Patient Experience Evaluation and Cost Savings Analysis of Carpal Tunnel Syndrome Decompression Surgery Using the WALANT Technique

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ABSTRACT

Introduction: Wide-awake local anesthesia no tourniquet (WALANT) is an anesthetic technique that was developed to improve patient access to treatment and optimize the use of available medical resources in hand surgery. The main purpose of this study was to evaluate patient experience and hospital cost savings during surgical treatment of carpal tunnel syndrome (CTS) with this technique at a South American public hospital. **Materials and Methods:** Between 2016 and 2022, a descriptive prospective observational study was conducted on patients with a clinical diagnosis of CTS who had undergone surgical treatment. Patient satisfaction was assessed using a questionnaire that asked about pain during different periods of time, anxiety, and the procedure itself. The costs of the anesthetic technique were also analyzed. **Results:** 92 patients were evaluated and the majority of them were satisfied with their WALANT experience; 94.5% said they would choose this procedure again, citing low levels of pain and anxiety. A cost reduction of 60.6% per procedure was achieved. **Conclusions:** CTS decompression with the WALANT technique resulted in significant cost savings for the national health system, as well as favorable outcomes in terms of satisfaction, anxiety, and pain; the procedure was safe, comfortable, and efficient. The benefits and profitability of employing fewer hospital resources could be further optimized and replicated to result in significant health-care cost savings.
Keywords: Hand; carpal tunnel syndrome; local anesthesia; epinephrine.
Level of Evidence: IV

Experiencia del paciente y análisis de ahorro de costos de la cirugía de síndrome de túnel carpiano con técnica WALANT

RESUMEN

Introducción: La técnica de anestesia local con epinefrina sin el uso de manguito hemostático (*Wide Awake Local Anesthesia - No Tourniquet*, WALANT) se desarrolló para mejorar el acceso a la atención de la cirugía de mano y optimizar recursos médicos. El principal objetivo de este estudio fue evaluar la experiencia del paciente y analizar el ahorro de costos hospitalarios en el tratamiento quirúrgico de descompresión del síndrome del túnel carpiano utilizando esta técnica anestésica. **Materiales y Métodos:** Se realizó un estudio descriptivo prospectivo observacional en pacientes con diagnóstico clínico de STC operados entre 2016 y 2022. El grado de satisfacción del paciente fue evaluado mediante un cuestionario sobre el dolor en diferentes momentos, ansiedad y experiencia con el procedimiento. También se analizaron los costos de la técnica anestésica. **Resultados:** Se evaluó a 92 pacientes. La mayoría se mostró satisfecha y el 94,5% confirmó que volvería a elegir este procedimiento, los niveles de dolor y ansiedad fueron bajos. Se registró un ahorro de costos del 60,6% por procedimiento. **Conclusiones:** La descompresión del síndrome del túnel carpiano con técnica WALANT generó un ahorro de costos considerable para el sistema de salud nacional, los resultados fueron buenos sobre la base de la satisfacción, la ansiedad y el dolor; y es un procedimiento seguro, cómodo y eficiente. Los beneficios y su rentabilidad al emplear menos recursos hospitalarios podrían ser optimizados y reproducidos para generar un ahorro considerable en gastos de salud.
Palabras clave: Mano; síndrome del túnel carpiano; anestesia local; epinefrina.
Nivel de Evidencia: IV

Received on October 28th, 2023. Accepted after evaluation on March 4th, 2024 • Dr. MARÍA SOLANGE FERRAGUTI • solangeferraguti@yahoo.com.ar https://orcid.org/0000-0002-3225-4561
How to cite this article: Ferraguti MS. Patient Experience Evaluation and Cost Savings Analysis of Carpal Tunnel Syndrome Decompression Surgery Using the WALANT Technique. *Rev Asoc Argent Ortop Traumatol* 2024;89(3):246-256. https://doi.org/10.15417/issn.1852-7434.2024.89.3.1840

