Original Research

Impact of WALANT Hand Surgery in a Secondary Care Hospital in Spain. Benefits to the Patient and the Health System

A.M. Far-Riera, MD, [*] C. Perez-Uribarri, MD, [*] M.J. Esteras Serrano, MD, [*]
J.M. Rapariz González, PhD, MD [*]

[*] Orthopedic and Trauma Department, Hand and Upper Extremity Surgery, Son Llàtzer University. Palma de Mallorca, Spain

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Purpose: The aim of this study is to compare patient benefits and economic costs of hand surgeries using the wide-awake local anesthesia no tourniquet (WALANT) technique versus a conventional major outpatient suite and review outcomes and complications in a series of cases of patients operated on using the WALANT technique.

Methods: A prospective cohort study was first conducted comparing 150 cases of ambulatory hand surgery (carpal tunnel syndrome and trigger finger) using the WALANT technique and not requiring an operating room setting with 150 cases of outpatient surgery performed in an operating room involving a preoperative evaluation and the use of sedation and tourniquet. Preoperative, intraoperative, and postoperative pain was monitored, and days requiring postoperative analgesia were recorded. The resources and costs were evaluated. and patient satisfaction was assessed using a specific survey.
Subsequently, 580 patient medical records were retrospectively reviewed, including 419 carpal tunnel syndrome and 197 trigger finger interventions (616 WALANT surgeries).

Results: Intraoperative pain was equivalent for both groups, and postoperative pain was significantly lower in the WALANT group, with a reduced need for analgesics. Satisfaction was greater for the local anesthesia group. The use of personnel resources and hospital materials was reduced in the WALANT group, with a total estimated cost savings of 1.019 USD per patient.
There were no complications related to the WALANT technique and the lidocaine and adrenaline combination. We found a complication rate of 5.58%, and, in line with the literature, most complications were minor, managed conservatively, and not related to the anesthetic technique.

Conclusions: Procedures such as carpal tunnel and trigger finger surgeries can be safely performed using wide-awake surgery. Patient satisfaction is higher than with the conventional procedure performed in the operating room. Pain control is excellent, especially during the postoperative period.

Clinical relevance: Hand surgery patients benefit from the WALANT technique in terms of comfort and timeliness because there is no need for preoperative tests or evaluations. In addition, it represents significant savings in hospital resources. In our case series, complications were in line with those previously reported with other anesthetic techniques.

With the development of minimally invasive techniques and the need to improve hospital efficiency and reduce costs, an increasing number of orthopedic surgeries are being performed on an outpatient basis (major outpatient surgery, [MOS]), thus avoiding hospital stays.[1-8] The wide-awake local anesthesia no tourniquet (WALANT) technique allows for a fully ambulatory setting outside the MOS process of care. In Canada, more than 80% of carpal tunnel surgeries are performed outside the operating room using this method.[9-11]

The basis of the WALANT anesthetic technique is that it only requires the administration of lidocaine and adrenaline, thereby avoiding the use of a tourniquet and the need for sedation and decreasing patient nausea and vomiting after surgery.[11-16] The

combination of lidocaine with adrenaline provided better post-operative pain control. It is also a safer anesthetic technique than general anesthesia for patients with comorbidities, such as renal failure, morbid obesity, and lung diseases.[17-19] Furthermore, anti-coagulant therapy does not need to be discontinued. The WALANT technique can be used either to perform simple or complex surgeries using the appropriate volume and dilution in each case.[20] Studies on the economic impact in health care systems consistently demonstrate an economic benefit derived from the reduced use of hospital resources.[21]

WALANT is not widely used in Spain. It is only performed in some hospitals for certain surgical procedures. We have only found one recent article in the Spanish literature dealing with the repair of flexor tendons in zone II of the hand.[22]

Until 2014, all hand surgeries in our department were performed in the operating room with regional anesthesia (brachial plexus), sedation, and tourniquet following preoperative assessment.

A prospective study was designed to evaluate the implementation of the fully ambulatory WALANT process of care for the surgical treatment of 2 common conditions: carpal tunnel syndrome (CTS) and trigger finger (TF).[23-26]

Our study hypothesis was that using local anesthesia only, no tourniquet, and no sedation in a fully ambulatory setting was safer and more resource-efficient than using regional anesthesia in a conventional operating room. Both CTS and TF require simple procedures with low complication rates, although few studies report surgical complications for these conditions and even fewer surgeries performed with WALANT. This prompted us to conduct a second study where we retrospectively reviewed the results and complications in a series of patients operated on using the WALANT technique in our department.

