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Original Research

Prospective Evaluation of Pain and Anxiety Levels Between Wide-Awake Local Anesthesia No Tourniquet and General Anesthesia With Tourniquet in Excision of Wrist Ganglions

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Purpose: Excision of wrist ganglions is a common procedure in hand surgery. Our objective was to determine whether the type of anesthesia (general anesthesia [GA] vs wide-awake local anesthesia no tourniquet [WALANT] technique) would affect patient satisfaction regarding intraoperative pain control, postoperative pain management, and anxiety.

Methods: This was a prospective study with patients divided into either the WALANT or GA cohort. The waiting time for surgery, Amsterdam Preoperative Anxiety and Information Scale, blood pressure, and heart rate were measured. Postsurgical questionnaires with the visual analog scale were completed. The surgeon's feedback on the ease of ganglion stalk visibility and usage of diathermy as a measure of a bloodless field was recorded. Patients reported the amount of analgesia consumed and overall satisfaction with the operation via the Surgical Satisfaction-8 questionnaire.

Results: A total of 42 patients underwent wrist ganglion excision in 2 orthopedic centers over a period of 2 years, with 21 undergoing GA and 22 undergoing WALANT. The GA group was more anxious about anesthetic use with a higher demand for information about GA ($P = .04$). The duration of surgery was significantly shorter in the WALANT group and with a lower diathermy usage ($P < .001$). There was no difference in terms of surgical difficulty and stalk visualization. The visual analog scale pain score was significantly lower in the WALANT group than in the GA group immediately after surgery ($P = .04$) and on discharge ($P = .004$). While at home for 2 weeks, the WALANT group (mean = 2.91 tablets) consumed significantly fewer analgesic tablets than the GA group (mean = 6.25 tablets). However, both groups were satisfied with their experience.

Conclusions: Wide-awake local anesthesia no tourniquet technique in the excision of ganglions provides another option of anesthesia with painless experiences, and no pain rebound after surgery. Patients were less anxious about WALANT than GA. Excision can be performed without diathermy usage with similar visualization of the stalk.

Type of study/level of evidence: Therapeutic II.

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Wrist ganglions are commonly excised with the assistance of a pneumatic tourniquet to provide a bloodless field. This aids in lowering postexcision recurrence of the cyst because a deep exploration is often needed to visualize and excise the pedicle, which is located deep into the joint. This procedure is often performed under general anesthesia (GA) or regional block, given the operative discomfort, which is often intolerable to patients with an inflated tourniquet for prolonged periods.¹

The ability to perform deep dissection of ganglions is aided by a bloodless field using a tourniquet. Tourniquet use can be disabling

and painful without GA or a brachial plexus block. Gunasagaran J et al¹ performed carpal tunnel releases, trigger releases, and ganglion excision under LA with tourniquets and found that patients recorded higher blood pressure (BP), visual analog scores (VASs), and discomfort as opposed to no tourniquet use. However, the study did not mention whether the ganglion excisions were done under wide-awake local anesthesia (LA) no tourniquet (WALANT) or LA with a tourniquet. The study mentions that the preoperative preparation time was more time-consuming, between 26 and 30 minutes, while waiting for WALANT to work maximally.

Mohd Rashid et al² compared randomized controlled trials of trigger finger release under WALANT and without adrenaline. They reported that WALANT offered longer analgesic duration and better hemostatic control, providing excellent surgical field visibility and is safe and on par with conventional methods without tourniquet-associated discomfort.

Ralte et al³ found considerable discomfort with tourniquet use compared with no tourniquet use in open carpal tunnel releases. Their prospective randomized controlled trials also showed no notable difference in patient discomfort during local anesthetic infiltration.

With the recent surge in WALANT publications, the stigma of adrenaline has been disproved.⁴⁻⁷ The WALANT technique has become popularized for various hand/upper extremity procedures. Before surgery, patients receive a local anesthetic, consisting of lidocaine with epinephrine, and remain awake for the entire procedure. It has become increasingly popular through interest and necessity. Since Lalonde et al's⁵ seminal description of WALANT in 2005 has created an alternative avenue for these surgeries to be done under LA avoiding intraoperative tourniquet pain. However, there remains skepticism on pain levels during and after the procedure, patient's anxiety or doubt about undergoing a relatively new anesthesia technique, and the efficacy of adrenaline-induced bloodless field specifically to excise the ganglion stalk.

