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

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Purpose Wide-awake, local anesthesia, no tourniquet (WALANT) hand surgery was developed to improve access to hand surgery care while optimizing medical resources. Hand surgery in the clinic setting may result in substantial cost savings for the United States Military Health Care System (MHS) and provide a safe alternative to performing similar procedures in the operating room.

Methods A prospective cohort study was performed on the first 100 consecutive clinic-based WALANT hand surgery procedures performed at a military medical center from January 2014 to September 2015 by a single hand surgeon. Cost savings analysis was performed by using the Medical Expense and Performance Reporting System, the standard cost accounting system for the MHS, to compare procedures performed in the clinic versus the operating room during the study period. A study specific questionnaire was obtained for 66 procedures to evaluate the patient's experience.

Results For carpal tunnel release (n = 34) and A1 pulley release (n = 33), there were 85% and 70% cost savings by having the procedures performed in clinic under WALANT compared with the main operating room, respectively. During the study period, carpal tunnel release, A1 pulley release, and de Quervain release performed in the clinic instead of the operating room amounted to $393,100 in cost savings for the MHS. There were no adverse events during the WALANT procedure.

Conclusions A clinic-based WALANT hand surgery program at a military medical center results in considerable cost savings for the MHS. *(J Hand Surg Am. 2017;42(3):e139–e147.*

Type of study/level of evidence Economic/Decision Analysis IV.

Key words Wide-awake hand surgery, WALANT, carpal tunnel release, trigger finger release, clinic-based hand surgery.

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Inadequate health care delivery and limited access to surgical care for veterans, active duty military, and their dependents has been under scrutiny in recent years.[1,2] With the passage of the United States (US) Patient Protection and Affordable Care Act of 2010, the adjusted rate of surgery for elective upper-extremity orthopedic procedures increased markedly for patients using a military health care plan (TRICARE) compared with Medicare, Medicaid, government-subsidized, or private insurance plans, which further overburdens the US military health care system (MHS).[3]

Wide-awake, local anesthesia, no tourniquet (WALANT) hand surgery in the clinic setting may improve access to hand surgery care in the MHS.[4] The use of local anesthesia with epinephrine in the hand and wrist provides excellent hemostasis, obviating the need for tourniquet use, which often requires intravenous sedation anesthesia (IVSA) or general endotracheal anesthesia (GETA) to minimize tourniquet related discomfort.[5–7] Because of this, WALANT hand surgery can be performed in the clinic under field sterility with no reported increase in complications while maintaining a high rate of patient satisfaction.[4,8,9] Specifically in the MHS, performing clinic-based WALANT hand surgery circumvents limitations with operating room availability, which is often exhausted by military trauma. In addition, eliminating the inefficiencies imparted by operating room delays, WALANT hand surgery translates to more hand surgery procedures in the clinic compared with the operating room in the MHS.[4,10]

However, the demand to treat patients urgently and effectively may be impeded by the necessity to maintain low costs for the MHS, which operates at a cost of $52.7 billion, or 13% of the Department of Defense budget, to cover 10 million beneficiaries.[11,12] Clinic-based WALANT hand surgery has been shown to produce substantial cost savings in the civilian sector by eliminating expenditures related to preoperative medical testing, perioperative nursing, anesthesiology, supplies, and medications.[4,10] The potential for expedient and cost-efficient hand surgery afforded by WALANT hand surgery may also be beneficial within the MHS.

However, patient safety, perioperative pain, and anxiety associated with a clinic-based WALANT hand surgery program in the US MHS have not been reported. The purpose of this study was to report the cost savings, safety, and patient experience (pain, anxiety, and willingness to undergo WALANT hand surgery again) of the first 100 clinic-based WALANT hand surgery procedures at a military medical center.