Together, both studies provide an overview of the transforming capacity of the implementation of WALANT surgery for 2 of the most common hand surgeries in a secondary care public university hospital, providing information on the impact on management and costs for the health care system and describing a new clinical approach with its expected patient benefits and complications.

Materials and Methods

Prospective study

Study design

In 2014, following approval by the hospital's ethics committee, a prospective study was conducted to compare the results of CTS and TF surgical procedures performed with 2 different anesthetic techniques. One group of patients underwent an office-based surgery using the WALANT technique, while the other group was operated on under regional anesthesia in a conventional operating room.

Three hundred patients diagnosed with CTS and TF were operated on consecutively by similarly experienced hand surgeons from June 2014 to December 2016 (240 CTSs and 60 TFs). Of the patients, 207 (69%) were women, and 93 (31%) were men. The mean age was 62 years (range 26–93 years). The choice between WALANT and the conventional process of care (regional anesthesia and tourniquet) was based on surgeon preference. Two surgeons performed surgeries under regional anesthesia and tourniquet, and another 2 under WALANT, so the type of intervention the patients underwent depended on the surgeon. Two groups of 150 patients with similar baseline characteristics were enrolled. A specific, informed consent was signed by participants. Surgeries were indicated after the failure of conservative treatment. Inclusion criteria were clinical findings of TF and/or CTS. All CTS cases showed moderate or severe

damage in electromyography studies. Only patients who refused to participate in the study were excluded. No patients were excluded because of previous surgeries, associated comorbidities, or treatment with anticoagulants or antiplatelets that were not discontinued.[18]

Surgical technique

The surgical technique was identical in both groups and performed using the usual technique described for both CTS and TF.

The postoperative analgesic regimen was identical in both groups, using only non-steroid drugs (the first analgesic step on the WHO scale), and the duration was based on patients' needs.

Postoperative monitoring and outcome assessment

The postoperative follow-up for both groups was performed in outpatient clinics 24 hours after the intervention to assess wound status and at one month to evaluate outcomes using a specific questionnaire (Appendix 1, available on the *Journal's* website at www.jhsgo.org). The form was completed by the patient, and the tolerability of the anesthetic techniques was assessed based on patient-related experiences.

Pain

We assessed pre-, intra-, and postoperative pain. Preoperative pain was defined as pain related to puncture for the axillary plexus block and the peripheral venous cannulation in the operating room group and pain related to local anesthetic administration in the WALANT group. Intraoperative pain was defined as pain perceived by the patient during the surgery in both groups and pain related to the tourniquet in the regional anesthesia group. The pain was assessed using a visual analog scale (VAS). Postoperative pain was defined as the need for postoperative analgesia (days). The analgesia prescribed was that of the first WHO ladder (non-opioid analgesics, such as nonsteroidal anti-inflammatory drugs (NSAIDs)). The time required for treatment was recorded by means of the questionnaire that patients completed one month after surgery.

Anxiety

The patient's level of anxiety during the 3 phases of the procedure was subjectively assessed using a VAS ranging from 0 (no anxiety) to 10 (extreme anxiety).

Wound management

Complications were assessed 1 day and 1 month after surgery and included the presence of a hematoma, infection, suture dehiscence, or skin necrosis.[26]

Patient satisfaction

Patient satisfaction for the whole process (preoperative testing, waiting time until surgery, length of hospital stay, pain, and postoperative period) was rated using a non-validated VAS ranging from 0 (lowest satisfaction) to 10 (greatest satisfaction). This form was completed by the patient during the one-month visit. We also assessed the level of adherence to the treatment. Patients were asked which option they would choose if they were operated on again: 1) awake, with local anesthesia, 2) sedation and local anesthesia, or 3) general anesthesia.

Costs and resource consumption

Information on the use of hospital resources (operating rooms used/released, personnel required) was collected. Costs were calculated based on the most recent price list published in the Balearic Islands Official Bulletin.

