



Contents lists available at ScienceDirect

## Journal of Hand Surgery Global Online

journal homepage: [www.JHSGO.org](http://www.JHSGO.org)

## Original Research

## A Prospective Study Comparing Wide-Awake Local Anesthesia No Tourniquet Versus General Anesthesia in Hand Fracture Fixation



Shalimar Abdullah, MS (Ortho), Dip Hand Surgery,<sup>\*</sup>  
 Khairul Azmi bin Ghazali, MBBS (Ortho & Traumatology),<sup>†</sup>  
 Elaine Zi Fan Soh, MBBS (Ortho & Traumatology),<sup>\*</sup> Jamari Sapuan, MD, MS (Ortho),<sup>\*</sup>  
 Parminder Singh Gill, MBBS, MS (Ortho),<sup>‡</sup> Chia Hua Lim, MD (Ortho & Traumatology)<sup>\*</sup>

<sup>\*</sup> Hand and Microsurgery Unit, Department of Orthopaedics and Traumatology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

<sup>†</sup> Department of Orthopaedics and Traumatology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

<sup>‡</sup> Hand and Microsurgery Unit, Department of Orthopaedics and Traumatology, Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

## ARTICLE INFO

## Article history:

Received for publication May 12, 2024  
 Accepted in revised form June 21, 2024  
 Available online August 24, 2024

## Key words:

Fracture fixation  
 General anesthesia  
 Hand fracture  
 Local anesthesia  
 WALANT

**Purpose:** Fixation of metacarpal or phalanx bone fractures is usually performed under general anesthesia (GA) or regional anesthesia and with the use of a tourniquet to minimize bleeding. However, the use of tourniquet causes pain and discomfort after surgery. Wide-awake local anesthesia no tourniquet (WALANT) enables the surgery to be performed with the patient fully awake and without a tourniquet, which allows intraoperative assessment of function during surgery. This study aims to compare the perioperative parameters and clinical outcomes between GA versus WALANT in hand fracture fixations. **Methods:** Forty-eight patients with hand fractures were recruited over a period of 15 months. Twenty-one patients had undergone fracture fixation under GA, whereas another 27 patients had the surgery under WALANT. Parameters including vital signs (heart rate and systolic blood pressure), surgery duration, estimated blood loss, visual analog scale, and quick disabilities of the arm, shoulder, and hand (QuickDASH) questionnaire were evaluated.

**Results:** Wide-awake local anesthesia no tourniquet group had significantly higher systolic blood pressure values and higher estimated blood loss than GA group. Wide-awake local anesthesia no tourniquet group also documented shorter surgical time compared with GA group, but the difference was not significant. In terms of clinical outcomes, WALANT group recorded significantly lower visual analog scale score at 2 hours and 2 weeks postsurgery. However, WALANT has a comparable QuickDASH score with GA group except at 3 months postsurgery.

**Conclusions:** Wide-awake local anesthesia no tourniquet surgery for hand fracture fixation provides a similar analgesic effect and comparable QuickDASH score except at 3 months postsurgery compared with GA.

**Type of study/level of evidence:** Therapeutic IIb.

Copyright © 2024, THE AUTHORS. Published by Elsevier Inc. on behalf of The American Society for Surgery of the Hand. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Hand fractures are one of the most common fractures of the hand comprising 18% to 44% of all hand fractures.<sup>1,2</sup> Fixation of metacarpal and phalangeal fractures is usually performed under general anesthesia (GA) or regional anesthesia and requires the use

of a tourniquet to minimize bleeding for better visualization of the surgical field. However, tourniquet use has been reported to cause pain and discomfort after surgery.<sup>3</sup> General anesthesia is also associated with several complications such as nausea and vomiting and also requires a series of preoperative investigations especially in patients with comorbidities.<sup>4–6</sup>

