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Original article

WALANT technique versus locoregional anesthesia in the surgical management of metacarpal and phalangeal fractures: Lessons from the Covid-19 crisis

L'anesthésie locale adrénalinée sans garrot comparée à l'anesthésie locorégionale dans le traitement chirurgical des fractures des métacarpiens et des phalanges: apprentissages tirés de la pandémie à Covid-19

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ABSTRACT

Wide Awake Local Anesthesia No Tourniquet (WALANT) is an anesthetic method which uses a local injection of anesthetic and epinephrine, avoiding use of a tourniquet. During the COVID-19 pandemic, human and logistic resources had to be reorganized, and WALANT ensured resilience in our department to maintain access to surgical care. The objective of the present study was to compare hand function recovery 3 months after surgery for unstable metacarpal or phalangeal fracture under regional anesthesia versus WALANT. From November 2020 to May 2021, 36 patients presenting a metacarpal or phalangeal fracture requiring surgical treatment were included in a single-center study in a university hospital center. Nineteen patients underwent surgery under locoregional anesthesia with tourniquet, and 17 under WALANT. The main endpoint was functional recovery at 3 months on QuickDASH score. Need for complementary anesthesia, surgery duration, analgesic consumption, reintervention rate, and patient satisfaction were also assessed. There was no significant difference between groups in functional recovery at 3 months or on the secondary endpoints. In the COVID-19 context, WALANT proved to be a safe and effective method in hand fracture surgery, ensuring access to surgical care. It should be included in surgical training to optimize day-to-day surgical care and face future crises.

Mots-clés:
WALANT
COVID
Fracture de métacarpien
Fracture de phalange

RÉSUMÉ

La Wide Awake Local Anesthesia No Tourniquet (WALANT) est une technique d'anesthésie qui comprend l'injection d'une solution d'anesthésique local adrénalinée, permettant de s'abstenir de l'usage du garrot. Durant la pandémie de COVID-19, les ressources humaines et logistiques durent être réorganisées, la WALANT fut une méthode de résilience pour maintenir l'accès aux soins chirurgicaux. Notre objectif était de comparer les résultats à 3 mois des patients opérés sous anesthésie locorégionale à ceux des patients opérés sous WALANT, d'une fracture instable d'une phalange ou d'un métacarpien. De Novembre 2020 à Mai 2021, 37 patients présentant une fracture d'un métacarpien ou d'une phalange, nécessitant un traitement chirurgical, furent inclus dans une étude de cohorte monocentrique dans notre CHU. Dix-sept patients furent opérés sous WALANT et 19 sous anesthésie locorégionale avec garrot. Le critère de jugement principal était la récupération fonctionnelle après trois mois selon le score QuickDASH. La nécessité d'une anesthésie complémentaire, la durée de l'intervention, de la consommation d'antalgique, le taux de réintervention et la satisfaction furent également évalués.

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Entre le groupe WALANT et le groupe ALR, il n'a pas été constaté de différence statistiquement significative concernant la récupération fonctionnelle après 3 mois, ni sur les critères de jugement secondaires étudiés. Dans le contexte de la pandémie de COVID-19, la WALANT était un outil efficace dans le traitement chirurgical des fractures des os de la main, permettant de maintenir l'accès aux soins chirurgicaux. Les auteurs recommandent son enseignement pour optimiser nos pratiques quotidiennes, mais aussi maximiser nos capacités d'adaptation aux situations de crise.

Introduction

Wide Awake Local Anesthesia No Tourniquet (WALANT) is a technique using a local injection of lidocaine, epinephrine, and sodium bicarbonate. The epinephrine acts as a hemostatic agent. Sodium bicarbonate buffers the acidity of the solution and thus minimizes injection pain [1]. The area of interest is injected with a sufficient volume to create an extravascular block and provide a bloodless surgical field without the pain of a tourniquet [2].

The 2019 coronavirus disease (COVID-19) is caused by the SARS–Cov 2 virus. The pandemic situation since the 2019 outbreak led public authorities to publish recommendations to help healthcare providers to face the challenge. Healthcare actors were asked to reduce the number of surgeries, so as to redeploy staff and logistic resources and to increase hospital bed capacity during major epidemic resurgences.

Hand fractures account for 19% of all fractures, predominantly in the active population [3]. In the absence of optimal care, consequences such as joint stiffness, deformity, loss of grip force and tendon adhesion have major functional impact on health and activity [4]. In most hand fractures, conservative treatment is indicated, in the absence of displacement or fracture site instability, but the impact of soft tissue adhesion together with progress in hand surgery have widened the indications for surgical treatment [5]. Unstable fractures can now be treated by open or closed surgical reduction and stabilization of the original anatomy, allowing quicker mobilization [6].