Table 1
Table of Results

WALANT Group		Regional Anesthesia Group	
Pain (0–10)			
Preop	3.19	Preop	3.13
Intraop	0.15	Intraop	0.29
Postop	2.75	Postop	3.99
Anxiety (0–10)			
Preop	3.34	Preop	3.20
Intraop	1.23	Intraop	0.13
Postop	0.28	Postop	0.01
Analgesic treatment in the postoperative period (d)	4.09		15.88
Length of stay in hospital (hr)	1.53		6.14
Overall satisfaction (0–10)	9.31		8.35

Statistics

The statistical power of 80% was calculated to obtain a significant sample, which in this case, was 150. Variable distribution was assessed with histograms and other normality tests. Quantitative variables were expressed as medians (P25–P75), and qualitative variables as frequencies (percentages). The statistical tests used to compare variables between groups were the Mann-Whitney U test for continuous variables and the chi-square test for categorical variables. A level of $P < .05$ was considered statistically significant. The results were analyzed using the IBM SPSS Statistics package V23.

Retrospective study

Study design

A retrospective study focusing on complications from the use of WALANT was performed after the prospective study. Five hundred and eighty patients were operated on in our hospital between 2014 and 2020. A total of 616 WALANT surgeries (419 carpal tunnel release and 197 TF) were collected and reviewed. Complications were defined as cases with persistent symptoms, wound complications, and any other injury that required treatment or did not resolve within 3 months after the operation.[27] Of the patients, 379 (65%) were women, and 178 (31%) were men, and the mean age was 59 years (range 23–94 years). The mean follow-up time was 12 months (2–21 months). All patients operated on in our center using the WALANT technique were included. Patients with previous surgeries, comorbidities, or anticoagulant therapy were not excluded. Patient records were reviewed, and patients were contacted to record complications following surgery.

Results

Prospective study

In the first study, postoperative follow-up of both groups was performed in outpatient clinics on the first day after surgery to assess wound condition. A second visit was performed one month after the operation to evaluate clinical outcomes with a specific questionnaire. The pain level for both groups was assessed using a VAS.

There was no loss to follow-up in either group. All patients in both groups attended the visits and completed the questionnaire (Table 1).

Pain

No statistically significant differences were found between the 2 groups in terms of postoperative pain.[27] Patients who underwent surgery in the operating room had a VAS score of 3 (0–5), and those

who underwent WALANT surgery also had a VAS of 3 (1–5) ($P = .72$).[28] No differences were found intraoperatively either as pain with local anesthesia interventions was similar to that with sedation and ischemia cuff in the operating room; both had a score close to 0 (0.15 vs 0.29; $P = .60$; Fig. 1).

Analgesic treatment in the postoperative period (days)

However, statistically significant differences were found in the duration of analgesic treatment during the postoperative period, with 2 days (0–3) for WALANT surgeries versus 5 days (3–7) for operating room surgeries ($P < .001$). (Fig. 2).

Anxiety

Although there were no statistically significant differences in intraoperative anxiety, the anxiety level experienced by the patients operated on in the operating room under sedation was lower (3.34 vs 3.20; $P = .80$). After surgery, none of the patients who underwent WALANT surgery experienced nausea or vomiting, whereas 3.3% of the patients who underwent surgery in the operating room experienced nausea or vomiting.

Wound management

The 1/100,000 dilution of lidocaine and adrenaline proved safe in our series. There were no skin necrosis or increased surgical wound problems and only one case of superficial infection that resolved without further complications.

Patients under anticoagulant therapy did not experience any postoperative complications in either group.

Patient satisfaction

Patient satisfaction for both procedures[27] was very high: 9.31 for WALANT and 8.35 for operating room interventions, although it was statistically significant in favor of WALANT ($P = .13$).

Treatment compliance was higher for the WALANT group, and 95% of patients would choose it again.

Up to 24% of patients who underwent surgery in the operating room would choose a simpler, more ambulatory process of care, such as the WALANT technique.

Length of hospital stay

The length of hospital stay, defined as the time from hospital admission to patient discharge, was significantly shorter (1 h; range 1–2 h) in the WALANT group compared with the conventional operating room group (6 h; range 4–7 h).

