



Surgical Management of Ankle Fractures with the Application of the WALANT Anesthetic Technique

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Abstract

Introduction: Ankle fractures occur relatively frequently in hospitals. The therapeutic approach is established through clinical and imaging evaluation. Conventional anesthetic methods applied in these have their inherent advantages and complications, but none exempts the use of a tourniquet if a blood-free field is to be achieved.

Objective: The work was to use the WALANT anesthetic method as an efficient alternative. 11 patients who presented ankle fractures requiring open reduction and internal fixation were operated on, from June 2021 to January 2022. For the WALANT anesthetic solution, lidocaine, bicarbonate and adrenaline mixed in 0.9% Na Chloride were used.

Results: males predominated over females, obtaining a value on the visual analogue scale (VAS) and on the numerical pain scale (NRS) of 0 in 8 patients, 2 presented slight discomfort and only one complained of pain scoring 2 points on said scales, the average bleeding volume was 19 ml. The average time per surgery was one hour, presenting a postoperative analgesia of 4 hours and the overall hospital stay was approximately 1 day. No reversal of the anesthetic method or change due to WALANT failure was required during the intraoperative period. The results obtained are encouraging to use in patients with morbidities that prevent the application of early analgesia in the surgical procedure.

Conclusions: The WALANT method constitutes a safe and reliable therapeutic alternative for ankle fracture surgery with the application of the WALANT anesthetic technique, significantly reducing anesthetic complications, intraoperative bleeding, and hospital stay.

Keywords: Ankle Fracture; Awake Patient; WALANT Technique; Local Anesthesia

Introduction

Ankle fractures occur relatively frequently in hospitals, mainly affecting young adults [1]. The therapeutic approach is established through clinical and imaging evaluation, depending on the characteristics of the fracture zone, location, stability, state of the local soft tissues and exposure or not to the external environment [2,3]. Surgical anesthesia can be administered in multiple ways, each technique has its own particular risks and costs, but none exempts the use of a tourniquet if a blood-free field is to be achieved [4,5]. In patients with various comorbidities, such as cardiovascular events and poor lung function, who are not suitable for general anesthesia, regional blocks, whether spinal, epidural, or popliteal nerve block, provide excellent surgical conditions with limited ef-

fects on cardiorespiratory function. However, neuropathic complications are remarkably high during the early postoperative period; In addition, it is a demanding surgical technique that cannot be performed in all local hospitals as highly specialized personnel are required [5,6]. WALANT (very awake patient, with local anesthesia, without a tourniquet) provides us with an alternative method in such situations. The combination of lidocaine with epinephrine provides excellent anesthetic results by infiltrating the subcutaneous tissue with large volume amounts of 1:100,000 saline and epinephrine to provide ischemia without damaging the area of the area to be operated on [7-10]. In the world this technique has gone gaining popularity and has become a trend in the specialty of Orthopedics and Traumatology. Studies have shown that

its use in various reconstructive ankle and foot surgeries is feasible [11-13]. In this study we describe our experience in open reduction and internal fixation of 11 patients with ankle fractures of different types, using the WALANT technique, based on reports of similar cases internationally [14-16]. In conventional surgeries, a tourniquet is applied in cases of ankle fractures to achieve adequate hemostasis and create a visually blood-free surgical field; this facilitates simple and rapid performance of open reduction and internal fixation (ORIF). However, in long operative times during treatment of complex fractures or fixation that requires the use of more than one site (p. Ej; fractures bimalleolar or trimalleolar) are cases that cause thigh pain related to tourniquet and post-surgical edema. Therefore, while tourniquets ensure a smooth procedure, they add discomfort and potential complications. Also, the discomfort of tourniquet pressure during surgery is only tolerable with general or spinal anesthesia [17]. The incorrect belief that the use of epinephrine is dangerous to the fingers and toes due to the risks of necrosis and cyanosis began in the 1950s. However, this belief arose from the use of procaine (novocaine), which was used until lidocaine was introduced in 1948. Procaine initially has a pH of 3.6; however, when stored for a long time, the pH drops to 1. Such acidity can cause necrosis of fingers and toes; however, this effect is not associated with epinephrine use [17-19]. The vasoconstrictive effect of epinephrine can be reversed using phentolamine; however, this is rarely necessary in clinical practice because there have been no clinical cases of finger necrosis, even when high doses of epinephrine (1:1000) were accidentally injected. Therefore, epinephrine injection is safe for use in fingers and toes because it does not induce necrosis. Previous studies on WALANT reported the use of 1:100,000 epinephrine and 1% lidocaine. Maximum cutaneous vasoconstriction occurred for more than 25.9 min, and no complications were reported [19,20]. Patient satisfaction is high with this technique, allows substantial savings in time and cost of hospitalization. Without the use of a tourniquet, there are few complaints of post-surgical pain by eliminating nerve compression irritation and local edema [21]. WALANT has been used very rarely for foot and ankle surgery, as evidenced in previous studies; in the investigation it was applied for ORIF of ankle fracture; Peri-surgical data was recorded and the patient's pain during surgery was quantitatively measured using the visual analogue pain scale (EVE) and a verbal numeric pain scale (NVS).