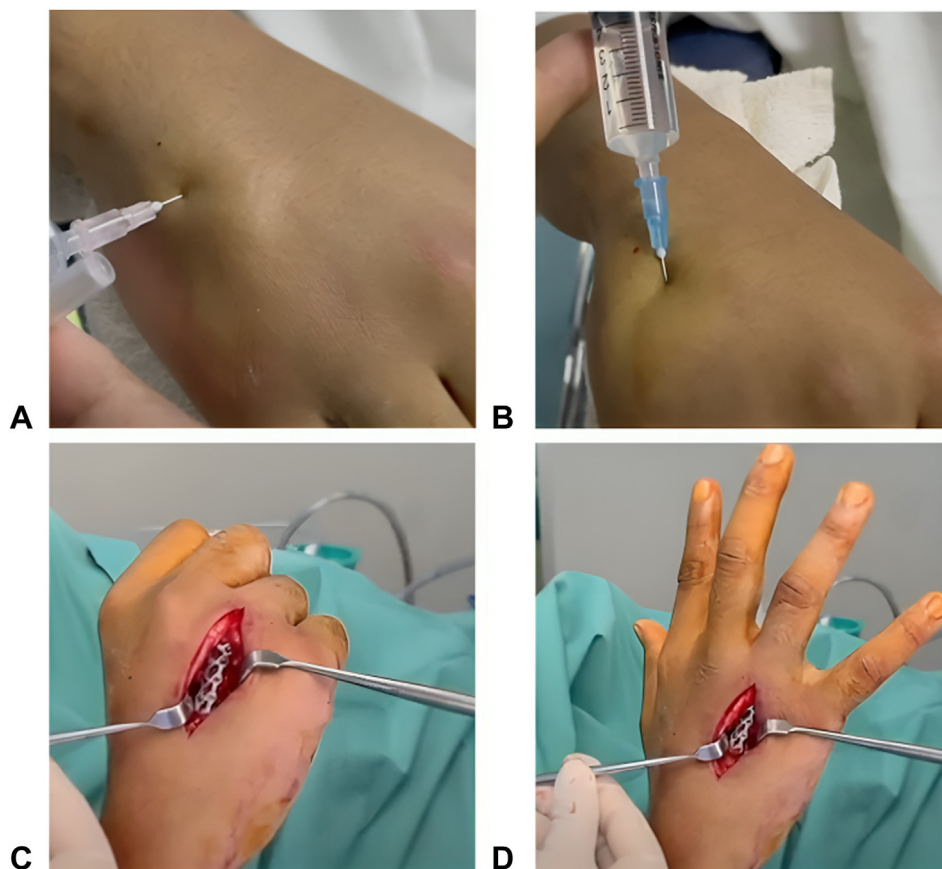
Wide-awake local anesthesia no tourniquet (WALANT) has been popularized in recent decades where a combination of lignocaine and adrenaline was used to achieve anesthesia and vasoconstriction effect.<sup>4,5</sup> This technique enables the surgery to be performed with the patient fully awake and without a tourniquet, which

**Corresponding author:** Elaine Soh Zi Fan, MBBS (Ortho & Traumatology), Hand and Microsurgery Unit, Department of Orthopaedics and Traumatology, Faculty of Medicine, Universiti Kebangsaan Malaysia, Jalan Yaacob Latiff, Kuala Lumpur 56000, Malaysia.

E-mail address: [elainesoh@ukm.edu.my](mailto:elainesoh@ukm.edu.my) (E.Z.F. Soh).

<https://doi.org/10.1016/j.jhsg.2024.06.008>

2589-5141/Copyright © 2024, THE AUTHORS. Published by Elsevier Inc. on behalf of The American Society for Surgery of the Hand. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



**Figure.** **A** WALANT solution is infiltrated using a 27-gauge needle along the planned skin incision into the subcutaneous tissue. **B** WALANT solution is infiltrated using a 23-gauge needle into the periosteum. **C, D** Intraoperative assessment of hand function, finger cascades, and any malrotations.

allows intraoperative assessment of function during surgery. It is usually used for minor procedures of the hand and wrist such as trigger finger and carpal tunnel release as an outpatient procedure.<sup>4,6</sup> More recently, WALANT has also been used for bone fracture fixation.

WALANT has been reported to have significant advantages, including faster operating time, ability to visualize functional repair of bone and soft tissue, provide adequate tension for tendon repair, and elimination of tourniquet in hand surgery together with its associated complications and rapid patient turnover, thus reducing medical costs, especially in centers with limited resources.<sup>6–8</sup>

This study aims to compare WALANT and GA in hand fracture fixation in terms of perioperative parameters, pain score, and functional outcomes. The hypothesis is there are no significant differences between the WALANT and GA in terms of perioperative parameters, pain score, and functional outcomes in hand fracture fixations.