TABLE 1. Patient Demographics

Demographic Variables	All WALANT Patients (n = 100)	Patients With Completed Surveys (n = 66)
Gender		
Male	54	36
Female	46	30
Age, y (mean ± SD)	51 ± 17	53 ± 16

TABLE 2. Description of First 100 Consecutive Clinic-Based WALANT Hand Surgery Procedures

WALANT Procedure	Total Performed
CTR	34
APR	33
Hardware/foreign body removal*	14
Phalanx fracture pin fixation	9
dQR	4
Tendon repair†	3
Nail horn excision ablation	2
Extensor carpi ulnaris debridement	1

*Hardware consisted of subcutaneous Kirschner wires (n = 13) and retained broken glass removal (n = 1).
†Tendon repairs consisted of wrist extensor tendons (n = 2) and thumb flexor tendon (n = 1).

MATERIALS AND METHODS

This was a prospective cohort study of the first 100 consecutive WALANT hand surgery procedures (Tables 1, 2), a sample of convenience, performed by one fellowship-trained orthopedic hand surgeon from January 2014 to September 2015. The institutional review board approved the study. All WALANT procedures were performed in the Orthopedic Surgery Clinic, which is an accredited section of a Level 1 civilian and military trauma facility and a military tertiary referral center.

Infrastructure of the WALANT hand surgery program

The WALANT hand surgery program was initiated in January 2014. A series of didactic sessions were provided to primary care managers (PCMs) throughout the local health care system to educate them regarding WALANT hand surgery and provide a direct referral system to streamline potential hand surgery patients for expeditious evaluation. Benefits described to the participants included patient convenience, elimination of preoperative testing (such as laboratory studies,

chest radiographs, electrocardiogram, and urine pregnancy tests) and the ability to continue medications without modification (including anticoagulation). In contrast to the published literature indicating that testing and anticoagulation cessation are not necessary for minor elective hand surgery, preoperative testing and withholding of anticoagulants are within the guidelines set forth by our institution's preoperative protocol for all operating room procedures. Every participant agreed to refer patients through the WALANT hand surgery program.

Once a direct referral was received, the patient was screened to determine whether contraindications to WALANT hand surgery were present. These included a history of a peripheral vascular disorder, history of substantial procedural anxiety, preference to have the procedure under IVSA or GETA, inability to lay supine on an operating table owing to back pain or obstructive sleep apnea, or shoulder pathology that would not permit the patient to lie supine with the upper extremity on a hand table comfortably. If the patient was deemed to be a candidate for WALANT hand surgery, he or she was given an appointment for initial surgical consultation expediently. Since the initiation of the WALANT hand surgery direct referral pathway, no referred patients had a contraindication to a procedure under WALANT. Patients were instructed that they did not have to restrict their diet and that they could drive themselves to and from the clinic, similar to going to a dental appointment. If the patient met the indication for surgery, they underwent a WALANT hand surgery procedure the same day or returned for WALANT surgery if further counseling was required or if the patient elected for further nonsurgical treatment.

Procedural protocol for WALANT hand surgery

Local anesthesia is injected into the operative extremity in the examination room. Injection techniques and dosages for the WALANT procedures were based on the descriptions by Strazar et al[13] and Lalonde et al,[14] consisting of 1% lidocaine with 1:100,000 epinephrine buffered with 8.4% sodium bicarbonate in a 10:1 ratio (Table 3). The patient then waits in the examination room for approximately 25 minutes to allow for the full vasoconstrictive effects of epinephrine to be achieved.[5]

The patient is then transferred to a procedure room in the orthopedic clinic, which is an all-purpose room for minor procedures, placement of orthoses, casting, and rehabilitation. The procedure room does not have laminar airflow and did not require alteration before initiation of the WALANT program. The patient is positioned supine on an operating room table with an attached hand table. All WALANT procedures are performed under field sterility using aseptic technique with no cardiopulmonary monitoring or intravenous use. Personnel for WALANT procedures include the staff surgeon, an orthopedic surgery resident, and a nurse trained in setting up a sterile field. If critical digit ischemia is encountered, phentolamine (1 g diluted in 1 to 10 mL saline) is available to reverse the vasoconstrictive effects of epinephrine. After the procedure, patients receive postoperative care instructions and then depart from clinic without further monitoring.

