WIDE AWAKE LOCAL ANESTHESIA NO TOURNIQUET AND LOCAL ANESTHIESIA WITH TOURNIQUET IN SURGICAL CARPAL TUNNEL RELEASE IN THE PHILIPPINE ORTHOPEDIC CENTER: A DOUBLE BLINDED CONTROL TRIAL

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ABSTRACT

BACKGROUND

Wide Awake Local Anesthesia No Tourniquet (WALANT) is an anesthetic technique which uses a prepared mixture of epinephrine and lidocaine for both anesthesia and hemostasis.

OBJECTIVES

This study aims to determine if there is a significant difference between WALANT and Local Anesthesia With Tourniquet (LAWT) for patients undergoing carpal tunnel release in terms of operative time, intraoperative blood loss, and intra and post- operative pain.

METHODOLOGY

Patients (n=47) indicated for open carpal tunnel release were randomly assigned to receive two different anesthetic techniques, particularly WALANT and LAWT. Operative time, intraoperative blood loss, Intra-, and post- operative pain data were recorded, and analyzed accordingly.

RESULTS

Mean age of all participants was 40.87 years old. In general, results illustrated that the mean operative time was 13.66 minutes (SD=3.25), the mean blood loss was 2.96 grams (SD=1.70), the mean intra-operative pain score was 3 (IQR=2.50), and the median post-operative pain score was 2 (IQR=1.50). Analyses of these outcome showed that the mean operative time (14.33±3.29 vs. 13.01±3.13, p=0.157) and mean blood loss (3.28±1.92 vs. 2.65±1.41, p=0.394) were slightly higher in Group 1 (WALANT) than in Group 2 (LAWT); These findings were found to be statistically not significant.

CONCLUSION

Over-all, there was no significant difference between LAWT (Local Anesthesia with Tourniquet) and WALANT (Wide Awake Local Anesthesia No Tourniquet) techniques when it comes to operative time, intraoperative blood loss and intra- and post- operative pain scores.

KEYWORDS

WALANT, LAWT, Carpal Tunnel, Hand Surgery

INTRODUCTION

Wide Awake Local Anesthesia No Tourniquet (WALANT) is a known anesthesia technique using a prepared mixture of epinephrine and lidocaine for both anesthesia and hemostasis. It has found convenient use in different hand surgeries such as carpal tunnel release, trigger finger release, primary tendon repair, tenolysis, and hand tendon transfers. It is beginning to be advocated by more hand surgeons due to the benefits of less preoperative preparation, less intraoperative discomfort, complications, and an overall decrease in overall time and financial expenditures since it may be done within a clinical setting.

RATIONALE

We are on the way to fully adopting WALANT for hand surgery at our institution. Within a year, an average of seventy-five (75) carpal tunnel releases are done at our outpatient operating room. Currently, carpal tunnel, trigger finger, and De Quervain's releases are sometimes still done with local anesthesia and a forearm tourniquet (which will be referred to as Local Anesthesia with Tourniquet, or LAWT), with the latter causing discomfort for most patients during application and use of the tourniquet. Options to relieve such discomfort are usually through additional anesthesia, or sedation, which is not always allowable for certain patients. This would then turn an otherwise simple outpatient procedure into a difficult one full of risks and possible complications.

Podium Presentation
POC Inter –Departmental Research Contest,
Philippine Orthopedic Center, December 14, 2023

1st place, Podium Presentation
1st place, Poster Presentation
28th Resident's Research Forum
Philippine Orthopedic Center, February 10, 2023

Completed and Presented as Requirement for Research, February 2023

A case series has been conducted in our institution presenting the immediate clinical outcomes of patients who underwent carpal tunnel with concomitant trigger finger and De Quervain disease releases under the WALANT technique. This study aims to expand on that study by comparing WALANT to the currently accepted method of local anesthesia with a tourniquet.

STATEMENT OF THE PROBLEM

Is there a significant difference in operative time, intraoperative blood loss, and pain between using Wide-Awake Anesthesia No Tourniquet (WALANT) compared to Local Anesthesia with Tourniquet (LAWT) for patients undergoing carpal release surgery?