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common compressive neuropathy in the upper limb and affects an estimated 3-5% of the population.[1] It is characterized by a set of symptoms consisting of pain, numbness and paresthesia in the sensitive territory of the median nerve caused by compression in its passage through the carpal tunnel.[2] It is usually treated with surgery, and is one of the most frequent interventions in hand surgery.[3] The surgical procedure is based on the decompression of the median nerve by resecting the transverse carpal ligament.[4]

In recent years, the use of local anesthesia with epinephrine without the use of a hemostatic tourniquet for outpatient surgery has become widespread in numerous surgical procedures of the hand and wrist. This technique, known as WALANT (*Wide Awake Local Anesthesia – No Tourniquet*), allows us to evaluate finger function and range of motion during the operation while keeping the patient awake and without the need for sedation or a hemostatic tourniquet, which can cause discomfort.[5] Patients who undergo hand surgery with the WALANT technique are as satisfied as those who have traditional surgery because it prevents nausea and vomiting, reduces urinary retention and dizziness caused by sedation, increases independence because no escort is required after surgery, and is more efficient because it requires fewer preoperative visits.[6]

The WALANT technique has been shown to result in significant savings in the hospital sector by eliminating expenses related to preoperative medical tests, perioperative nursing, anesthesiology, supplies, and medicines,[7,8] but no studies have evaluated this benefit in Argentina.

The main objective of this study was to evaluate the patient experience and cost savings in CTS decompression surgery using the WALANT technique in a national hospital center.

MATERIALS AND METHODS

An observational prospective descriptive study was conducted. The population consisted of 92 patients with a clinical diagnosis of CTS,[2] operated on by the author, together with an assistant, between February 2016 and July 2022. Surgery was indicated after failure of conservative treatment (anti-inflammatory agents, kinesiology plus nocturnal splints). The demographic characteristics recorded were: gender, age, dominant hand, affected hand, and work activity: active or retired (Table 1).

Table 1. Demographic characteristics of the sample (n = 92).

	Male	Female	n = 92
Sex, n (%)	24 (26.1%)	68 (73.9%)	
Age (mean)	69.12 (min. 38, max. 85)	62.14 (min. 20, max. 89)	63.96 (min. 20, max. 89)
Dominant hand			
Right	19	67	86
Left	3	3	6
Affected hand, n (%)			
Right	12 (50%)	41 (61%)	53 (34.3%)
Left	12 (50%)	27 (39%)	39 (57.6%)
Work activity, n (%)			
Active	12 (50%)	38 (56%)	50 (54.4)
Retired	12 (50%)	30 (44%)	42 (45.6)

Patients diagnosed with CTS based on clinical symptoms and verified with electromyography were included.[9] Patients aged <18 years or previously treated with CTS decompression, those with other neuropathy requiring surgery at the same time, Raynaud syndrome, pregnancy, history of severe procedure anxiety, inability to lie supine on a surgical table due to low back pain or obstructive sleep apnea, and history of adverse reactions to local anesthesia were excluded.

The requested preoperative studies were: a chest radiograph and an electrocardiogram (both with reports), and a complete blood count and coagulation test. No anesthetic evaluation was requested. The patient's usual medication, including anticoagulants, was not discontinued.[10] As per the institution's protocol, the patients fasted for 8 hours before the procedure.

Procedural protocol for hand surgery with the WALANT technique

The injection technique and dosage for the procedure were based on the descriptions of Lalonde and Wong:[5] 2% lidocaine with 20 mg/ml bottle epinephrine (formula available in Argentina: each 100 ml contains 2% lidocaine hydrochloride 2 g). All procedures were performed with aseptic technique without cardiopulmonary monitoring or venoclysis. Unlike the original technique described by Lalonde, sodium bicarbonate was not used as a buffer due to unavailability in the hospital.

When the patient is admitted to the operation room, they are positioned supine with their wrist supinating on a hand table.