TABLE 3. Typical Dosages of Local Anesthetic to Perform Various WALANT Procedures

Procedure	Typical Volume of Injection, mL
CTR	22
APR	5
Phalanx fracture pin fixation	11
Hardware removal	5–11
dQR	11
Nail horn ablation	5
Tendon repair	22–40

Cost savings analysis

The Medical Expense and Performance Reporting System (MEPRS), which is the standard cost estimation protocol for the US MHS, was used to determine the cost of performing each procedure based on the Current Procedural Terminology code. This system determines the bundled cost of performing a procedure in the clinic or operating room. This accounts for both direct and indirect costs associated with the Current Procedural Terminology code. Direct costs include those that directly affect the actual surgery, such as operating room time, medications, drapes, and disposable supplies. Indirect costs are those linked to the procedure but are shared among other procedures and specialties, such as transcriptionist fees, sterilization costs, and housekeeping wages. An analysis using MEPRS represents the institutional cost of performing these procedures. Therefore, the difference in cost for performing procedures in the clinic versus the main operating room is indicative of cost savings.

The mean cost to perform 3 common hand surgery procedures (carpal tunnel release [CTR], A1 pulley release [APR], and de Quervain release [dQR]) in clinic under WALANT was compared with the mean

cost of performing the same procedures in the main operating room under IVSA in a cohort of patients treated by the same surgeon during the study period who declined WALANT hand surgery, requested surgery under sedation, were not evaluated through the WALANT pathway, failed the WALANT screen, or owing to scheduling conflicts could not undergo the procedure on the days when WALANT hand surgery was performed.

Complications and Periprocedural Adverse Events

Postoperative complications were characterized as either general complications or those directly attributed to the WALANT procedure. In addition, any periprocedural adverse events that occurred during the WALANT procedure were noted.

Patient Experience

We evaluated patient acceptance of the WALANT process, pain, and perioperative anxiety with WALANT hand surgery using a patient-reported questionnaire (Appendix A), modified from Davison et al.[15] Pain and anxiety scores were based on the visual analog scale, in which 0 indicated no pain or anxiety and 10 indicated the worst pain or anxiety. Patient surveys were obtained for 66 procedures (Table 1); the remaining 34 patients were unable to complete the surveys at the 2-week postoperative visit. Inclusion of surveys beyond this point would have introduced a recall bias.

RESULTS

Cost savings

Table 4 presents the mean institutional cost to perform a CTR, APR, and dQR in the clinic (WALANT) compared with the main operating room (IVSA). There was a 70% to 85% cost savings for the MHS by performing these procedures in the clinic versus the main operating room.

The total cost saved for the MHS during a 21-month period by performing CTR, APR, and dQR in the clinic under WALANT compared with an estimated cost of performing the same type and number of procedures in the main operating room under IVSA was $393,099.53 (Table 5).

Safety

There were 3 complications (3%): superficial infection after CTR that resolved with oral antibiotics (n = 1), loss of reduction (n = 1), and nonunion (n = 1) in proximal phalanx fractures after percutaneous pin fixation. No patients required phentolamine for critical digit ischemia. No patients sustained a syncopal event, required termination of the procedure owing to pain or anxiety, required postprocedure in-patient admission, or necessitated prolonged observation (more than 15 minutes) for any medical reason after the WALANT procedures.

TABLE 4. Cost-effectiveness per Hand Surgery Procedure Performed in Clinic Compared With Main Operating Room*

	Clinic Cost (WALANT)*	Main Operating Room Cost (IVSA)*†	Cost Savings for Clinic Versus Main Operating Room Procedure
CTR	$1,111.09	$7,386.15	−$6,275.06 (85%)
APR	$1,960.21	$6,565.10	−$4,604.89 (70%)
dQR	$1,329.24	$8,275.77	−$6,946.53 (84%)

*Cost is the mean MEPRS value per procedure.
†Determined by the MEPRS cost per procedures performed in the main operating room during the study period.