We investigated the difference in patients' anxiety, satisfaction, surgeons' confidence, operating time, and pain control between those under GA and those under WALANT, specifically in the excision of wrist ganglions. We hypothesized that WALANT surgery would have superior patient satisfaction with better intraoperative and postoperative pain control with decreased postoperative analgesia.

Materials and Methods

Ethical approval details: We obtained a Research and Ethical Committee approval (approval project code: JEP-2020-547) and National Medical Research Register, NMRR (approval project code: NMRR-19-3439-51240) as this study was performed in 2 centers. **Details of informed consent:** Each patient fully understood and consented to the surgery as described in the article.

This was a prospective cohort study. Patients presented with wrist ganglion to 2 centers, Hospital Tuanku Jaafar Seremban and Hospital Canselor Tuanku Mukhriz, and those who fulfilled the inclusion criteria were counseled regarding the study and, upon agreement, were included. Both volar and dorsal wrist ganglions were included. Patients were counseled for both options of GA and WALANT. Then, they were arranged for day surgery based on their preference.

We excluded patients diagnosed with peripheral vascular disease, diabetes, ischemic heart disease, psychiatric illness, and a history of allergy to lignocaine. We included patients with a clinical diagnosis of only wrist ganglions, and patients with recurrence were excluded.

Ganglion excision in both WALANT and GA groups was done by orthopedic residents with experience. Experience was defined as

excising >5 wrist ganglions and administering WALANT in >5 instances. They also prepared and infiltrated the WALANT solution.

Measurement for anxiety used the Amsterdam Preoperative Anxiety and Information Scale (APAIS) score (Table 1).⁸ It is a valid and reliable tool for assessing patients' preoperative anxiety and their need for information. There are 6 questions, with each question scored on a scale of 1–5 (minimum 6 and maximum 30). Mohd Fahmi et al⁹ suggested that those with a score of ≥ 11 are more anxious and require more information about their anesthesia. Based on this study, we further grouped our patients into those with a score of ≥ 11 as being "anxious" and those with a score of ≤ 10 as "not anxious."

For pain, we used the VAS based on a scale of 0–10 (0 being no pain and 10 extremely painful). For surgical difficulty and stalk visibility, surgeons of both groups were asked to rate surgical difficulty on a scale of 0–5 (0, very easy, to 5, most difficult). Surgeons of both groups were also questioned on a confidence scale of 0–5 if the ganglion stalk was visualized and successfully excised. (5 suggest most confident and 0 not at confident at all).

Data were recorded in 3 parts:

1. Before surgery: demographic data (age, gender), baseline VAS, heart rate (HR), BP, waiting time for surgery (weeks), APAIS score;
2. Intraoperatively: BP and HR upon skin incision and skin closure were recorded;
3. After surgery: BP, HR, VAS, duration of surgery (defined as the time from skin incision to the completion of the last suture of skin closure), surgical difficulty and stalk visibility, side effects of WALANT and GA, and use of diathermy.

Specifically, there were 2 occasions after surgery where VAS were recorded, immediately after surgery and before patients' discharge from the daycare surgery center.

At discharge, a chart for daily consumption of analgesia was given to the patient. We standardized the amount of analgesia prescribed to the patient as 10 doses of paracetamol 1 g thrice a day and 10 doses of celecoxib 200 mg twice a day. At 2 weeks post-surgery, the patients were seen in the follow-up clinic and the chart for daily consumption of analgesia was collected.

Patient satisfaction was recorded via the Surgical Satisfaction-8 questionnaire (Fig.). This questionnaire is composed of 8 questions. We placed a numerical score of 0–5 (0, very unsatisfied, and 5, very satisfied) for the first 6 questions. The higher the score, the more satisfied were the patients.