The anesthetic technique begins with a 15/5 intradermal needle infiltrating the skin 1 cm proximal to the proximal wrist crease on the axis of the third commissure while avoiding superficial veins. 1 cc is infiltrated and the surgeon waits 30 seconds. The needle is replaced with a 50/8 intramuscular needle, which is inserted into the same hole and infiltrates the remaining anesthetic solution from the 20 ml syringe proximally, distally, medially, and laterally.

20 minutes are set aside to begin with the placement of the surgical fields, this adds between 5 and 10 min that favor the vasoconstrictive effect of epinephrine.[11]

Surgical technique

A 3 cm incision is made distal to the distal wrist crease on the axis of the third commissure. The distal edge of the transverse carpal ligament is identified. The entire ligament, including the distal antebrachial fascia, is sectioned along the ulnar edge of the palmaris longus tendon (Figure 1). The skin is washed with physiological solution and closed.

Figure 1. 69-year-old woman. Decompression of carpal tunnel syndrome in the left hand.

After the procedure, patients are given postoperative care instructions and information on signs of concern before being discharged without staying in the anesthesia recovery room. Nonsteroidal anti-inflammatory agents are prescribed for pain relief. In a 24-hour control, the dressings are changed, while the sutures are removed two weeks later.

Complications and adverse events related to the procedure

Postoperative complications that were characterized as general or directly attributed to the WALANT procedure were recorded, such as finger necrosis, infection, hematoma, neuropraxia. Additionally, any adverse events that occurred during the WALANT procedure that were unrelated to the underlying disease, such as vasovagal syncope or atypical pain, were recorded as well.

Patient experience

The patients' perspectives on their anesthetic experiences were documented in a questionnaire completed during the first postoperative consultation, 24 hours after the procedure. Patient acceptance of the WALANT procedure, pre- and post-operative pain and anxiety were assessed using the modified Davison questionnaire.[6] Pain and anxiety were determined with the visual analogue scale (VAS), where 0 indicates no pain or anxiety and 10, worst pain or worst anxiety (Table 1).

Cost Savings Analysis

Costs were based on the hospital's fee schedule: surgical procedure, code CP-121710 Median nerve decompression at the carpal tunnel level; procedure anesthesia, code HC-161004 Adult major anesthesia (the code does not distinguish general anesthesia or regional block) and anesthesia evaluation, code HC-165081 Anesthesia evaluation. These costs include direct costs, defined as those that directly affect actual surgery, such as used drugs, and disposable supplies; and indirect costs that are those linked to the procedure, and are included in the value of the surgery for the establishment, including transcription fees, sterilization costs, and salaries of medical and cleaning assistants. Values are expressed in dollars due to changes in the exchange rate of the local currency*.

Statistical methods

Student's t test for two-tailed unpaired data and Mann-Whitney U test for continuous variables were used to compare variables between groups. The repeated measures ANOVA test was used to compare means of three or more groups where participants are the same in each group. A p-value <0.05 was considered statistically significant.

RESULTS

92 patients were evaluated over seven years. The series consisted of 24 women and 68 men, with an average age of 63.96 years (min: 20, max. 89), with predominant age ranges between the sixth and seventh decades of life. In 86 patients, the dominant hand was the right, and in six, the left. However, the percentage of affected hands was similar, with a slight predominance of the left hand (57.6%) over the right hand (34.3%). 54.4% of patients were occupationally active and 45.6% were retired (Table 2). The results of the electromyography were: eight mild cases (8.7%), 60 moderate cases (65.2%) and 24 severe cases (26.1%).

There were no general or procedural complications. None had critical digital ischemia, nor was it necessary to discontinue the procedure due to pain or anxiety, nor to indicate hospitalization after the intervention. Three (3.26%) required prolonged observation (more than 15 min) for dizziness in the immediate postoperative period. Patients treated with anticoagulant agents did not have any postoperative complications.

Everyone completed the follow-up. Regarding the modified Davison questionnaire on patient experience, 94.5% (87 patients) stated that they would undergo the procedure again under WALANT anesthesia if it had to be operated on again. The rest reported that they would prefer sedation (5.4%).