Hand fracture surgery is usually conducted under regional anesthesia (RA), to avoid pain, but there is some discomfort related to limb compression by the tourniquet. Tourniquets are also associated with risk of nerve, muscle and skin injury, and toxic metabolic release in the systemic circulation after removal [7]. RA requires an anesthesiologist, a preliminary anesthesia consultation and continuous monitoring during surgery. WALANT requires considerably fewer human and material resources [8]. During the pandemic, our department, like others [9,10], systematized WALANT as a method enabling resilience to maintain urgent surgical care.

WALANT could offer other benefits in hand fracture surgery. Lalonde, who popularized WALANT at the beginning of the century, emphasized that it allowed the surgeon to ascertain adequate reduction, functional stability in finger fracture osteosynthesis and whether soft-tissue impingement was interrupting active finger movement [2]. These benefits were recently reported in a case series of metacarpal bone fracture [11]. WALANT can enable early initiation of protected movement and shorten the time to functional recovery and return to work, as recently shown in distal radius fracture osteosynthesis [12–14].

The present study aimed to compare functional results in metacarpal and phalangeal fracture between RA with tourniquet and WALANT during the context of restricted resources in the COVID-19 pandemic.

Patients and methods

Patients

We compared the two techniques in a retrospective cohort. All patients undergoing surgery for metacarpal or phalangeal fracture in the orthopedic department of a university hospital center between November 2020 and May 2021 were assessed for eligibility. Approval was obtained from the competent review board. Patients' informed consent was obtained.

Inclusion criteria comprised: age $\geq$18 years; one metacarpal or phalangeal open or closed fracture, requiring surgical treatment by closed or open reduction and fixation; adequate understanding of French (the official language of the country); and place of residence compatible with follow-up in the hospital clinic. Exclusion criteria comprised: multiple fracture; associated finger amputation; other notable trauma; diagnosed unstable psychiatric condition; peripheral vascular disease; upper-limb neurological disorder; history of pain disorder; systemic inflammatory disease; contralateral hand disability; <3 months' follow up at the hospital; and any medical condition making either RA or WALANT inappropriate.

Surgical indications were decided collegially by 6 senior orthopedic surgeons: 2 highly experienced (level 4) and 4 experienced (level 3) specialists on the Tang and Giddins classification [15]. Patients were operated on under one or the other procedure depending on monitored operating room access restrictions, and the experience of the on-call anesthesia and surgical team.

Anesthesia

WALANT procedure

WALANT was performed by the surgeon in a dedicated area adjacent to the operating room, respecting asepsis requirements. The technique routinely used in the department was based on the available literature and the experience of previous department studies [14]. No fasting was required before surgery. On arrival in the outpatient department the patient received one dose of cefazoline 2 g according to the current guidelines of the French Society of Anesthesia and Intensive Care Medicine (SFAR) [16].

The local anesthetic solution (LAS) contained lidocaine chlorhydrate 1% and epinephrine 0.0005% buffered with sodium bicarbonate 8.4% at ratio of 10:1. To reduce injection pain, 27-gauge needles were used, the syringe was held in both hands, the skin was penetrated at a 90° angle [17], and the pace of injection was slow [18].

For metacarpal anesthesia, 10 ml LAS was injected in the subcutaneous fat tissue on the dorsal side of the metacarpal bone. Subsequently, in the proximal third of the metacarpal, 2 ml was slowly injected until the periosteum was reached, and an additional 8 ml was injected in contact. Then, the procedure was repeated in the distal third. In case of intermetacarpal fixation, the operation was repeated at the corresponding entry point of the adjacent metacarpal.

For phalangeal anesthesia, 4 ml LAS was injected on the volar side of the hand in the subcutaneous fat, followed by 4 ml on the dorsal side, at the level of the metacarpal head. In addition, 2 ml was injected in the middle of each side of the proximal and middle phalanges.

The maximum recommended dose of 7 ml/kg lidocaine was respected, with a minimum 30-min interval between injection and incision to obtain optimal anesthesia and hemostasis [19].

Regional anesthesia

RA was administered in the recovery room. The axillary block technique was performed with associated medication at the discretion of the on-call anesthesiologist.