TABLE 5. Cost-effectiveness for Clinic-Based WALANT (Actual) Compared With Main Operating Room (Estimated) Hand Surgery From January 2014 to September 2015

Procedure	n	Total Cost for Clinic (WALANT)	Estimated Total Cost for Main Operating Room (IVSA)	Cost Savings for Clinic Versus Main Operating Room Procedure
CTR	34	$37,777.06	$251,129.10	−$213,352.04
APR	33	$64,686.93	$216,648.30	−$151,961.37
dQR	4	$5,316.96	$33,103.08	−$27,786.12
	Total	$107,780.95	$500,880.48	−$393,099.53

Patient willingness to undergo WALANT again

Overall, 94% of patients (62 of 66) stated that they would have the procedures performed under WALANT if they had to have the procedure again. The remaining patients stated that they would choose IVSA (5%; n = 3) or GETA (2%; n=1) instead of WALANT if they had to have the procedure performed again. Table 6 presents the preferred method of anesthesia for subsequent surgery for each individual WALANT procedure.

Pain

Overall, 71% of procedures (n = 47) caused less pain than a dental procedure (Table 7). Narcotic pain

TABLE 6. Patient Satisfaction Based on Preferred Method of Anesthesia for Subsequent Procedures

Procedures and Survey Response		Preferred Method of Anesthesia for Subsequent Procedures		
WALANT Procedure	Total Surveys	WALANT	IVSA	GETA
CTR	29	29 (100%)		
APR	22	20 (91%)	2 (9%)	
Hardware/foreign body removal	5	4 (80%)	1 (20%)	
Phalanx fracture pin fixation	4	4 (100%)		
dQR	3	3 (100%)		
Tendon repair	1			1 (100%)
Nail horn excision ablation	2	2 (100%)		
Total	66	62 (94%)	3 (5%)	1 (2%)

TABLE 7. Pain Level During WALANT Hand Surgery Compared With Dental Procedure

Procedures and Survey Response		Pain Level With WALANT Hand Surgery Compared With Dental Procedure*,†		
WALANT Procedure	Total Surveys	Less	Same	Worse
CTR	29	21 (72%)	1 (3%)	7 (24%)
APR	22	16 (73%)		6 (27%)
Hardware/foreign body removal	5	3 (60%)		2 (40%)
Phalanx fracture pin fixation	4	2 (50%)	1 (25%)	1 (25%)
dQR	3	3 (100%)		
Tendon repair	1	1 (100%)		
Nail horn excision ablation	2	2 (100%)		
Total	66	48 (73%)	2 (3%)	16 (24%)

*Dental procedure includes crown placement, root canal, or tooth extraction.
†Pain scale range = 0 (no pain) to 10 (worst pain).

medication was required after 64% of procedures (n = 42). Mean maximum pain after all WALANT procedures was 4.9 ± 2.9 (range, 0–10). Mean maximum pain scores were 5.0 ± 3.1 (range, 0–10) for CTR, 4.5 ± 2.7 (range, 0–8) for APR, and 6.0 ± 3.6 (range, 2–9) for dQR.

Anxiety

Overall, mean anxiety levels before, during, and after the procedures were 2.8 ± 3.4, 2.4 ± 3.2, and 0.4 ± 1.0, respectively (Table 8).

DISCUSSION

A clinic-based WALANT hand surgery program at a military medical center resulted in considerable cost savings for the MHS with satisfactory patient experiences and no periprocedural adverse events in this study sample.

A study by Leblanc et al[4] reported that during a 3-hour surgical block, 9 CTRs were performed under WALANT in the ambulatory setting, compared with 4 CTRs in the operating room. The efficiency noted with clinic-based surgery may be attributed to the lack of perioperative process errors and operating room delays that were reported to occur at an average of 4.3 and 1.7 times per case, respectively, within the veterans administration system.[16] However, the case volume proficiency reported by Leblanc et al was for a well-established WALANT hand surgery program within the Canadian health care system and may not be able to be reproduced in the US civilian health care system.[4] Nonetheless, our WALANT hand surgery program allocates 10- to 15-minute turnover time between patients, which permits 2 to 3 CTRs, APRs, or dQRs in 1 hour.