## Materials and Methods

The is a prospective randomized controlled trial conducted in a hand center in a tertiary hospital over a period of 15 months. All patients above the age of 18 years, presenting with closed metacarpal or phalangeal fracture requiring fracture fixation, were recruited in the study. The methods of fracture fixation include plating or screw fixation. The exclusion criteria included those patients with multiple bone fractures, peripheral vascular disease, diabetes mellitus, psychiatric illness, history of allergy to lignocaine, and anxiety. The subjects were randomized into two groups (GA vs WALANT) by using online randomization program, [www.randomizer.org](http://www.randomizer.org).

**Table 1**  
Demographic Data of the Subjects

Variables	WALANT (n = 27)	GA (n = 21)
Age (y)	39.7 ± 15.36	30.29 ± 8.66
26 y old and younger	2 (7.4%)	8 (38.1%)
27–35 y old	11 (40.7%)	7 (33.3%)
36–44 y old	7 (25.9%)	5 (23.8%)
44 y old and older	7 (25.9%)	1 (4.8%)
Gender		
M	21 (77.8%)	19 (90.5%)
F	6 (22.2%)	2 (9.5%)
Methods of Fixation		
Plates	12 (44.4%)	8 (38.1%)
Screws	15 (55.6%)	13 (61.9%)
Hypertension		
Yes	5 (18.5%)	2 (9.5%)
No	22 (81.5%)	19 (90.5%)

[www.randomizer.org](http://www.randomizer.org). Informed consent was taken. The study has been approved by the institute's ethics committee.

WALANT mixture solution is prepared with 50 mL of normal saline, 50 mL of lignocaine 2%, 1 mL of 1:1,000 adrenaline solution, and 10 mL of 8.4% sodium bicarbonate (total of 111mL). Thirty milliliters of the prepared solution will be used, with a safety limit of 7 mg/kg body weight of lignocaine. Ten milliliters of WALANT solution is infiltrated using a 27-gauge needle along the planned skin incision. Then, by using a 23-gauge needle, a total of 20 mL of local anesthesia was injected at the periosteum of metacarpal or phalanx bone, starting proximally with 3–4 mL in each injection site (Fig.). The WALANT solution is injected at least 30 minutes prior to

**Table 2**  
Comparison of Heart Rate and Systolic BP Between Two Groups

Variables	WALANT (n = 27)	GA (n = 21)	P Value
Heart rate			
Baseline	76.19 ± 12.20	68.95 ± 11.48	.042
During anesthesia injection	75.78 ± 11.70	68.71 ± 9.99	.032
During skin incision	71.41 ± 12.18	67.67 ± 10.12	.261
Gentle fracture manipulation	72.52 ± 11.68	69.43 ± 10.43	.346
Aggressive fracture manipulation	73.19 ± 12.9	68.38 ± 9.47	.159
During drill and screw insertion	75.67 ± 12.48	70.29 ± 8.5	.097
Systolic BP			
Baseline	132.81 ± 14.35	115.81 ± 15.09	<.001*
During anesthesia injection	132.81 ± 16.78	117.00 ± 16.13	.002*
During skin incision	130.85 ± 18.27	117.14 ± 16.13	.009*
Gentle fracture manipulation	132.96 ± 18.13	118.24 ± 15.69	.005*
Aggressive fracture manipulation	132.81 ± 18.34	118.38 ± 14.47	.005*
During drill and screw insertion	131.67 ± 17.52	119.05 ± 12.69	.008*

\* P < .05 is significant.

**Table 3**  
Comparison of Visual Analog Score Between Two Groups

Variables	WALANT (n = 27)	GA (n = 21)	P Value
VAS score			
Baseline	7.19 ± 1.11	7.10 ± 1.22	.791
During WALANT injection	0.67 ± 0.68	-	-
During skin incision	0.33 ± 0.56	-	-
During deep tissue manipulation	0.19 ± 0.4	-	-
During first drilling of the bone	0.33 ± 0.56	-	-
2 h postsurgery	1.11 ± 1.63	7.43 ± 0.93	.001*
24 h postsurgery	3.93 ± 1.17	4.19 ± 1.08	.427
2 wk postsurgery	0.19 ± 0.48	0.81 ± 1.12	.012*
6 wk postsurgery	0.00 ± 0.00	0.10 ± 0.44	.261
3 mo postsurgery	0.00 ± 0.00	0.00 ± 0.00	-
6 mo postsurgery	0.00 ± 0.00	0.00 ± 0.00	-

\* P < .05 is significant.