Surgical procedure

In the operating room, fracture reduction under fluoroscopy ascertained the efficacy of the anesthesia and of any complementary anesthesia: complementary local injection, sedation, or general anesthesia. Patients were operated on by the on-call orthopedic surgeon. Surgery consisted in adapted open or closed reduction and fixation by K-wire, screw, or plate. In the RA group, a pneumatic tourniquet was inflated (250 mmHg) in mid-arm position. In the WALANT group, after fixation, active mobilization of the hand was performed to assess immediate functional stability and detect any soft tissue impingement. Postoperative radiographic control was obtained in the operating room. The optimal method and duration of immobilization were decided by the surgeon. After surgery, patients were given appropriate postoperative care and surveillance in the outpatient surgery department.

Endpoints

The primary endpoint was patient-rated hand function on QuickDASH (Disabilities of the Arm, Shoulder and Hand) score at the 3-month follow-up consultation in the outpatient clinic [20,21]. Secondary endpoints comprised intra- and post-operative complications, surgery time, and analgesic consumption. Patient satisfaction was also measured, on a 5-point Likert scale.

Statistical analysis

Continuous variables were reported as mean and standard deviation (SD). Categorical variables were reported as number and percentage. A Shapiro–Wilk test was performed on continuous variables to assess normal distribution. Differences between means were assessed on Student t-test and non-parametric Mann–Whitney U test. Differences between proportions of categorical variables were assessed on χ^2 test, or Fisher's exact test if sample size was small. All tests were two-sided at a 5% alpha level. $P < 0.05$ was considered significant. All analyses used SPSS software, version 26 (IBM, Armonk, NY, USA).

Results

Demographic data

Thirty-six patients were included. The WALANT group included 17 patients, and the RA group 19 (Fig. 1). Patient data are shown in Table 1. Fracture and surgery data are shown in Table 2.

Endpoints

Self-rated disability at 3 months on QuickDASH did not differ significantly between the two groups. There were no significant differences in surgery duration, need for complementary anesthesia or duration of postoperative analgesia. Only one patient in each group required revision surgery (Table 3). Patient satisfaction is reported for descriptive purposes in Table 3.

Discussion

During the COVID-19 pandemic, we found no significant difference in functional outcome 3 months after hand fracture surgery between WALANT and monitored anesthesia. WALANT appeared to be a feasible and safe method for either open or closed reduction and internal fixation of metacarpal and phalangeal fracture.

Perioperatively, there was no significant difference in terms of complementary anesthesia. In 1 case, RA failed and was completed by general anesthesia. In the WALANT group, additional LAS was applied for 1 patient with 5th metacarpal midshaft fracture, but after further examination it appeared that the discomfort felt by the patient during surgery was related to pain caused by ipsilateral osteoarthritis of the thumb during the reduction maneuver. WALANT requires thorough examination of potential sources of discomfort during the intervention, including associated preexisting local tendinopathy or rheumatic disease which could be indications for an alternative anesthetic method.

Postoperatively, duration of analgesia did not differ between groups. In the RA group, 1 patient with open middle phalanx fracture of the index required revision surgery for non-union. In the WALANT group, 1 patient suffered from iterative midshaft fracture of the 4th metacarpal bone following a fall. These complications were unrelated to anesthetic modality.

The literature specific to metacarpal and phalanx surgery under WALANT is sparse. Feldman et al. reported encouraging results in 11 patients treated either by CRIF or ORIF [11]. None needed extra

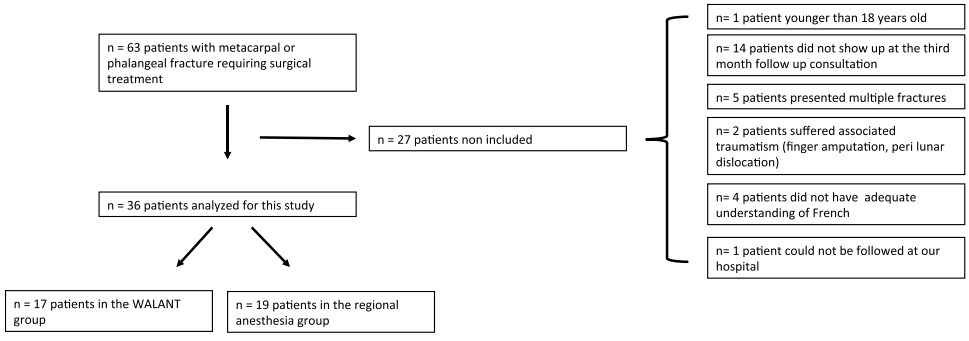

Fig. 1. Flow chart summarizing the study design and inclusions.

Table 1
Demographic data.