HYPOTHESIS TESTING

- Null hypothesis: there is no significant difference in operative time, intraoperative blood loss, and pain in the use of WALANT compared to LAWT for carpal tunnel release surgery

- Alternative hypothesis: there is a significant difference in operative time, intraoperative blood loss, and pain in the use of WALANT compared to LAWT for carpal tunnel release surgery

OBJECTIVES

In general, this study aims to determine if there is a significant difference between WALANT and LAWT for patients undergoing surgical carpal tunnel release

SPECIFIC OBJECTIVES:

- To determine the difference between WALANT compared to LAWT for patients undergoing surgical carpal tunnel release with regard to:

    - Operative time
    - Intraoperative blood loss
    - Intra-, and post-operative pain
    - Post-operative complications

METHODOLOGY

RESEARCH DESIGN

This study was a double blinded control trial conducted at the Philippine Orthopedic Center in coordination with the Hand Surgery Unit conducted from 2019-2020 and 2021-2022. The researchers used purposive sampling in gathering the sample size. Both the participants and the statistician were blinded to the control and treatment arms of this study.

SAMPLE SIZE

Sample size was initially computed using the average census of open carpal tunnel release done at POC in a year. Sample size (priori) computation for Mann – Whitney U Test was conducted using GPower version 3.1.9.4. From the study of Gunasagaran et al. (2017), the mean blood loss for the WALANT group was 3.33 (SD=2.39), while the LA/Tourniquet Group had a mean blood loss of 2.05 (SD=1.40). A minimum of at least 80.00% power is necessary to detect true relationships and lessen Type II errors to 20.00% (Daniel & Cross, 2013). A default 5.00% alpha or significance level will be used to detect significant results (Daniel & Cross, 2013). With these parameters and with a minimum power of 80%, and a significance level of 5.00% (two-tailed), a minimum sample size of 32 respondents is necessary. However, the final sample size will be adjusted for a 20.00% attrition rate and a 10.00% non-response rate. Hence, the final sample size for the study is a total of 44 respondents (22 in each group).

INCLUSION CRITERIA

Patients of any age diagnosed with Carpal Tunnel Syndrome (presenting with any of, but not limited to numbness and/or paresthesia at the median nerve distribution, aching weakness, and atrophy of thenar eminence) , and indicated for open carpal tunnel release at the outpatient operating room were included in the study. Patients with concomitant conditions such as De Quervain's Tenosynovitis and trigger finger were also included, but these conditions were not treated at the same time as the CTS Patients were then randomly assigned to either treatment (WALANT) group or the control (LAWT) group.

EXCLUSION CRITERIA

Patients with a previous injury to the affected extremity (fractures, laceration, amputations), that may change the patient's perception of pain around the surgical site were excluded from the study. Patients with allergies to either epinephrine or lidocaine were also excluded from the study.

CONTROL

A stock dose of 2% Lidocaine was used as anesthesia for the control group of patients. After aseptic and antiseptic preparation, 5ml was injected in the wrist proximal to the flexion crease and another 5ml at the planned incision site using a gauge 25 needle. Exsanguination and application of a tourniquet using a four-inch elastic bandage at the proximal forearm was done. The surgeon then waited for 5 minutes after infiltration before start of surgery.

TREATMENT

Twenty milliliters of 1% Lidocaine mixed with 1:100,000 epinephrine were used. This was obtained by mixing 10ml of 2% lidocaine (stock dose) with 10ml of sterile water, and 0.2ml of 0.1% epinephrine. Bicarbonate is usually included in the solution but was omitted for this study. This solution was injected 10ml at the wrist proximal to the flexion crease and 10ml at desired incision site using a gauge 25 needle. The surgeon then waited for 30mins after the infiltration of anesthesia before the start of surgery.

SURGICAL CARPAL TUNNEL RELEASE

The procedure was conducted in the outpatient operating room by the principal investigator and orthopedic residents in their 2nd-3rd year of training, rotating under the hand subspecialty service. The "mini-palm" open carpal tunnel release as described in Campbell's Operative Orthopedics (Fig1) was performed. This was done through a longitudinal incision beginning just distal to the distal wrist flexion crease and slightly ulnar to the midline of the wrist extending distally to 2.0 to 3.0cm in line with the third web space. Hypothenar fat was retracted clearly and parallel palmar fascia fibers were split to reveal the transverse carpal ligament (TCL), which was then incised with a no. 15 blade. Gentle blunt dissection was done to ensure that carpal contents did not remain adherent to the TCL. The incisions were then closed using 4.0 nonabsorbable sutures. A compressive post-operative dressing was applied afterward.

OBJECTIVE ANALYSIS

Intraoperative blood loss was determined by the surgeon by using the gravimetric method of weighing the operative sponges' pre- and post-operatively used using a digital weighing machine, taking into consideration that 1g = 1ml. The operating sponge was weighed three times and the average of these values was used for the study.