WALANT group

We adhered to the general rule of 7 mg/kg of mixture solution of lignocaine 1% with 1:100,000 adrenaline is considered safe for surgery in extremities. A total of 5 ml of normal saline was mixed with 5 ml of lignocaine 2%. Another 0.1 ml of 1:1000 adrenaline solution was added, followed by 1 ml of sodium bicarbonate. Hence, a total of 11.1 ml of this solution was used at the surgical site.

In the daycare ward, patients had their skin prepared with alcohol swabs. Once the alcohol solution had dried, their ganglion was delineated by a surgical skin marker, followed by the proposed skin incision. Wide-awake LA no tourniquet solution was then infiltrated. First, a total of 2 ml of subcutaneous WALANT was infiltrated at a 90° angle as a bleb using a 27-gauge needle. Then, another 3 ml was infiltrated along the line of the planned incision. Infiltration was performed until the site was "tumescent." The site of the presumed ganglion stalk was then infiltrated with 5 ml with the needle hitting deep down into the periosteum. This was to ensure that the stalk could be comfortably excised without pain.

Table 1
The APAIS and Results

Questions	The APAIS				
	1	2	3	4	5
1. I am worried about the anesthetic					
2. The anesthetic is on my mind continually					
3. I would like to know as much as possible about the anesthetic I am worried about the procedure					
4. I am worried about the procedure					
5. The procedure is on my mind continually					
6. I would like to know as much as possible about the procedure					
	1. Not at all	2. Somewhat	3. Moderate	4. Moderately High	5. Extremely
Minimum score = 6, Maximum score = 30. A score of ≥ 11 is considered anxious ⁸					
	Group				Total
	WALANT				GA
APAIS Score	Not Anxious	20		13	33
	Anxious	2		7	9
	Total	22		20	42
Chi-square Test $P = .041$					

Once in the operating theater, povidone-iodine was used to prepare the surgical site.

The remaining 5 ml of WALANT solution was kept in case of a 'top-up' anesthesia during deep dissection. It is ideal to allow the LA for at least 30 minutes to take effect. It requires an average of 25 minutes for maximal cutaneous vasoconstriction to occur with 1:1,000 epinephrine. The adequacy of anesthesia was assessed by testing the incision site with tooth forceps. Allowing at least 30 minutes or longer of WALANT infiltration to elapse before surgery allows the tumescent/swollen area to return to near normal anatomic landmarks.

GA group

Patients were assessed in the daycare surgery center by the anesthetist and surgeon and examined for any contraindications to using a tourniquet and GA. After intubation, the tourniquet was applied to the operated limb on the operating table. Cleaning and draping are performed, followed by exsanguination of venous pooled blood before inflation of tourniquet. Thereafter, the ganglion was surgically excised. After the skin was sutured, plain 2% lignocaine was injected in all patients for postoperative analgesia.

Statistical analysis was done using SPSS version 23.0, and all continuous variables were tested for normality using the Shapiro-Wilk test. Because the test results were stastical significant, indicating a skewed distribution, a nonparametric test was used - in this case, the Mann-Whitney U test.

Results

Demographic details are shown in Table 2. The average age in the WALANT group is 38.64 years, whereas, in the GA group, it is 28.05 years ($P = .04$). Patients in the WALANT group were significantly older than those in the GA group. There is no significant difference in waiting time (in weeks) between patients in either group ($P = .58$).

Anxiety

Interestingly, the GA group was significantly more anxious about anesthesia and demanded more information than the WALANT group (chi-square test $P = .04$).

BP and heart rate (baseline, intraoperative, and at skin closure)

There were no significant differences in diastolic BP and HR intraoperatively and at skin closure. Only during baseline measurement was the systolic BP significantly higher in the WALANT group (mean = 138.91 mm Hg) than in the GA group (mean = 116.85 mm Hg) ($P = .003$) (Table 2).

Diathermy use

The use of diathermy was significantly higher in the GA group than in the WALANT group. Using Fisher exact test, there is a significant association between the use of diathermy with both surgical groups, with a P value of $< .001$ (Table 3).