*1 US dollar = 24.10 Argentine pesos. May 2018 - Based on the daily U.S. currency quote published by Banco Nación (www.bna.com.ar).

Table 2. Questionnaire: Patient experience

1. Pain during the procedure (VAS 0-10).
   a) needle insertion.
   b) infiltration of anesthetic fluid.
   c) during surgery.
2. How severe was your pain after surgery? (VAS 0-10)
3. Did you need to take medication for the first 12 hours after your surgery? Yes No
4. Did your medicine manage the pain? Yes No
5. Were you able to sleep well the first night after your surgery? (VAS 0-10)
6. How anxious (nervous) were you about your surgery? (VAS 0-10)
7. How anxious (nervous) did you feel after your surgery? (VAS 0-10)
8. If you had to have the same surgery again and were given a choice, would you rather be awake or sedated for surgery?

VAS = visual analog scale.

Pain intensity assessed by VAS was 4.38 ± 2.20 during needle insertion (Table 3) and 3.13 ± 1.77 at the time of fluid injection.

Table 3. Pain assessment.

	Mean	Standard deviation	Minimum	Maximum	95% confidence interval
Needle insertion	4.38	2.20	1	9	3.93- 4.84
Liquid injection	3.13	1.77	1	71	2.76- 3.50
Intraoperative pain	1.59	0.71	1	5	1.44- 1.73
Postoperative pain	2.77	1.84	0	8	2.39- 3.15

The score for pain during surgery was 1.59 ± 0.71. Pain measurement after surgery was 2.77 ± 1.84 ($p < 0.00001$) (Figure 2). 64.1% of patients (n = 59) needed analgesics after surgery and, in 97.8% of cases (n = 90), pain subsided with prescribed medication, except in two patients in whom it subsided after 24 hours. The VAS score for rest during the first night was favorable (2.45 ± 1.46).

Average values of anxiety were: 3.97 ± 1.79 before the procedure and 1.35 ± 0.89 ($p < 0.05$) after (Figure 3).

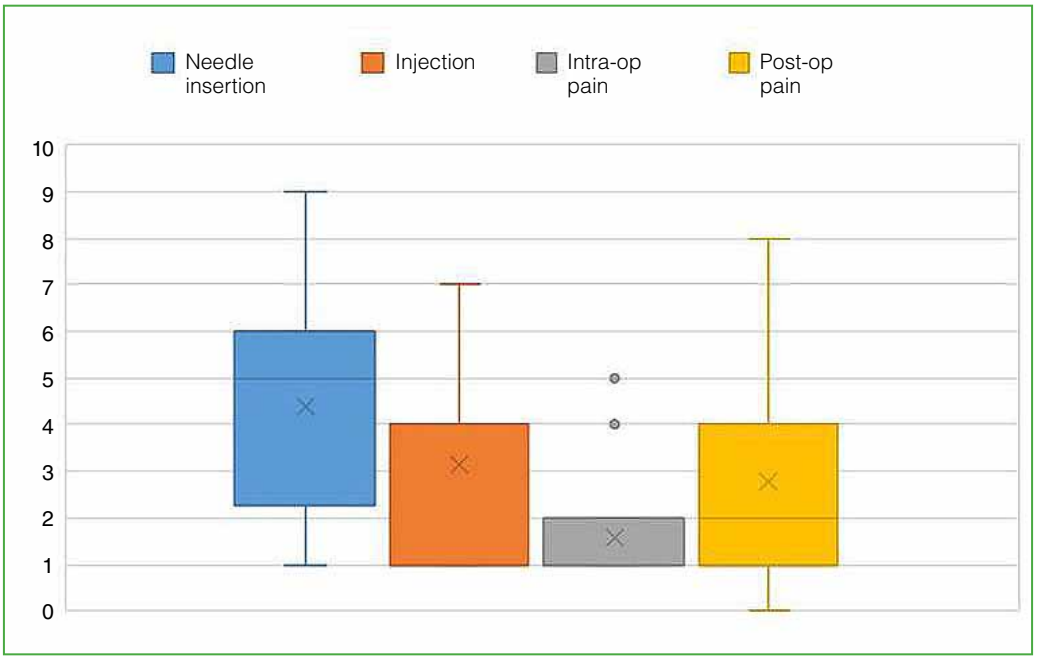

Figure 2. Pain assessment plot at different times of the procedure.

