischer MM, Rhee LS, McMillan H, Johnson AE. Cost savings and patient experiences of a clinic-based, wide-awake hand surgery program at a military medical center: a critical analysis of the first 100 procedures. *J Hand Surg Am*. 2017;42(3):e139–e147.
- McGlaston TJ, Kim DW, Schrodel P, Deangelis JP, Ramappa AJ. Few insurance-based differences in upper extremity elective surgery rates after healthcare reform. *Clin Orthop Relat Res*. 2012;470(7):1917–1924.
- Rhee PC. The current and possible future role of wide-awake local anesthesia no tourniquet hand surgery in military health care delivery. *Hand Clin*. 2019;35(1):13–19.
- Lovely LM, Chishti YZ, Woodland JL, Lalonde DH. How much volume of local anesthesia and how long should you wait after injection for an effective wrist median nerve block? *Hand (N Y)*. 2018;13(3):281–284.
- Geoghegan JM, Clark DI, Bainbridge LC, Smith C, Hubbard R. Risk factors in carpal tunnel syndrome. *J Hand Surg Br*. 2004;29(4):315–320.
- Sheetz KH, Clancy CM. Veterans affairs health care—It is the local market. *Health Serv Res*. 2018;53(6):4118–4122.
- Jagodzinski NA, Ibish S, Furniss D. Surgical site infection after hand surgery outside the operating theatre: a systematic review. *J Hand Surg Eur Vol*. 2017;42(3):289–294.
- Health Do. Heating and Ventilation Systems Health Technical Memorandum 03-01: Specialised Ventilation for Healthcare Premises Part A: Design and Validation. In: Department of Health, The Stationery Office UK; 2007. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/144029/HTM\\_03-01\\_Part\\_A.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/144029/HTM_03-01_Part_A.pdf). Accessed November 16, 2020.
- Nichter B, Norman S, Haller M, Pietrzak RH. Physical health burden of PTSD, depression, and their comorbidity in the U.S. veteran population: morbidity, functioning, and disability. *J Psychosom Res*. 2019;124:109744.
- Ayyala HS, Castel N, Mohamed OM, Xue EY, Oleck NC, Lee ES. Utility of local anesthesia for open carpal tunnel release in patients with psychiatric diagnoses. *JPRAS Open*. 2020;23:26–31.