Surgical difficulty and stalk visibility

Between WALANT and the GA groups, there was no significant difference in both surgical difficulty (chi-square test, $P = .11$) and stalk visibility (chi-square test, $P = .275$) (Table 3).

Surgical time (minutes)

The WALANT group records a quicker surgical time than the GA group with a tourniquet with a mean of 28.05 minutes versus 43.20 minutes and has a significant P value of $< .001$ (Table 3).

Postoperative VAS for pain

Wide-awake LA no tourniquet technique recorded significantly lower VAS at both times, immediately postop (mean VAS 1.36; $P < .044$) and right before patients were discharged from the daycare surgical center (mean VAS 0.82; $P < .004$) (Table 4). For the GA group, the mean VAS was 2.75 immediately after surgery and 2.5 on discharge. Using the independent t test and Mann-Whitney U test, there is a significant difference between VAS (after surgery) and VAS (Discharge) between both surgical groups, with P values of $= .04$ and $.004$ at both times. However, although numerically the results are significant, realistically, it is less than a score of 2 points on the VAS, which in a real-life context, may be considered irrelevant.



Date: ____/____/____

Surgical Satisfaction Questionnaire

Instructions: Following are a list of questions about your satisfaction with your surgery. All information is strictly confidential. Please check the box that best answers the question for you.

1. How satisfied are you with how your pain was controlled in the hospital after surgery?
 Very Satisfied Satisfied Neutral Unsatisfied Very unsatisfied
2. How satisfied are you with how your pain was controlled when you returned home after surgery?
 Very Satisfied Satisfied Neutral Unsatisfied Very unsatisfied
3. How satisfied are you with the amount of time it took for you to return to your daily activities, for example housework or social activities outside the home?
 Very Satisfied Satisfied Neutral Unsatisfied Very unsatisfied
4. How satisfied are you with the amount of time it took for you to return to work?
 Very Satisfied Satisfied Neutral Unsatisfied Very unsatisfied
5. How satisfied are you with the amount of time it took for you to return to your normal exercise routine?
 Very Satisfied Satisfied Neutral Unsatisfied Very unsatisfied
6. How satisfied are you with the results for your surgery?
 Very Satisfied Satisfied Neutral Unsatisfied Very unsatisfied
7. Looking back, if you “had to do it all over again” would you have the surgery again?
 Yes Maybe Unsure Do not think so No
8. Would you recommend this surgery to someone else?
 Yes Maybe Unsure Do not think so No

Figure. Surgical satisfaction-8 questionnaire.

Postoperative analgesia at home

Consumption of analgesia in the WALANT group was a mean of 1.32 tablets for celecoxib and 1.59 tablets for paracetamol

compared with the GA group, a mean of 2.80 tablets for celecoxib and 3.55 tablets for paracetamol (Table 4). Again, although statistically significant, realistically, an additional 2 tablets may be considered very small.

Table 2
Demographic Details with Baseline, During Incision and at Skin Closure Measurement of BP and Heart Rate

Variable	Group	Mean	SD	Median	IQR	P Value
Age	WALANT	38.64	16.578	36.5	27.25	.041*
	GA	28.05	11.033	23.5	18.25	
Waiting time (wk)	WALANT	5.73	6.533	3	11.25	.585
	GA	6.60	6.557	5.5	6.75	
Baseline						
Systolic BP	WALANT	136.23	21.485	134.5	34.75	.005*
	GA	120.30	13.615	124	20.25	
Diastolic BP	WALANT	77.09	8.624	75.5	13.25	.566
	GA	75.40	10.128	75.5	13.75	
Heart rate	WALANT	81.14	12.977	78.5	16.25	.715
	GA	79.00	11.425	79	13.75	
During incision						
Systolic BP	WALANT	138.91	21.627	135.5	36	.003*
	GA	116.85	22.963	113.5	30.75	
Diastolic BP	WALANT	75.64	10.107	76	17.25	.301
	GA	71.65	14.383	73.5	26.5	
Heart Rate	WALANT	79.00	13.501	75.5	20	.373
	GA	75.60	10.923	76.5	19.5	
At skin closure						
Systolic BP	WALANT	130.95	21.221	128	36.75	.172
	GA	120.55	26.558	119	28.5	
Diastolic BP	WALANT	71.95	11.429	71	18.75	.941
	GA	71.70	10.741	74.5	19.25	
Heart rate	WALANT	75.23	12.847	71	20	.930
	GA	74.70	11.425	72.5	22.75	

* Statistically significant, $P < .05$.