Methodological design

The universe of the study was 14 patients with ankle fractures who attended from June 2021 to January 2022. All patients over 18 years of age who gave their written informed consent to participate in the study were included. Patients with a history of blood dyscrasias, CRF, patients with chronic decompensated diseases (HBP, diabetes and ischemic heart disease), with psychiatric dis-

eases, patients with scars or fibrosis in the surgical area, patients with active sepsis, immunosuppressed patients, trimalleolar fractures of the ankle requiring fixation of the posterior malleolus, A descriptive-interventional-longitudinal study was designed, which was carried out from the patient's acceptance for surgery by the WALANT method, until hospital discharge.

The variables to be used were age, sex, anatomical classification of the fracture, amount of bleeding, pain classification using a visual analogue scale. (EVE)and verbal numeric pain scale (NVS), surgical time, postoperative analgesia and hospital stay.

Results

14 patients were informed about WALANT; the pros and cons of the technique were explained and their personality and attitude were observed. Consequently, 2 patients who were easily nervous, anxious, and apprehensive and 1 patient who met the criteria but refused to undergo the WALANT technique were excluded. Finally, the sample in this study included 11 patients (7 men and 4 women) with a mean age of 45.3 years with ankle fractures requiring ORIF. Fracture types among these 11 patients included 2 unimalleolar fractures, 5 bimalleolar fractures, and 4 trimalleolar fractures with less than 25% posterior involvement. The table presents the demographic data, fracture pattern, perioperative variables, and quantitative measurements by VAS and NVS before and during surgery.

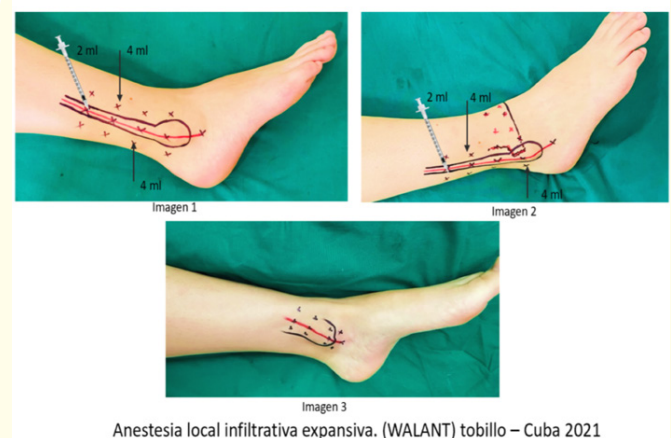


Figure 1: Infiltration method.

The WALANT infiltrative local anesthetic solution that was used was prepared with 2% lidocaine, 8% Na bicarbonate and epinephrine. mixed with Chloride 0.9% Na to produce a 100 mL solution (0.25% lidocaine, Bicarbonate, mixed with epinephrine 1:100,000). The infiltration was carried out in three times figure 1 subcutaneous injections were performed with 27 G needles.

During the intraoperative period, the surgeon could verbally interact with the patients about care and methods to avoid post-

Patient	Age (Years)	Sex	Fracture	EVA	NVS	Bleeding (ml)	Time Surgical (minutes)	Analgesia postoperativ (hours)	Stay hospitable(Hours)
1	49	F	Bi	0	1	15	60	3	48 hrs
2	36	F	Tri	0	0	15	90	4	24 hrs
3	40	F	Tri	0	0	20	85	4	48 hrs
4	44	M	Bi	0	0	15	50	4	24 hrs
5	44	M	Uni	0	2	5	45	3	24 hrs
6	52	M	Uni	0	0	10	50	6	24 hrs
7	77	F	Tri	0	0	20	80	6	24 hrs
8	37	M	Bi	0	0	15	80	4	24 hrs
9	26	M	Bi	0	0	10	60	4	48 hrs
10	31	M	Bi	2	3	20	90	2	72 hrs
11	62	M	Tri	0	0	15	60	3	48 hrs

Table 1: Demographic data, fracture pattern, peri-surgical variables, and measurements quantitative of all patients.