	Treatment groups			
	RA (n = 19)	WALANT (n = 17)	P-value	Test
Characteristics				
Gender (n)				
Male	17	15	1	Fisher
Female	2	2		
Age (years) (mean, range)	30.3 (18–68)	35.6 (18–69)	0.22	Student t test
Smokers (n)	5	7	0.34	Chi^2
Manual workers (n)	11	9	0.77	Chi^2
Work-related injuries (n)	4	3	1	Fisher bilateral
Dominant hand injured (n)	11	9	0.77	Chi^2

n: Number; *RA*: regional anesthesia; *WALANT*: Wide Awake Local Anesthesia No Tourniquet.

Table 2
Fracture and treatment characteristics.

	Treatment groups			
	RA (n = 19)	WALANT (n = 17)	P-value	Test
Bone (n)				
Phalanx	9	7	0.71	Chi^2
Metacarpal	10	10		
Open fracture (n)	3	3	1	Fisher
Open vs Percutaneous reduction (n)				
Open	8	5	0.43	Chi^2
Percutaneous	11	12		
Fixation method[a] (n)				
K-wires	10	11		NT
Plate	2	2		NT
Screw	4	3		NT
External fixator	1	0		NT
Hybrid technique	2	1		NT

n: Number; *NT*: no statistical test performed; *RA*: regional anesthesia; *WALANT*: Wide Awake Local Anesthesia No Tourniquet.
[a] Hybrid techniques comprise screws + K-wires, screws + external fixator, and screws + plate.

Table 3
Functional results at 3 months and secondary outcomes.

	RA	WALANT	P-value	Test
Mean QuickDASH score at 3 months (SD)	14.2 (13.7)	8.4 (8.6)	0.21	Mann Whitney U
Mean surgery duration (minutes)	49.1	45.9	0.53	Mann Whitney U
Need for complementary anesthesia (n)	1	1	1	Fisher
Mean duration of analgesic use (days) (SD)	6.8 (9.4)	9.5 (16.5)	0.85	Mann Whitney U
Revision surgery (n)	1	1	1	Fisher
Satisfaction[a] (n)				
Excellent	12	13		NT
Good	4	3		
Neutral	2	0		
Poor	0	0		
Very poor	0	0		

DASH: disabilities of the arm, shoulder and hand; *n*: number; *NT*: no statistical test performed; *RA*: regional anesthesia; *SD*: standard deviation; *WALANT*: Wide Awake Local Anesthesia No Tourniquet.
[a] Two missing values.

intraoperative injections of local anesthetic, and there were no cases of revision surgery. But this study had no control group. Regarding upper limb surgery under WALANT, Ki Lee et al., in a randomized control trial in 2020, with 185 patients, showed that the duration of effective anesthesia was doubled in hand surgery (including carpal tunnel, trigger finger release and De Quervain disease) under WALANT compared to RA, and analgesia consumption in the first two days was significantly lower [22]. In the present series of 36 patients, there was no significant difference in duration of analgesic use between the two groups; however, durations were highly variable, and the size of our sample precludes any definite conclusion.

Abitbol et al. in 2021, in a comparative prospective study on distal radius fracture plating, showed that patients operated on under WALANT, compared to RA, stopped analgesia earlier and returned to work earlier. Their study also showed better range of motion and QuickDASH score at 3 months [14]. The patients in the WALANT group in the present study tended to have a lower (i.e., better) QuickDASH functional scores at 3 months, although the difference was not significative. The context of the pandemic

prevented evaluating time off work because many of the patients' work was interrupted.

Finally, in 2021, Moscato et al. reported their experience of WALANT in trapeziometacarpal arthroplasty. Among other benefits, WALANT allowed intraoperative functional testing of different implant sizes. At 4 months, clinical scores were similar but QuickDASH functional score was better in the WALANT group. The present study did not show better functional results in the WALANT group, but it involved the wide variety of fixation methods inherent to hand traumatology, in contrast to the high reproducibility of scheduled arthroplasty [23].

Surgical management of unstable phalangeal and metacarpal fracture aims to enable early mobilization to prevent edema, articular stiffness, and tendon adhesion. To achieve this goal, one of the main assets of WALANT is to numb a precise area, allowing intraoperative active mobilization. Thus, the surgeon ascertains the correction of any deviation or rotational disorder in active motion. In our study, one patient had a proximal phalangeal fracture reduced and fixed by cross K-wires; in passive motion, the correction was judged satisfactory, but active movement showed rotational deviation, and the fixation was immediately revised using a plate. This finding would not have been possible under RA.

Furthermore, the local anesthesia given by the surgeon increases the possibility of patient education regarding surgery and postoperative course [2]. Fixation stability was shown to the patient directly or on the fluoroscope screen. We believe that such visual memory in optimal painless conditions in full active range of motion enhances patients' self-confidence when asked to start immediate mobilization. Moreover, increasing the active involvement of the patient in treatment can increase satisfaction; our study did not include enough participants to test this hypothesis, and further investigation could consider exploring this point.