Satisfaction score

There was no difference in satisfaction in both groups.

Using an online calculator, OpenEpi, a post hoc analysis for the power of the study for VAS (immediately after surgery) was 71.1% and for VAS (pain on discharge) was 90.0%. However, for the APAIS score for anxiety, the power of the study was very low at 5.9%, and thus, a larger sample would be required for a more accurate result.

Discussion

The Anxiety Preoperative and Information scale is an effective tool to measure patient anxiety toward anesthesia.⁹ In the study by Abd Hamid et al¹⁰ on a sample size of 65 patients undergoing distal end radius plating, there was no significant difference ($P = .233$) between the GA and WALANT groups regarding APAIS anxiety scoring. However, in our study, patients undergoing GA were more anxious about their anesthesia and demanded more information regarding their anesthesia. We took a score of ≥ 11 to measure a patient's anxiety level.⁹ There is a possible bias when the anesthetist explains GA to a patient compared with LA. Adding another specialist, an anesthetist, will also increase the patient's anxiety.

Gunasagaran et al¹ found that WALANT patients were more comfortable intraoperatively with lower VAS. This study compared WALANT versus LA with tourniquet, which has an obvious and direct discomfort toward the latter group. In our study, the immediate mean VAS postoperative pain score was 2.75 in the GA group and 1.36 in the WALANT group. On discharge, the mean VAS pain score was 2.5 in the GA group and 0.82 in the WALANT group. Thus, in our study, the GA group recorded significantly higher pain scores versus WALANT on 2 occasions of recording after surgery ($P = .044$ and $P = .004$). We feel that the higher VAS in our GA group with a tourniquet is because of just plain 2% lignocaine being infiltrated postsurgery. The analgesic effect of 2% lignocaine lasts for approximately 45 minutes. Hence, by the time the patients were extubated, reversed from GA, and fully conscious of being questioned on VAS, its effect had disappeared. Another slightly similar

Table 3
Intraoperative Details

Intraoperative variables	WALANT	GA	Total
Diathermy usage			
None	20	7	27
Yes	2	13	15
Total	22	20	42
Surgical difficulty			
0 (Easy)	16	9	25
1 (Moderately difficult)	5	6	11
2 (Quite difficult)	0	4	4
3 (Very difficult)	1	1	2
Total	22	20	42
Stalk visibility			
1 (Easily visualized)	1	2	3
2 (Average visualization)	1	0	1
3 (Difficult to visualize)	4	8	12
4 (Very difficult to visualize)	16	10	26
Total	22	20	42
Duration of surgery (mins)			
Mean	28.05	43.20	$P < .01$
SD	13.022	11.024	
Median	26	46	

study on distal end radius plating recorded no pain in 14 patients and a pain score of < 3 in 6 patients.⁸

One question which could arise is whether these seemingly low VASs are clinically relevant as they could be considered mild pain. Minimal differences may not translate as meaningful differences because both WALANT, and GA groups were satisfied with their choices. Further studies may be required to elucidate this point.