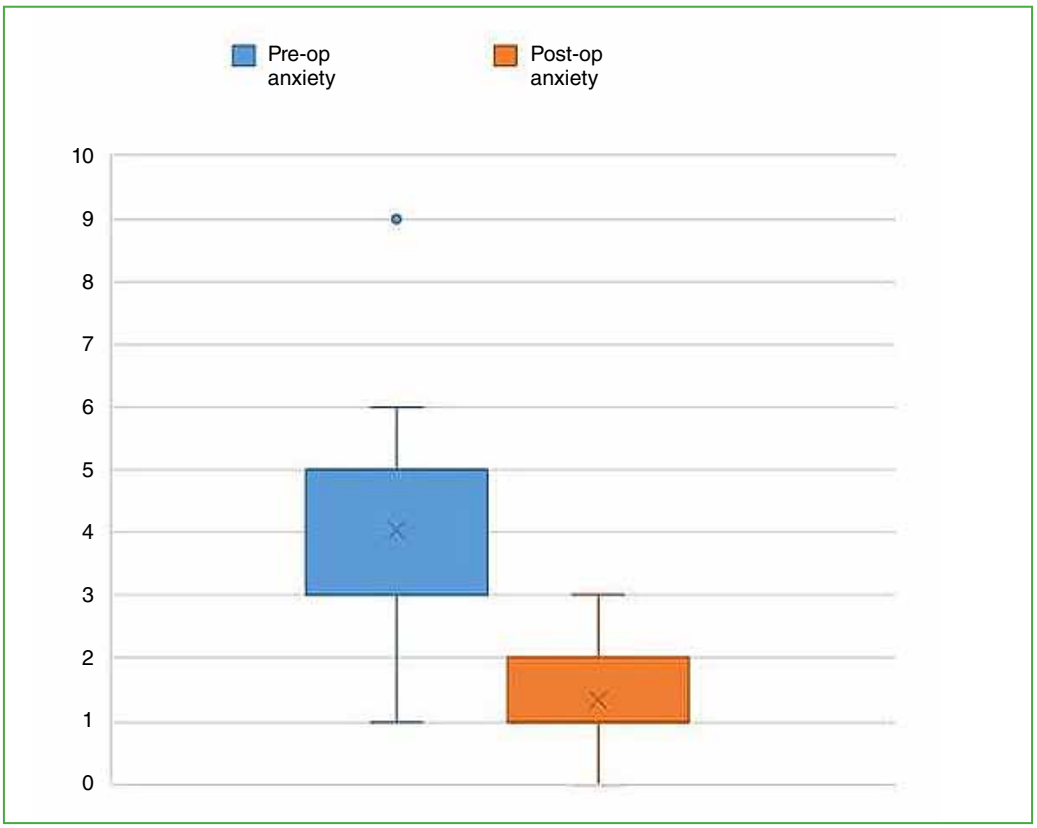

Figure 3. Anxiety assessment plot before and after the procedure.

The institutional cost of the CTS decompression procedure was compared with that of the use of general anesthesia or regional anesthetic block (Table 4).

Table 4. Cost-effectiveness of carpal tunnel syndrome decompression using the WALANT technique or general anesthesia or block.

	Cost of WALANT technique	Cost of anesthesia procedure	Comparative cost savings
Anesthetic evaluation	-	25.1	-25.1 (100%)
Procedure	98.34	224.39	-126.05 (56.2%)
(n = 1)	98.34	249.49	-151.15 (60.6%)
Carpal tunnel syndrome n = 92	9047.30	22953.84	-13906.54 (60.6%)

The total savings were 60.6%, taking into account the sum of the cost of the anesthetic evaluation and the procedure itself for one case and for the total of 92 cases analyzed (Figure 4).