F: Female; M: Male; Tri: Trimalleolar; Bi: Bimalleolar; Uni: unimalleolar. Pain Analogue Scale (VAS), Verbal Numerical Pain Scale (NVS). Fountain: medical records. HCG Medical Records Department

surgical complications; patients could also provide feedback on pain or traction. The patients’ vital signs and VAS and NVS score were recorded every 10 minutes during surgery. An elevation of the NVS score was observed during surgery in 2 patients in whom an additional 3-5 ml of local anesthetic was injected into the surgical field, without exceeding the safety limit of 7 mg/kg lidocaine with epinephrine. Patients could feel pulling and movement at the fracture site after reduction, which was normal and they followed the surgeon’s instructions on how to perform dorsiflexion, plantarflexion, inversion and eversion to check the stability of the tibio-fibular syndesmosis area.

A baseline score was obtained in 11 patients who underwent surgery. EVA and NVS of 0 and only one patient had a result of 2. In no case was the tourniquet used; the mean surgical bleeding volume was 14.5 ml. Surgical time ranged from 45 to 90 minutes with a mean of 68 minutes. In particular, only 2 patients required 5 ml of additional local anesthesia due to the elevation of the NVS score during surgery to 3 points; none exceeded the safety limit of 7 mg/kg lidocaine with epinephrine. No local complications of infiltration of arteries, veins or nerves, terminal cyanosis of the toe, ischemic skin or dehiscence of the surgical wound were observed; Systemic reactions such as arrhythmia, arterial hypertension or vasovagal syncope were not observed either.

During post-surgical care, a short leg splint was applied to protect the injured area. Vital signs, skin color, and foot temperature were monitored for 1 day. Patients were mostly discharged after 24 to 72 hrs if their follow-up evaluation showed normal status. Weekly outpatient follow-ups were performed post- surgery.

No patient was switched to other methods of anesthesia due to failure of WALANT.

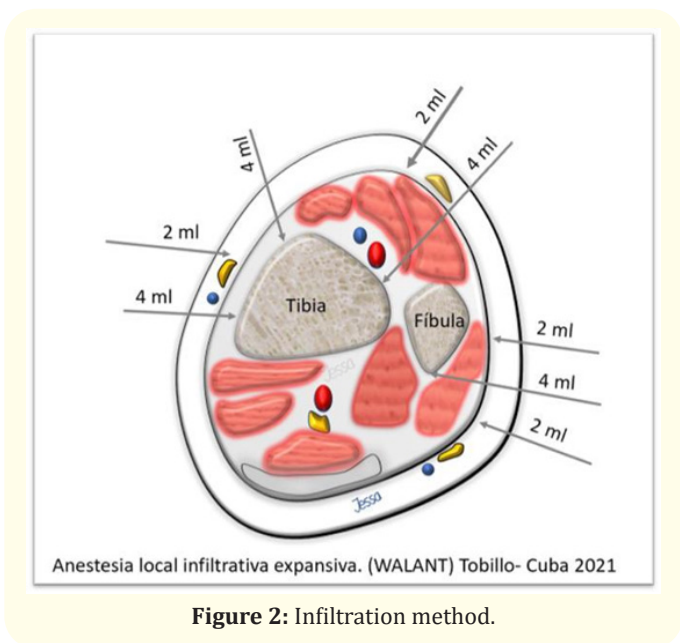


Figure 2: Infiltration method.