Operative time was measured in minutes completed starting from the time of initial skin incision to the last suture of wound closure. Patients were asked for their pain score intraoperatively during TCL release, and immediately post-op using the numerical rating score (NRS) or visual analog scale.

Additionally, patients were observed for post-operative complications such as tendon/nerve injury or palsy, distal finger necrosis, infection, or wound dehiscence. Sutures were removed 10-14 days after the operation and patients were assessed for any complication arising from the procedure.

ANALYSIS

Statistical analysis was performed by a statistician who was blinded to the treatment and control arms of this study.

Statistical analyses were performed using STATA MP Statistical Software, Version 13, College Station, TX: StataCorp LP. A p-value ≤ 0.05 was considered statistically significant. Descriptive statistics utilized to summarize and describe the demographic characteristics and the study outcomes included mean, standard deviation, frequency, and percentage. Data normalities were tested using Shapiro-Wilk's test for normality (Daniel & Cross, 2013). Comparative analyses of the demographic characteristics according to group allocation (WALANT vs. Tourniquet Groups) were conducted using Chi-Square Test or Fisher's Exact Test for categorical outcomes and independent t-test for continuous-level, normally distributed outcomes (Daniel & Cross, 2013). On the other hand, between-group comparisons of the outcomes (intraoperative blood loss, operative time, intra-operative pain, and postoperative pain) according to two group allocation for a non-normal distribution involved a Mann – Whitney U Test (Raykov & Marcoulides, 2008).

RESULTS

DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

Table 1 illustrates the demographic characteristics of the participants. Results showed that the mean age of all participants was 40.87 years old (SD=9.06), with those in Group 1 (WALANT) and Group 2 (LAWT) having a mean age of 40.83 years old (SD=8.41) and 40.92 years old (SD=9.83), respectively. Results also showed that most of the participants were female (61.70%) and, the majority of the participants in Group 1 WALANT (65.22%) and Group 2 LAWT (58.33%) were females. Comparative analyses according to group allocation indicated that the age and sex distribution of the two groups were not significantly different ($p>0.05$). The presence of other comorbidities were not included in the demographics of this study.

COMPARISON OF OUTCOMES BETWEEN GROUP 1 (WALANT) AND GROUP 2 (LAWT)

Table 2 presents the comparative analyses of the outcomes among the participants according to group allocation. In general, results illustrated that the mean operative time was 13.66 minutes (SD=3.25), the mean blood loss was 2.96 grams (SD=1.70), the median intra-operative pain score across groups was 3.00 (IQR=2.00) and 2.50 (IQR=2.25), and the mean postoperative pain score was 2.00 (IQR=1.50), and 2.00 (IQR=1.50)

respectively. Analyses of these outcomes showed that the mean operative time (14.33±3.29 vs. 13.01±3.13, p=0.157) and mean blood loss (3.28±1.92 vs. 2.65±1.41, p=0.394) were slightly higher in Group 1 (WALANT) than in Group 2 (LAWT); however, all these comparisons were not statistically significant.

DISCUSSION

The Wide-Awake Local Anesthesia No Tourniquet (WALANT) is an anesthetic technique reliant on local anesthetic and epinephrine to provide suitable conditions for hand surgery without sedation and tourniquet (Fish & Bamberger, 2022a). Gaining traction in recent years, WALANT can be performed both in the operating room or ambulatory setting and is known to be cost-effective and time-efficient (Maliha et al., 2019). This approach which consists of only lidocaine and epinephrine is known to be a fitting strategy to be employed in resource-deprived settings as it only serves like an extravascular bier block, acting where it is needed to eliminate pain and decrease bleeding (Lalonde, 2017b).

In contrast, the Local Anesthesia with Tourniquet (LAWT) approach has been widely used for hand surgeries. The use of tourniquets in orthopedic and plastic surgeries is common as these compressive devices occlude blood flow to the limbs. Using a tourniquet enables a bloodless surgical locale and helps decrease perioperative blood loss. The LAWT technique is also used to prevent the central spread of local anesthetics. This technique, however, has been associated with several physiological alterations which can affect patient outcomes after surgery (Kumar et al., 2016).

This study was made to determine whether there is a significant difference between WALANT and LAWT for patients undergoing surgical carpal tunnel release. Specifically, it aimed to compare both approaches using operative time, intraoperative blood loss, intra-, post-operative pain, and post-operative complications.