**Table 4**  
Comparison of QuickDASH Score Between Two Groups

Variables	WALANT (n = 27)	GA (n = 21)	P Value
QuickDASH Score			
3 wks	73.3 ± 10.25	74.95 ± 9.97	.588
6 wks	50.52 ± 11.50	46.62 ± 12.65	.270
3 mo	25.91 ± 10.56	17.76 ± 13.37	.023*
6 mo	6.11 ± 7.97	2.86 ± 7.11	.148

\* P < .05 is significant.

procedure for it to take effect. Adequacy of anesthesia is assessed by palpating the fracture site for tenderness before skin incision.

The surgeries were performed by hand surgeons with more than 5 years of experience and familiar with WALANT injection techniques. Vital signs including heart rate and systolic blood pressure (BP) were recorded before surgery and intraoperatively during WALANT solution injection, skin incision, gentle and aggressive fracture manipulation, bone drilling, and screw insertion. Surgical time was recorded in minutes from the start of skin incision until the last skin suture was completed. Estimated blood loss was calculated by estimating the blood-soaked gauze used intraoperatively according to the description by Algadiem et al.<sup>9</sup>

Pain score was recorded using the visual analog score (VAS). For WALANT group, VAS was recorded before WALANT injection, 10

minutes after injection, and during skin incision, tissue dissection, and first drilling of the bone. If VAS was more than 4, an additional 10 mL of WALANT solution will be injected into the subcutaneous tissue and periosteum. If the VAS remains at more than 4, the operation will be converted to be done under GA. Visual analog scores were also recorded before surgery for both groups and after surgery at 30 minutes, 2 hours, and 24 hours postsurgery.

Functional outcome was assessed with QuickDASH score at 3 weeks, 6 weeks, 3 months, and 6 months of follow-up.

## Results

Forty-eight patients were recruited with 27 in WALANT group and 21 in GA group. The demographic data of the subjects are shown in Table 1.

Wide-awake local anesthesia no tourniquet group had a higher heart rate at baseline and during the procedure compared with GA group, but the differences were not statistically significant ( $P > .05$ ). For the systolic BP, WALANT group had a significantly higher value than GA group at all time intervals ( $P < .05$ ; Table 2).

Mean surgical time in WALANT group (71.85 ± 26.43 minutes) was shorter compared with the 83.57 ± 41.84 minutes in GA group, but the difference was not statistically significant. The mean estimated blood loss was significantly more in WALANT group (57.37 ± 16.38 mL) compared with 43.43 ± 25.20 mL in GA group ( $P = .025$ ). Visual analog score is comparable between the two groups at all time intervals except at 2 hours and 2 weeks postsurgery as shown in Table 3.

The QuickDASH score showed improvement from 3 weeks to 6 months after surgery in both groups, and the differences were only significant at 3 months ( $P = .023$ ) after surgery as shown in Table 4.

## Discussion

There have been multiple studies comparing the efficacy of WALANT versus GA in fracture fixation especially on distal radius fractures,<sup>5,6,10,11</sup> but this study particularly looked at the differences in vital signs, operation time, blood loss, pain score, and also the functional outcome in hand fracture fixation between WALANT versus GA. The results showed that WALANT group had significantly higher systolic BP values, higher estimated blood loss, shorter operation time, and comparable VAS score and QuickDASH score compared with GA group.

Vital signs comparison of heart rate and systolic BP pre- and intraoperatively between the WALANT and GA group might be one of the parameters to estimate anxiety level of the subjects. In our study, WALANT group had a higher heart rate and systolic BP compared with GA group at all time intervals. This may suggest higher anxiety levels among the subjects in the WALANT group as the patient is conscious during the procedure. However, a more objective assessment is required to assess the anxiety level in the subjects. This finding correlates with the study in distal radius fracture fixation by Hamid et al,<sup>10</sup> where their subjects in the WALANT group reported higher Amsterdam Preoperative Anxiety and Information Scale scores. However, despite the higher heart rate and systolic BP, none of the patients in the WALANT group require conversion to GA during the operation.

In this study, the mean operation time in WALANT group was shorter (71.85 ± 26.43 minutes) than that of GA group (83.57 ± 41.84 minutes), although the difference was not significant. In comparison with a similar study by Hamid et al,<sup>10</sup> the mean operation time in WALANT group is significantly longer, whereas studies by Dukan et al<sup>4</sup> and Tahir et al<sup>5</sup> reported no difference in operation

time between WALANT and GA groups. We postulate this could be affected by the complexity of the surgery and the fracture pattern.