Cost and resource consumption

Patients who underwent the WALANT anesthesia technique did not require a preoperative visit with the anesthesiologist and, therefore, did not need to have the electrocardiogram, chest X-ray,
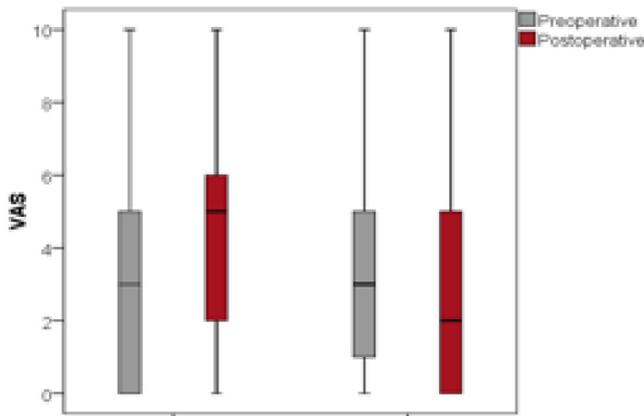
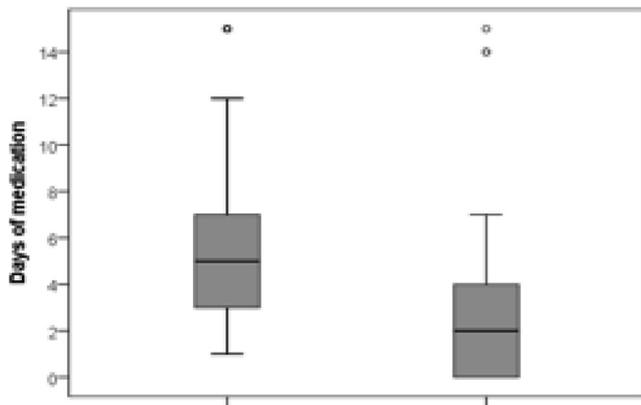**Figure 1.** Pain (VAS scale) preoperatively and after surgery.

Figure 2. Postoperative oral analgesia requirements (days).

Table 2
Results

580 Patients	No of Surgeries	% of Complications
CTS	419	10.16
Trigger finger	197	5.58
Total	616	**9.74**

Table 3
Complications Following Carpal Tunnel Release

Complications following Carpal Tunnel release	48	10.16%
Scar pain	23	5.47
Superficial infection	1	0.23
Sympathetic reflex dystrophy	2	0.47
Incomplete release	4	0.94
Recurrence	2	0.47
Nerve compression at the elbow	9	2.11
Persistent symptomatology	7	1.61

persisted in 7 cases, some of which may have been related to cervical problems, while in the others, the cause remained unknown. Systemic diseases or neurological conditions may mimic the symptoms of CTS and lead to unnecessary surgery.

No lesions of the thenar branch, digital nerves, median nerve, or ulnar nerve were documented. Tendon, ulnar vessels, or superficial palmar arcade injuries were also not found.

Six patients had to undergo reoperation, and 9 required median nerve release at the elbow.

The most common complication was the persistence or recurrence of TF with 3 cases (1.5%), followed by pain in the scar area and loss of flexion and extension (1%). It should be noted that there was one case of deep infection (0.5%) which resolved without complications (Table 4).

Discussion

The combination of lidocaine with adrenaline and its use in the most common surgical procedures in hand surgery has gained popularity in recent years since its widespread use for flexor repair, and its use is expanding to an increasing number of more and more complex surgeries.[9,10,29-31] Its safety has been demonstrated in several studies.[14] The cases of skin necrosis published before 1950 were related to the acidity of procaine.[15] This does not occur with lidocaine, which has been proven safe and is used daily by dentists all over the world. At doses recommended for hand surgery, no general anesthetic effects have been reported. However, dilution is recommended for more complex surgical procedures requiring a larger anesthetic area.[16] As for adrenaline, there are no known effects of maintained ischemia, even with the accidental administration of doses a hundred times higher than those used in wide-awake surgery.[32] If it does occur, its effects can be reversed by phentolamine.

Prospective study

In our prospective study, we were able to observe the benefits of the WALANT technique to the patient and the health system.

Benefits to the patient

By avoiding preoperative testing and the need for venous access for sedation, patients only receive a single puncture for anesthesia on the day of surgery. Following the technique proposed by Lalonde et al,[16] with the use of small-gauge needles, patients'

or preoperative blood tests that are performed in our hospital for all patients who are going to be operated on in an operating room, regardless of their disease and comorbidities. This saved a cost of 17.78 USD per patient. Additionally, they did not use the MOS suite (347.45 USD). The cost of surgeries conducted as outpatient procedures was lower and resulted mainly from resource consumption, reaching a cost of 413.96 USD each. Each intervention performed in a conventional operating room staffed with an anesthesiologist, nurses, assistants, and surgeons, had a cost of 1487.32 USD, including the length of stay in the MOS suite.