Improved access to hand surgery care can be achieved in the MHS with a WALANT hand surgery

TABLE 8. Mean Anxiety Level Before, During, and After WALANT Hand Surgery Procedure

WALANT Procedure	Total Surveys	Mean Perioperative Anxiety Level*		
		Before (SD)	During (SD)	After (SD)
CTR	29	2.4 (2.6)	2.3 (2.7)	0.5 (1.1)
APR	22	2.7 (3.6)	1.8 (2.9)	0.4 (0.7)
Hardware/foreign body removal	5	6.6 (3.4)	6.0 (4.2)	0.2 (0.4)
Phalanx fracture pin fixation	4	3.5 (4.4)	2.5 (3.8)	0
dQR	3	0	0	0
Tendon repair	1	10	10	5
Nail horn excision ablation	2	0.5 (0.7)	0.5 (0.7)	0
Total	66	2.8 (3.4)	2.4 (3.2)	0.4 (1.0)

*Anxiety scale range = 0 (no anxiety, calm) to 10 (intense anxiety).

program. Providing a streamlined process for PCMs to refer patients for surgical consultation has been shown to minimize the delay to evaluation by a hand specialist.[9] Educational events to make PCMs aware of our WALANT hand surgery program facilitated direct referrals for carpal tunnel syndrome and trigger digits, and may have resulted in considerable cost for TRICARE if the patients in the current study had been outsourced to civilian providers, as is frequently required because of overtaxing of the MHS. This is advantageous for the MHS, because one study noted that among all insurance categories, TRICARE patients exhibited the highest proportion of carpal tunnel syndrome.[3]

Common hand surgery procedures performed under clinic-based WALANT results in substantial cost savings for the MHS. A study by Chatterjee et al[10] reported that the cost of performing an open CTR in the operating room was nearly 4 times more expensive than in the clinic ($2,273 vs $985) at a US civilian tertiary health care center. Similarly, Leblanc et al[4] noted a cost of $137.06 per CTR when performed in the main operating room compared with $36.46 in the clinic under the Canadian health care system. In the current study, common hand surgery procedures such as CTR, APR, and dQR are 3 to 7 times more expensive for the MHS when performed in the main operating room compared with the clinic. These procedures performed by a single hand surgeon under WALANT resulted in nearly $400,000 in cost savings for the US MHS during a 21-month period. If WALANT hand surgery is adopted into the practice of other military hand surgery practices, the cost savings could be substantial for the Department of Defense.

Clinic-based WALANT hand surgery appears to be safe and meets the standard of care for hand surgery.[6–8] Injection of epinephrine into the hand and wrist has been discouraged owing to concerns regarding critical ischemia in the digit or infarction. However, in contrast to conventional wisdom regarding its use in hand surgery, 2 large studies with over 4,000 cases of epinephrine injected into the finger or hand reported no complications.[7,17] In the current study, no patients developed critical ischemia, nor was phentolamine rescue necessary. The superficial surgical site infection rate of 1% was noted in this study for all WALANT procedures; however, the infection rate for CTR was 2.9% (1 of 34), in contrast to the infection rate of 0.4% (6 of 1,504) reported by Leblanc et al[18] for WALANT CTR under field sterility in a minor procedure room. Although the current study did not compare infection rates for procedures performed under WALANT with a matched cohort performed in the main operating room, the higher infection rate noted for CTR necessitates careful consideration of performing clinic-based WALANT hand surgery for patients who are immunocompromised or at risk for infection.

A clinic-based WALANT hand surgery program in the MHS provides high rates of patient acceptance with the perioperative process. A study evaluating 100 consecutive WALANT CTRs noted that 93% of patients stated that they would prefer WALANT over IVSA or GETA if they had the surgery again.[15] In the current study, 100% of patients who underwent CTR (n = 23) and 94% of all patients (62 of 66) stated that they would choose WALANT again. Although patient willingness to undergo the same procedure under WALANT again is not a validated outcome measure, it may serve as a surrogate indicator of positive reception of the WALANT process. This may be because with WALANT hand surgery, by eliminating standardized preoperative nursing visits or screening laboratory or diagnostic studies, and

with no need to alter medication and dietary routines and no postoperative nausea that is often associated with IVSA or GETA, the perioperative process is much more convenient for patients at a military medical center.