To elaborate further, the GA with tourniquet cohort requires more oral analgesia of both COX-2 inhibitor (Celebrex) and paracetamol after being discharged home. This is evidenced by the higher mean amount of Celebrex and paracetamol consumed at home for 2 weeks. With both of these statistically significant data and without any prior studies which record postoperative pain of WALANT patients, the effects of tourniquet would be the main suspect attributing to pain, or this further says that WALANT has

Table 4
Pain and Analgesia

	Group	Mean	SD	Median	IQR	P Value
Pain score using VAS						
VAS for pain (immediately after surgery)	WALANT	1.36	1.136	1	2.25	.044*
	GA	2.75	2.221	3	3.75	
VAS for pain (on discharge)	WALANT	0.82	1.053	0	2	.004*
	GA	2.50	2.090	2	3	
Consumption of analgesic tablets within 2 weeks postsurgery						
Celecoxib tablets	WALANT	1.32	2.169	1	2	.022*
	GA	2.80	2.353	2.5	5	
Paracetamol tablets	WALANT	1.59	2.218	1.5	2	.001*
	GA	3.55	1.932	4	3	

* Statistically significant, $P < .05$.

better pain control as opposed to procedures performed under GA with a tourniquet. There was no pain rebound in the next few days after surgery.

The use of electrocautery is safe, reduces blood loss, and has less postoperative pain.^{11,12} Visualizing of the ganglion's stalk is vital to ensure a successful excision of the ganglion, preventing future recurrences.^{13,14} A bloodless field with the integral role of diathermy has to be achieved to ensure a successful excision. In our study, the use of diathermy was significantly higher in the GA group, which uses a tourniquet, compared with the WALANT group. It shows that the adrenaline-induced hemostasis of WALANT is effective. Our practice uses the diathermy during the surgery itself and not after tourniquet release. The tourniquet is released only after the wound has been closed and bandaged.

From the economic aspect, there is no need for a diathermy apparatus, which could incur further financial costs. There have been concerns regarding the use of diathermy with possible carcinogenic and immunogenic components found in its smoke during its operation.¹⁵ Despite the advantages of electrocautery, the exposure of its fumes not only to the operating surgeon but surrounding health care workers poses a biohazard in its immediate and long-term effects.¹⁵

As our finding of surgical time is significantly shorter in the WALANT group ($P < .001$), the use of diathermy in the GA group could have a direct correlation. Some possibilities are that when diathermy is used, there may be technical issues involving voltage adjustments or instrument failure prolonging surgical time. The mean difference between both groups is >15 minutes which is fairly significant for what is considered a short procedure. On the other hand, WALANT surgery is quicker as it offers a straightforward operation without switching between diathermy and blunt dissection.

An increase in heart rate and BP during surgery often indicates that the patient is experiencing pain. These parameters are used as an indirect gauge of intraoperative pain control. Because in this study, BP and HR showed no intraoperative increase upon skin incision and closure both groups, it was concluded that intraoperative pain control was similar in both groups.

An interesting finding in this study was the 10-year difference in age between the WALANT versus the GA group. On average, patients in the WALANT group were significantly older (38.64 years old) than those in the GA group (28.05 years old; $P = .041$). Because the choice of anesthesia was solely based on their preference, the younger age group might have preferred GA over WALANT. Alternatively, the older age group might have been more wary of medical complications and selected WALANT. Also, this younger age group was more anxious and demanded more information. Unfortunately, this difference and how it could affect anxiety and pain scores were not explored further.

Limitations of this study include the variability of the orthopedic residents performing the surgery and the actual ganglion sizes, whether there are multilobulated or otherwise. The ganglion sites were not explicitly classified as this study included volar and wrist ganglions. Volar wrist ganglions are generally more difficult to excise than dorsal wrist ganglions because of the presence of the radial artery intertwining around them. They also tend to have a long stalk from the scapho-trapezio-trapezoid joint than the scapholunate joint. A better study would compare WALANT versus regional anesthesia, the gold standard for upper-limb surgery. However, our center has only a few anesthetists skilled with regional blocks, and they could not provide the service.

Our hypothesis that patients undergoing WALANT surgery would have superior patient satisfaction with better intraoperative pain is partially disproved. They did have better intra- and postoperative pain control but were not superiorly satisfied.

In conclusion, WALANT in the excision of ganglions provides another anesthesia option with painless intraoperative and postoperative experiences and no pain rebound postsurgery. Patients are less anxious about WALANT than GA. Excision of ganglions under WALANT can be performed without diathermy and offers similar visualization of the ganglion stalk to ensure successful excision.

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