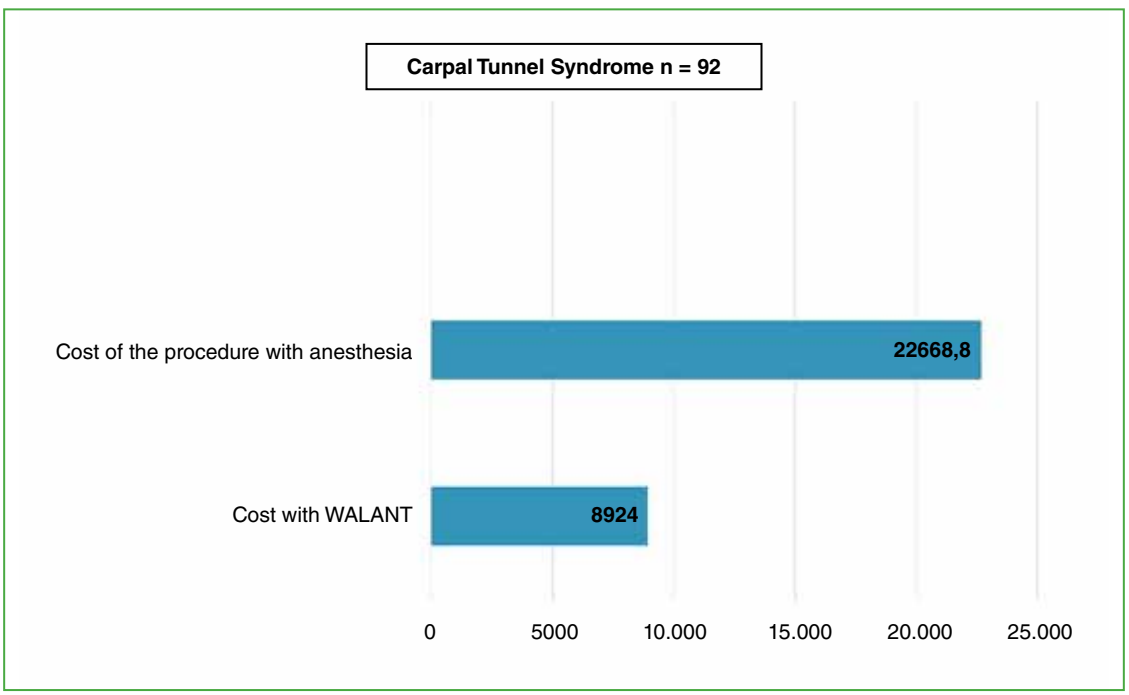

Figure 4. Cost graph for the WALANT technique compared to general anesthesia or block (n = 92).

The total cost savings for the institution during the evaluated period of the WALANT procedure versus the same procedure if performed under anesthesia were US$ 13,906.54 in total (Table 4). Table 5 provides a detailed comparison of the disposable supplies required for a regional block vs anesthesia with the WALANT technique, indicating that the latter uses fewer resources (Figure 5).

Table 5. Comparison of disposable supplies and commonly used drugs in a regional block vs. the WALANT technique.

		Anesthesia	WALANT
Disposable supplies	15/5 Intradermal needle	1	1
	50/8 Intramuscular needle	1	1
	22G 500 mm Anesthesia needle	1	
	Guedel cannula	1	
	Nasal cannula	1	
	Intravenous catheter	1	
	Gauze (package)	1	1
	Pair of gloves	1	1
	Macrodrip tubing	1	
	20 mL Syringe	2	1
	10 mL Syringe	3	
	5 mL Syringe	1	
	3-way key	1	
	Mandrel	1	
	Laryngeal mask	1	
	Extension line	1	
	Endotracheal tube	1	
Drugs	1 5 ml Atrobutin ampoule	1	
	1 10 ml Ethylephrine/Ephedrine ampoule	1	
	20 ml Lidocaine 2% with epinephrine	1	1
	20 ml Lidocaine 2% without epinephrine	1	
	1 5 ml Midazolam ampoule	1	
	10 ml Ropivacaine 7.5 mg/ml	1	
	500 cc Saline	1	