Retrospective study

There were no complications related to the WALANT technique and the lidocaine and adrenaline combination. Forty-nine complications (10.16%) occurred in CTS (Table 2). The most common complication was residual pain around the wound, with a total of 23 cases (5.47%). This included transitory palmar cutaneous branch neurapraxia and persistent pain at the level of the thenar eminence or hypothenar eminence (pillar pain). One case of superficial infection (0.2%) was resolved with antibiotics, and no deep infections were reported for the CTS surgical procedures (Table 3).

Two patients (0.47%) developed complex regional dystrophy that required hand therapy.

Incomplete releases were obtained in 4 patients (0.94%) and 2 recurrences (0.47%) were found. Nine patients did not improve because of median nerve compression at the elbow. Symptoms

Table 4
Complications Following TF Surgery

Complications following TF surgery	11	5.58%
Scar pain	2	1
Loss of extension	2	1
Loss of bending	2	1
Persistent or recurrent trigger	3	1.5
Misdiagnosis	1	0.5
Deep infection	1	0.5

subjective pain during anesthetic infiltration is minimal.[33-35] In our study, the pain related to the local anesthetic injection was similar to that perceived by patients receiving sedation and regional anesthesia, as previously described by authors such as Ralte et al[36] and Tomaino et al[37] In the latter study, no statistically significant differences in preoperative anxiety levels were observed. In our study, we found lower levels of anxiety with the axillary block technique due to sedation, but these findings were not statistically significant.

The use of adrenaline in combination with lidocaine avoids using a tourniquet, making the surgery more comfortable for the patient.[38] In contrast to our study, previous papers comparing regional versus local anesthetic techniques always include the use of a tourniquet.[36-37] Cuff-related pain has been studied, and according to Bidwai et al,[13] it averages 4.1 on the VAS scale. In our study, the WALANT intraoperative pain VAS score was 1, with no significant differences compared with surgery under regional anesthesia and sedation. In a previous study by Maury et al, the mean time for tourniquet tolerance was 18 minutes.[39] This tourniquet time is not exceeded in most surgeries. However, complications requiring an extension of this time can occur, or further procedures may need to be performed (occasionally, in TF surgery, more than one finger may be operated on in the same surgical procedure). Moreover, starting the surgery with adrenaline does not preclude the placement of a cuff if necessary (eg, due to uncontrollable bleeding, the need to perform an additional procedure, or others). Finally, the use of adrenaline allows surgeries to be performed in patients in whom the use of a tourniquet would be contraindicated.

We found significant differences in postoperative pain and the need for analgesics. The prolongation of the anesthetic effect may be partially explained by the addition of adrenaline. However, we believe that other factors may coexist, such as the perception of a "minor" surgery by patients undergoing an office-based surgery, a fact that may have an influence on patients' postoperative analgesic intake, which in our study, did not exceed 48 hours.[16,18,40] These differences were also observed in a study by Ralte et al. However, although the authors of that study compared the same anesthetic techniques, they kept the ischemia cuff in place during surgeries with local anesthesia.[41]

Patient satisfaction after WALANT surgery was very high, as already demonstrated by other authors.[42] In addition to showing high treatment compliance, up to 95% of patients would choose outpatient surgery with local anesthesia and vasoconstriction again, and 24% of patients in the operating room group would prefer a simpler, short-stay procedure. Furthermore, as no sedatives are used, no fasting or withdrawal of medication is necessary, and patients can come to the hospital alone and avoid medication side effects such as nausea and vomiting. In addition, because of the brief duration of the procedure, surgery waiting times are shortened, and hospital stay is reduced to a minimum.

WALANT and anticoagulants

The use of anticoagulants is not contraindicated for WALANT surgery. There is literature supporting the nonwithdrawal of

anticoagulants before hand surgery, thus avoiding complications derived from their suspension.[17] In the case of warfarin, there would be no contraindication below an international normalized ratio (INR) of 2.5 or even 3.[18,19] In our series, we operated on 4 patients without interrupting their treatment with acenocumarol, and none experienced any complications or wound bleeding.