Mean estimated blood loss following WALANT surgery was significantly higher than GA group in our study. This is a similar finding to other studies.<sup>4,10</sup> Although the difference in value is statistically significant, clinically the value difference is relatively small and does not affect the surgical field visualization nor do the subjects require any blood transfusion.

In terms of pain score, the difference between the two groups was not significant for all timelines, except for 2 hours' and 2 weeks' postsurgery. The mean VAS scores for WALANT group during the procedure itself was less than one even during the aggressive fracture manipulation and bone drilling. This is similar compared with Hamid et al with a VAS score of one during aggressive manipulation and screw drilling, respectively. Dukan et al<sup>4</sup> and Yi et al<sup>6</sup> also reported few patients with mild pain (VAS ranging from 1 to 4).

Functional outcome of patients was assessed based on QuickDASH scores recorded at 3 weeks, 6 weeks, 3 months, and 6 months postsurgery. The QuickDASH score improved from 3 weeks to 6 months after surgery for both groups. However, the WALANT group exhibited a higher QuickDASH score compared with GA group for all time points, with significant between-group differences observed for the time point at 3 months postsurgery. This shows that with functional outcome of subjects improved postsurgery, irrespective of the type of anesthesia. The difference between the two groups could be postulated to the differing complexity of the fracture patterns and also compliance with rehabilitation exercises.

In conclusion, WALANT for hand fracture fixation provides a similar analgesic effect and comparable QuickDASH score except at 3 months postsurgery compared with GA, despite higher systolic BP values.

## Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

## References

1. Karl JW, Olson PR, Rosenwasser MP. The epidemiology of upper extremity fractures in the United States, 2009. *J Orthop Trauma*. 2015;29(8):e242–e244.
2. Kollitz KM, Hammert WC, Vedder NB, Huang JI. Metacarpal fractures: treatment and complications. *Hand (N Y)*. 2014;9(1):16–23.
3. Ralte P, Selvan D, Morapudi S, Kumar G, Waseem M. Haemostasis in open carpal tunnel release: tourniquet vs local anaesthetic and adrenaline. *Open Orthop J*. 2010;4(1):234–236.
4. Dukan R, Krief E, Nizard R. Distal radius fracture volar locking plate osteosynthesis using wide-awake local anaesthesia. *J Hand Surg Eur Vol*. 2020;45(8):857–863.
5. Tahir M, Chaudhry EA, Zaffar Z, et al. Fixation of distal radius fractures using wide-awake local anaesthesia with no tourniquet (WALANT) technique: a randomized control trial of a cost-effective and resource-friendly procedure. *Bone Joint Res*. 2020;9(7):429–439.
6. Yi LM, Ahmad AA, Ruslan SR, Abdullah S, Ahmad AR. Plating distal radius fractures using wide-awake local anesthesia no tourniquet (WALANT) versus general anesthesia: a cohort study. *J Hand Surg Glob Online*. 2020;2(6):331–338.
7. Ahmad AA, Yi LM, Ahmad AR. Plating of distal radius fracture using the wide-awake anesthesia technique. *J Hand Surg Am*. 2018;43(11):1045.e1–1045.e5.
8. Orbach H, Rozen N, Rubin G. Open reduction and internal fixation of intra-articular distal radius fractures under wide-awake local anesthesia with no tourniquet. *J Int Med Res*. 2018;46(10):4269–4276.
9. Ali Algadiem E, Aleisa AA, Alsubaie HI, Buhlaiqah NR, Algadeeb JB, Alsneini HA. Blood loss estimation using gauze visual analogue. *Trauma Mon*. 2016;21(2):e34131.
10. Abd Hamid MH, Abdullah S, Ahmad AA, et al. A randomized controlled trial comparing wide-awake local anesthesia with no tourniquet (WALANT) to general anesthesia in plating of distal radius fractures with pain and anxiety level perception. *Cureus*. 2021;13(1):e12876.
11. Ki Lee S, Gul Kim S, Sik Choy W. A randomized controlled trial of minor hand surgeries comparing wide awake local anesthesia no tourniquet and local anesthesia with tourniquet. *Orthop Traumatol Surg Res*. 2020;106(8):1645–1651.