DISCUSSION

In recent years, interest in hand and wrist surgeries using the WALANT technique has increased because it has been shown to be safe and cost-effective.[12] The use of epinephrine anesthetic agents has long been discouraged because of the presumed risk of acute ischemia in the fingers, although their safety has been demonstrated in several articles, such as Lalonde et al., in 2005, with a series of more than 3000 patients,[13] or the literature review by Thomson et al.[14] on cases attributed to digital epinephrine necrosis. Before 1948, , when this myth originated, the only local anesthetic accessible was procaine; at the time, expiration dates did not exist, therefore, its acid pH level could reach even 1, making it extremely unsafe; that is, the cause of the necrosis was procaine, but epinephrine was blamed.[15] It should be highlighted that, while four cases of digital necrosis have recently been reported after injecting lidocaine with epinephrine,[16] all of them were caused by infiltrating directly into the flexor sheath, which was discouraged in the original technique.[5] In this study, no patient developed critical ischemia.

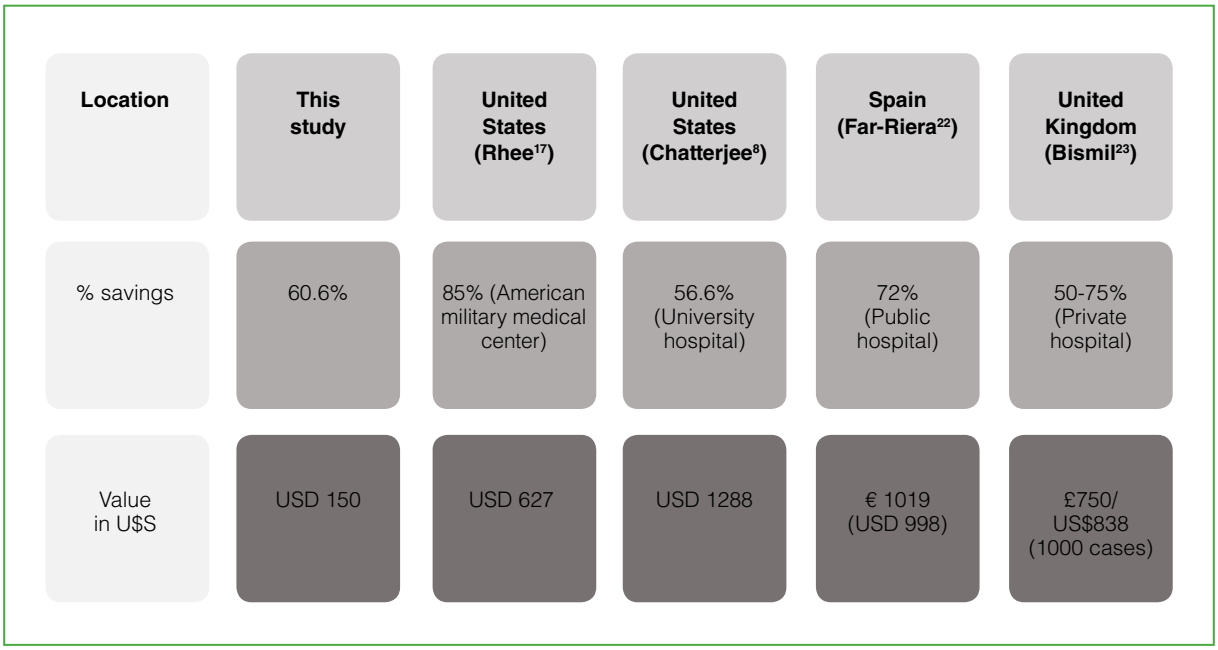

Figure 5. Disposable supplies and drugs used for WALANT vs. disposable supplies, laryngoscope and drugs used for regional block.