Benefits to the health system

The economic benefit of implementing a wide-awake surgery process of care outside the operating room has already been demonstrated by several authors.[36,43,44] In our case, the cost savings amounted to approximately 1053.34 USD per patient. In the case of the United States health system, savings of around 6275 USD per patient were calculated, and in the United Kingdom (NHS), these were around 941.83 USD per patient.[43,44] Considering that CTS and TF are 2 highly prevalent conditions that account for the fourth most common surgical procedures performed in Spanish hospitals,[24-26] cost savings can be very important. Other authors have extended the indications to many more pathologies, multiplying these benefits exponentially. However, the savings could be lower if the switch to WALANT surgery is made from ambulatory interventions performed using local anesthesia with a tourniquet; in this case, the most important improvement would be patient comfort.[12] In our center, a complete preoperative work-up is performed on all patients who are going to undergo surgery in the ambulatory surgery setting. This includes a chest X-ray, an electrocardiogram, blood tests with coagulation profiles, and a preoperative anesthetist visit. The implementation of a WALANT process of care for these conditions in other centers may result in different savings depending on the type and number of preoperative tests and visits.

The less time-consuming WALANT procedure allowed for a higher throughput of patients (8 patients per day) in our study compared with the throughput obtained with the standard procedure performed in the operating room (5–6 patients). In addition, performing these surgeries outside the usual surgical suite leaves operating rooms available for other, more complex procedures. Performing these 150 surgeries in the outpatient area left 30 general operating rooms available for other pathologies. The combination of these 2 factors allowed us to reduce the waiting list for WALANT surgeries and the overall waiting list. For CTS, the waiting time was reduced by half. In a study by Leblanc et al, it was shown that the use of a specific facility outside of the surgical suite is safe for outpatients.[45]

Retrospective study

We analyzed the outcomes and complications of the surgeries performed in our hospital using the WALANT technique in the retrospective study.

Very few studies have documented complications after WALANT TF release. Reynolds et al[29] published a study in 2020 in which they assessed 314 surgical releases of the A1 pulley with WALANT, among other interventions, and observed 8 complications (2.5%).

Other studies have described complications after A1 pulley release with other anesthetic techniques or without differentiating between them (Table 5).[46-49] Complication rates vary widely from 1% to 43%. However, this could be due to the different definitions of complications used in each study, as well as the different sample sizes and follow-up times.

We found a complication rate of 5.58%, and, in line with the literature, most complications were minor and managed conservatively.

The use of sedation, in contrast to the use of local anesthesia, has been identified as a risk factor for developing complications, most

Table 5
Revision of Complications of TF Surgery

Author of the Article	% of Complications
Thorpe et al[46]	43
Will and Lubahn[47]	31
Lim et al[48]	1.4
Bruijnzeel[49]	5.3

Table 6
Revision of Complications of Carpal Tunnel Release

Author of the Technical Article WALANT	N	% of Complications
Chang et al[51]	60	0
Reynolds et al[29]	10	0
Castro et al[52]	10	0

likely because patients are not able to perform active flexions intraoperatively to check for the complete release.[50]

Releases performed with the standard anesthetic technique show complications in 1-25% of cases with reoperation rates of up to 12% (Table 6).[50-52,53-56] Our study found a complication rate of 10.16 %, with a reoperation rate of 1.5 %. These differences may result from the small sample sizes used in the WALANT studies.

As already mentioned, there was no case of digital necrosis in our study. Several studies have demonstrated that the use of WALANT in hand surgery is safe and achieves adequate hemostasis.[12,32,57,58]

Limitations of the study

The study has several limitations. First, the surgeries were performed by different surgeons, although they all had a similar degree of experience. Second, the first study was a nonrandomized prospective cohort study as the choice of the anesthetic technique used was determined by the surgeon; however, as the second study had a retrospective design, all the complications may not have been documented in the medical records. Third, the questionnaire used for patient assessment had not been validated. Finally, cost savings calculations were based on the resources used in our hospital; therefore, overall percentage savings cannot be generalized to all centers.

Conclusions

CTS and TF surgeries can be performed safely and without pain using the technique of infiltration of 1% lidocaine and 1/100,000 adrenaline. Compared with the conventional surgical process of care based on the use of a cuff, regional anesthesia, and sedation, WALANT surgery provides similar pre and intraoperative pain control and better postoperative pain management. As no sedation is required, patients do not need to fast and can come to the hospital unaccompanied. High user satisfaction and lower use of resources are achieved, leading to savings and reductions in waiting time.

CTS and TF surgeries using the WALANT technique have been shown to be safe, and, in our case, complications were in line with previous reports for other anesthetic techniques.

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