Operative Time

Table 2 indicates that Operative time is comparable in using the WALANT ($\bar{x}$=14.33 minutes) procedure to LAWT ($\bar{x}$=13.01 minutes) and the difference was found not to be statistically significant, *p*=0.157. Clinically, this difference is also insignificant in the setting of open carpal tunnel release surgery.

This information is consistent with the meta-analysis conducted by Evangelista et al in 2019 when it investigated nine (9) qualified studies tackling WALANT and LAWT Techniques. On average, the study found that the WALANT technique yielded longer operative times by an average of 2.06 minutes. The longer operative time may be attributed to the waiting period required for WALANT. Part of the protocol of this technique is the deliberate delay of surgery with a waiting time of around 26-30 minutes for the adrenaline to cause optimal vasoconstriction for hemostasis while the surgery is ongoing. (Evangelista et al., 2019)

Another possible reason for a longer operative time would be the fact that the technique is relatively new. In a review article on conceptual origins, current practice, and views of wide-awake hand surgery, Lalonde discussed the history and concerns revolving around the use of epinephrine long before WALANT was widely practiced. There was a myth that the use of epinephrine was closely related to necrosis. This, however, was proven wrong by several studies later. Surgeons since then, welcomed WALANT as an alternative approach in hand surgery. Earlier WALANT practices can be traced back to 2012, which makes it a comparatively novel technique (Lalonde, 2017a). LAWT on the other hand has been employed by hand surgeons before WALANT. The familiarity and frequency of using either technique contribute to how long or short the operative time will be. In this case, full adoption, maximum familiarity, and mastery of WALANT might come later when the practice would be as widely used as LAWT.

Intraoperative Blood Loss

The WALANT Technique had a slightly objectively higher intraoperative blood loss at 3.28±1.92 compared to 2.65±1.41 (p=0.394) as shown in Table 2. This also was not statistically significant. The same findings were evident in a study conducted in Malaysia in 2016. Gunasagaran et al looked into the perceived comfort during minor hand surgeries (carpal tunnel release and trigger finger release) with WALANT and LAWT. Similarly, the WALANT technique garnered the higher mean volume at 3.22± 2.39 ml; while LAWT came up with 2.05± 1.40 ml. At (p=0.06), however, these figures were found to be statistically not significant (Gunasagaran et al., 2017). In the same vein, the study of Huang et al also demonstrated WALANT garnering a higher amount of blood loss compared to LAWT when operating on distal radius fractures (Huang et al., 2018).

Ruxagalwong's study, although showcasing an opposite effect (LAWT having a higher blood loss volume) explained how the vasoconstriction effect reduces the total amount of blood loss. However, the vasoconstriction that occurs from epinephrine cannot create a bloodless surgical field as with a tourniquet. Minimal to moderate bleeding would most likely occur within the WALANT group. Surgeries, however, can still push through. It is worth noting that the reason behind

Ruxasagulwong's observation of a higher amount of blood loss from LAWT can be attributed to what comes after the release of tourniquet pressure, which was vasodilation with a moderate amount of bleeding (Ruxasagulwong et al., 2015).

Blood loss is usually not deemed very significant in open carpal tunnel release surgery, barring any complications. However, the amount of blood present in the surgical field can determine whether the surgeon can properly perform the procedure without difficulty. Despite the notable blood loss, WALANT still allows surgeons to operate with less blood loss allowed by the vasoconstriction that epinephrine provides.

PAIN SCORES

Table 2 depicts how group 1 (WALANT) gained a slightly higher objective median intra-operative (3.00, IQR =2 vs 2.50, IQR = 2.25, *p*=0.779) and no difference in the median post-operative (2.00, IQR = 1.50 vs 2.00, IQR = 1.25, p=0.614) pain score, arriving to a not statistically significant result as well.

The result of this study mirrored previous analyses showing no significant difference in the intra and post-operative pain control between WALANT and procedures using tourniquet (Segal, 2022). This can be attributed to the short operation time across all patients as previously demonstrated by Shulman, et al. (2020). The study proved that hand procedures not lasting more than 20 minutes can yield a tourniquet pain of only 2.3-2.9 which was similar to pain levels reported by patients undergoing WALANT.

Historically, studies involving the use of WALANT in carpal tunnel release showed mixed findings. Several studies also reported superiority of WALANT over procedures utilizing tourniquet. Tourniquet usage, at times, can be both disabling and painful. It is known to cause discomfort and can only be tolerated for a certain amount of time, depending if it was placed on an arm or a forearm. Discomfort can be attributed to either direct compression of the skin and soft tissues under the tourniquet or forearm and hand muscle ischemia (Gunasagaran et al., 2017).