In terms of patient experience, the procedure's acceptance rate was high (94.5%), similar to that obtained by Rhee et al.,[17] who, in evaluating the preference over intravenous anesthetist-assisted sedation, found that patients would prefer the WALANT technique if they had surgery again, due to the shorter time involved thanks to the elimination of standardized preoperative medical consultations, not having to change medication or dietary routines, and the absence of the postoperative nausea commonly associated with sedation. Furthermore, Gallucci et al.[18] found that when they compared this anesthetic technique with a control group that used a hemostatic tourniquet, the outcomes were similar in terms of patient satisfaction.

Different elements have been described as possible causes of preoperative pain: introduction of the hypodermic needle through the skin, increased tension of tissues in the palm as a result of volume infiltration, and pain associated with the temperature or acidity of the anesthetic.[19] However, pain during and after surgery has been reported to be equivalent to that of sedation procedures. Davison et al.[6] reported that 64% of patients rated perioperative pain as less than a routine dental procedure, and stressed that pain attributed to the WALANT procedure may be influenced by local anesthetic injection technique and nerve block quality. Another factor that can influence pain assessment, as described by Braithwaite et al.,[20] is intraoperative pain, which can become up to twice as severe with the use of the hemostatic tourniquet compared to only local infiltration plus epinephrine. Because it normally causes discomfort after a certain time, not using the tourniquet favors lower pain scores and improves the patient's intraoperative well-being.

Patients and surgeons may have reservations about WALANT procedures because of the possibility of considerable perioperative anxiety, as patients are fully awake without sedation. In the study group, the scores on this item in the VAS were relatively low, this could even correspond to the fact that they had already been given enough information about the characteristics of the procedure. These values are similar to those of the study by Davison et al.[6] who reported significantly lower preoperative anxiety for the WALANT technique (2.3 ± 2.7) than for sedation (3.4 ± 2.8; p = 0.007). Satisfaction levels in his group also reached 93%.

Teo et al.[21] reported that 86% of patients who underwent the WALANT technique for different hand surgical procedures would choose the same anesthetic technique again, as well as to be able to remain awake during surgery. 91% of respondents felt that the pain suffered during surgery was comparable to that of a dental procedure and that anxiety levels were generally low.

The general data gathered in this study demonstrate that the costs of the WALANT technique allow for an average saving of 60.6% when compared to the institution's value for general anesthesia or regional anesthetic block. Figure 5 shows a cost comparison of other authors in various countries.

The main limitation of this study is not comparing the study group with a control group including patients who underwent anesthetist-assisted sedation or wore hemostatic tourniquets. Although this was one of the initial objectives, the study's extension over time resulted in many of the institution's hand surgeons gradually transitioning to less invasive and more efficient anesthesia, leading to almost no use of sedation for this procedure in the last three years. Furthermore, the discontinuation of surgeries due to the health emergency* during the COVID-19 pandemic in 2020 and part of 2021 resulted in a much lower number of both groups in comparison to the control group, leading to an important statistical bias between the groups. Therefore, estimates of this type are qualitative and based on studies published under conventional anesthesia.

Another limitation was the inability to account for a breakdown of the cost of medical supplies used and the cost of post-operative analgesia, which would have yielded more precise results. However, the savings evidenced by the WALANT technique represent a positive impact on the health system economy and patient satisfaction.

CONCLUSIONS

CTS decompression with the WALANT technique results in considerable cost savings for the national health system, is well tolerated by the vast majority of patients, and good outcomes are achieved in terms of satisfaction, perioperative anxiety, and pain. The benefits and cost-effectiveness of using fewer hospital resources with a safe, comfortable and efficient technique could be optimized and replicated in the healthcare units of the national health system to generate extremely significant savings in health costs.

Conflict of interest: The author declares no conflicts of interest.

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