In the present study, satisfaction did not seem to be affected by the anesthesia method, and LAS injection was well-tolerated. Finger anesthesia consisted first in a volar injection. This type of block was shown to be as effective as conventional block by two dorsal injections [24]; Martin et al. reported that the difference in pain reduction between the two techniques was not significative. However, another study reported that, in healthy participants receiving both forms of anesthesia and asked to choose between the two, single palmar injection was preferred [25].

Use of epinephrine in hand surgery was long restrained by fear of finger necrosis, but this risk was well-studied and ruled out at the beginning of the century: two prospective studies, including more than 4000 cases of lidocaine and epinephrin in finger surgery, found no cases of necrosis [26,27]. Likewise, we did not find any complications related to epinephrine injection. Epinephrine was an effective hemostasis agent, as no electrosurgical device or tourniquet was used in the WALANT group and no significant difference in surgery duration was observed.

Achieving a bloodless surgical field without tourniquet is a non-negligible advantage. Pneumatic tourniquet compression on the arm or forearm causes pain that non-anesthetized patients cannot support for more than 15 or 20 min [28,29]. Apart from pain, blisters and skin burn, compression, together with ischemia and reperfusion, is associated with vascular and neuromuscular damage which can impair rehabilitation [30]. A prospective randomized study by Nitz and Dobner compared electromyographic changes 3 weeks before and after carpal tunnel decompression in patients operated on with and without tourniquet. More than 75% of the patients in the tourniquet group showed mild to moderately severe denervation in forearm muscles that had been healthy before surgery, persisting for up to 6 months [31]. Oddinson and Finsen, in a large-scale retrospective study, reported clinical tourniquet-related complications in 3 out of 18,464 operations; 2 of the cases of neurological complications were permanent [32].

WALANT simplifies access to surgery. In the university hospital where this study took place, it allowed emergency hand trauma surgery to continue despite the limitation of resources associated with the COVID crisis, with medical and paramedical anesthetic staff required in emergency units. Analogous situations where WALANT helped maintain emergency surgical care during the pandemic were recently reported in the literature. Khor et al. showed how integrating WALANT in their practice helped to reduce surgical wait-time for hand injuries [9]. Similarly, Turcotte et al. advocated WALANT for maintaining access to surgical care, in a series of varied cases including clavicle fracture and ulnar neuropathy treatment [10].

Also, by diminishing the logistic requirements of conventional anesthesia, WALANT reduces the cost of hand surgery. In 76 cases of trigger finger release, Canadian surgeons [33] showed that WALANT cut costs to a third of those of conventional anesthesia.

Various limitations are inherent to WALANT. It requires strong cooperation between patient and surgeon to prevent discomfort or anxiety during the intervention. Another limitation concerns the pre-established numbed area. The surgeon needs to carefully plan the osteosynthesis method. For instance, after failure of intramedullary metacarpal pinning, a switch to transmetacarpal fixation will require reinjection of LAS; we were not confronted by this issue.

The results of this study are encouraging for extending the use of WALANT but need to be carefully interpreted as this was a retrospective study with a small number of patients. Further investigations are needed to study the peri- and post-operative impact of WALANT in hand fractures, including functional progression during the first weeks.

Conclusion

The COVID-19 pandemic has challenged hospital routine, and WALANT appeared to be a safe and effective means of maintaining access to surgical care. In the future, WALANT should be included in surgical training, not only to face similar crises with limited resources but more generally to optimize day-to-day practice.

Human and animal rights

The authors declare that the work described has been carried out in accordance with the Declaration of Helsinki of the World Medical Association revised in 2013 for experiments involving humans as well as in accordance with the EU Directive 2010/63/EU for animal experiments.

Informed consent and patient details

The authors declare that this report does not contain any personal information that could lead to the identification of the patient(s) and/or volunteers.

Disclosure of interest

The authors declare that they have no known competing financial or personal relationships that could be viewed as influencing the work reported in this paper.

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Author contributions

All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for authorship. Individual author contributions are as follows:

Paul Ruterana: Conceptualization, Writing – original draft.

Louis Charles Castel: Statistics, Writing – review & editing.

Andreas Abitbol: Methodology, Supervision, Validation Investigation, Writing – review & editing.

Thomas Gregory: Methodology, Supervision, Validation Investigation, Writing – review & editing.

Ethics

The authors declare that the work described has been carried out in accordance with the Declaration of Helsinki of the World Medical Association revised in 2013 for experiments involving humans. The authors declare that this report does not contain any personal information that could lead to the identification of the patient(s).

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