Operations using the WALANT Technique help avoid the unnecessary pain that patients feel intraoperatively when tourniquets are used on them. Additionally, Fisher explained the two main groups of local anesthetics which are amides and esters. WALANT typically utilizes lidocaine, an amide, which blocks voltage-gated sodium channels leading to decreased pain sensation (Fish & Bamberger, 2022b).

It has always been difficult assessing the quality of pain experienced from person to person. Overall, the less pain felt when using WALANT can be explained by two major factors namely, the omission of a tourniquet in the process and the use of lidocaine which leads to less pain felt by the patient.

In synthesis, operative time, intraoperative blood loss, and intra-operative and post-operative pain scores were used to compare WALANT and LAWT. As demonstrated by the data gathered, these two procedures do not have a statistically significant difference. Both approaches can be used to operate on minor hand surgeries.

CONCLUSION

Overall, there was no significant difference between LAWT (Local Anesthesia with Tourniquet) and WALANT (Wide Awake Local Anesthesia No Tourniquet) techniques when it comes to operative time, intraoperative blood loss, and intra- and post-operative pain scores.

RECOMMENDATIONS

Minor hand surgeries are performed almost every day in the Philippine Orthopedic Center. While the tourniquet technique (LAWT) has been used for decades now, the presence of an alternative approach (WALANT) which can yield the same, even less painful surgeries can be very helpful for surgeons and patients alike. In open carpal tunnel release, surgeons may opt for either anesthetic technique depending on their preference and clinical setting.

In an effort to grow the practice, studies tackling further post-operative results would complement this current study and can aid other surgeons in using WALANT and creating an established protocol specific to the Filipino populations moving forward.

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FIGURES AND TABLES

Figure 1. Surgical Mini Open Carpal Tunnel Release as described in Campbell's Operative Orthopedics

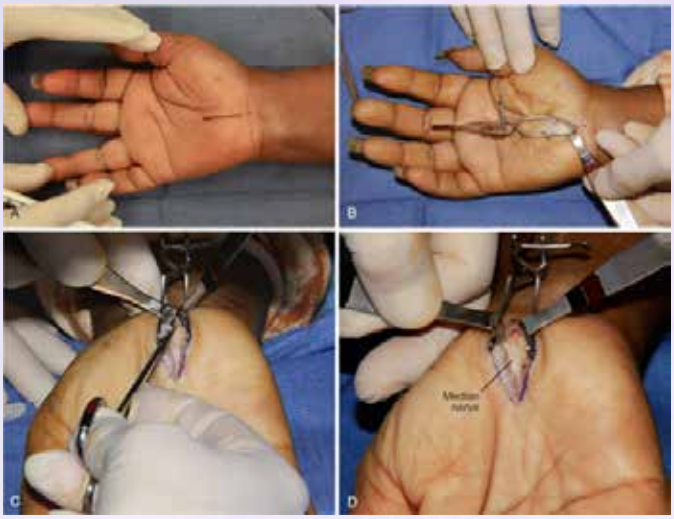

Table 1. Demographic Characteristics of the Participants according to Group Allocation (N = 47)

Characteristics	Group Allocation (N = 47)			Test Statistic	p-value (Two-Tailed)
	Group 1 (n = 23)	Group 2 (n = 24)	Total (N = 47)		
Age (Years; $\bar{x}$, SD)	40.83 (8.41)	40.92 (9.83)	40.87 (9.06)	–0.03	0.973
Sex (f, %)				0.24	0.627
Male	8 (34.78%)	10 (41.67%)	18 (38.30%)		
Female	15 (65.22%)	14 (58.33%)	29 (61.70%)		

*Significant at 0.05
†Significant at 0.01

Table 2. Between-Group Comparisons of the Outcomes among the Participants according to Group Allocation (N = 47)

Outcomes	Group Allocation (N = 47)		p-value
	Group 1 (n = 23)	Group 2 (n = 24)	
Operative Time (Minutes; $\bar{x}$, SD)	14.33 (3.29)	13.01 (3.13)	0.157
Intraoperative Blood Loss (Grams; $\bar{x}$, SD)	3.28 (1.92)	2.65 (1.41)	0.394
Intra-Operative Pain	3 (2.00)	2.50 (2.25)	0.779
Post-Operative Pain	2.00 (1.50)	2.00 (1.25)	0.614