Pain during and after WALANT hand surgery is equivalent to procedures performed under IVSA. A study by Davison et al[15] reported that 64% of patients (64 of 100) rated perioperative pain to be less painful than a routine dental procedure, with a mean maximum postoperative pain of 4.3 ± 2.7 after IVSA CTR, compared with 54% (54 of 100) and 4.3 ± 2.7 after WALANT CTR. This is comparable to the current study values of 72% (21 of 29) and 5.0 ± 3.2 for WALANT CTR, respectively. Interestingly, when all WALANT procedures were included, such as tendon repairs and phalangeal fracture pin fixation, 71% of patients (62 of 66) experienced less pain than during a dental procedure, which suggests that a broader scope of procedures could be performed under WALANT with adequate pain control. However, pain attributed to the WALANT procedure may be influenced by local anesthetic injection technique and the quality of nerve blockade. Therefore, surgeons should individualize the offering of clinic-based WALANT hand surgery, favoring regional or general anesthesia in the main operating room for patients who may be at risk for poor periprocedural pain tolerance.

Hand surgery performed under WALANT is well tolerated with minimal perioperative anxiety. Patients and surgeons may have reservations about performing WALANT procedures owing to the potential for considerable perioperative anxiety because patients are wide-awake with no sedation. However, one study reported significantly lower preoperative anxiety with CTR under WALANT (2.3 ± 2.7) compared with IVSA (3.4 ± 2.8; $P = .007$).[15] These values are similar to the preoperative anxiety noted in the current study for WALANT CTR (2.4 ± 2.6). Interestingly, the current study noted preoperative and perioperative anxiety levels of 2.8 ± 3.4 and 2.4 ± 3.2 for all WALANT procedures, respectively. This finding also suggests that a wide variety of WALANT procedures can be performed with low perioperative anxiety, even for fracture pin fixation, during which the patient can hear the sound of the drill.

The major limitation of this study is the inability of MEPRS to account for all direct and indirect costs for performing a procedure in the main operating room compared with in the clinic. Because MEPRS determines the global cost for a procedure, accounting for the location of services rendered such as the clinic or the main operating room, many cost-saving aspects cannot be elucidated. For example, procedures performed in the clinic under WALANT do not require preoperative laboratory studies, perioperative nursing, or intravenous medications. These costs are not accounted for directly under the MEPRS values. Therefore, the cost savings presented in this study are likely a considerable underestimation for the MHS. As payment options in the civilian sector shift toward capitation and bundled payments, providing clinic-based WALANT hand surgery may be even more beneficial in the civilian sector. Finally, a selection bias could have been introduced because only patients who were screened to tolerate the clinic-based WALANT hand surgery well were offered it.

A clinic-based WALANT hand surgery program at a military medical center results in considerable cost savings for the MHS and is tolerated well by most patients.

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Appendix A

Patient Survey

1. How did the surgery compare to having a procedure done at the dentist (such as a crown, root canal, or tooth extraction)? Please circle one option.
   a. Less pain than a dental procedure
   b. More pain than a dental procedure
   c. The same pain as a dental procedure

2. How bad was the worst of your pain after the surgery? Please circle a number between 0 and 10 below. (0= no pain at all; 10=worst pain imaginable)

0 1 2 3 4 5 6 7 8 9 10

3. If you were to have the same surgery again and given the choice, would you prefer to be awake for the surgery, sedated, or to be completely asleep? Please circle one option.
   a. Be completely awake (doctor uses local freezing (anesthetic), no sedating medications)
   b. Be sedated (I.V. medicine given to make you sleepy and have little to no memory of the procedure, in addition to local anesthetic)
   c. Be completely asleep (I.V. medicine given so that you are unconscious and have a ventilator breathing for you)

4. What medication did you take for pain after the surgery? _____

5. Did your medication control your pain to your satisfaction?
   Yes No

6. How anxious (nervous) were you about your surgery? Please circle a number between 0 and 10 below. (0= no anxiety or nervousness; 10=extreme anxiety or nervousness)

Before Surgery	0	1	2	3	4	5	6	7	8	9	10
During Surgery	0	1	2	3	4	5	6	7	8	9	10
After Surgery	0	1	2	3	4	5	6	7	8	9	10