Figure 3

Discussion

As far as reference exists, this study represents the first analysis of the application of WALANT to ankle fractures in Cuba. The technique was applied in cases of unimalleolar, bimalleolar, and trimalleolar fractures without the need for posterior malleolar fixation. Fracture site hematoma block has been widely used to perform closed reduction of ankle fractures in emergency departments without the requirement to control the patient's airway and medication dose; this is in contrast to the standard requirements during the sedation procedure. In the present study, hematoma block prior to subcutaneous injection was combined with WALANT to achieve an effective anesthetic result, although there is concern that the use of lidocaine in blocking bruises is detrimental to articular cartilage. The maximum dose of hematoma block with 0.25% lidocaine was less than 10 ml, which was shown to be relatively safe, since chondrotoxicity with 2% lidocaine is greater than that observed with 1% lidocaine. However, Karpie JC, Chu CR in their studies in 2007 did not verify long-term negative effects of lidocaine on human cartilage; in particular, single intra-articular injection of lidocaine did not influence the viability, morphology, or chondrocyte culture potential of articular cartilage biopsy samples, and intra-articular involvement was not present in any of the fractures. 25% was less than 10 ml, which was shown to be relatively safe, since chondrotoxicity with 2% lidocaine is greater than that observed with 1% lidocaine. However, Karpie JC, Chu CR in their studies in 2007 did not verify long-term negative effects of lidocaine on human cartilage; in particular, single intra-articular injection of lidocaine did not influence the viability, morphology, or chondrocyte culture potential of articular cartilage biopsy samples, and intra-articular involvement was not present in any of the fractures. 25% was less than 10 ml, which was shown to be relatively safe, since chondrotoxicity with 2% lidocaine is greater than that observed with 1% lidocaine. However, Karpie JC, Chu CR in their studies in 2007 did not verify long-term negative effects of lidocaine on human cartilage; in particular, single intra-articular injection of lidocaine did not influence the viability, morphology, or chondrocyte culture potential of articular cartilage biopsy samples, and intra-articular involvement was not present in any of the fractures. Chu CR in his studies in 2007 did not verify long-term negative effects of lidocaine on human cartilage; in particular, single intra-articular injection of lidocaine did not influence the viability, morphology, or chondrocyte culture potential of articular cartilage biopsy samples, and intra-articular involvement was not present in any of the fractures. Chu CR in his studies in 2007 did not verify long-term negative effects of lidocaine on human cartilage; in particular, single intra-articular injection of lidocaine did not influence the viability, morphology, or chondrocyte culture potential of articular cartilage biopsy samples, and intra-articular involvement was not present in any of the fractures.

In this protocol at 1: 100,000 of epinephrine and 0.25% lidocaine, the anesthetic effect of this amide has not been reduced, in addition to maintaining the pre-surgical wait of the international average at the beginning of the surgical act at 25 minutes.

During the technique, no patient required phentolamine for the reversal of the vasoconstrictor effect and no complication of necrosis or cyanosis was observed. Therefore, it is corroborated, like the case series described by D. Lalonde, Bell M and Benoit P in multicenter studies, that the 1:100,000 epinephrine solution can be considered safe. Using the injection technique of "only one prick: a single prick"; previously inoculating the solution in the surrounding tissues before advancing with the needle and rigorously carrying out the application in the three aforementioned times, it was possible to avoid the complications and adverse reactions described as vasovagal reaction in response to needle penetration and epinephrine rush (p.Ej; agitation and tremor).

The possibility of epinephrine-induced cardiac ischemia has been reported rarely, even with high doses of epinephrine (1:1000), supporting the fact that no adverse effects or intolerable discomfort were observed during the anesthesia procedure in this study. WALANT's blood loss compared to the absence of the tourniquet during surgeries is insignificant. Huang, *et al.* reported that the average blood loss in distal radius fractures was 18.9 mL without the use of a tourniquet. Yi-Syuan, *et al.* in their series of ankle fractures, had an average loss of 9.23 ml in 13 operated patients. The average values in the 11 cases were 14.5 ml that was in correspondence in the complexity of the intervened cases whose values were equal to similar trimalleolar fractures in the series by Yi-Syuan, *et al.* However, the amount of blood lost in the conventional tourniquet group may be significantly higher than in the WALANT group due to the bleeding that occurs after tourniquet release. On the advantages of using WALANT for ORIF in ankle fractures. Patients were able to remain fully awake, allowing the surgeon to test ankle stability after fixation under physiologic forces; In particular, the patients were able to actively perform dorsiflexion and plantarflexion, making it possible to evaluate the stability of the osteosynthesis and the conditions of the syndesmosis once it was placed. Despite these advantages, surgeons must carefully evaluate each patient before surgery; patients with psychological disorders and anxious personalities are contraindicated to undergo WALANT. For those who are not willing to use the awake procedure, general or spinal anesthesia should be considered. This study has several limitations, including the small sample size and the lack of a comparison group of patients treated with general anesthesia, spinal anesthesia, or popliteal block. Furthermore, only general or spinal anesthesia should be considered. This study has several limitations, including the small sample size and the lack of

a comparison group of patients treated with general anesthesia, spinal anesthesia, or popliteal block. Furthermore, only general or spinal anesthesia should be considered. This study has several limitations, including the small sample size and the lack of a comparison group of patients treated with general anesthesia, spinal anesthesia, or popliteal block. Furthermore, only selected patients with selected fracture patterns, such as unimallolar, bimalleolar, and trimalleolar fractures without the need for posterior fixation. Open, Maisonneuve, and trimalleolar fractures with posterior fixation were not evaluated in this study.

Conclusions

The results obtained in the study are encouraging, WALANT constitutes an efficient alternative surgical anesthetic method that simplifies surgical preparation and provides a safe and reliable approach for the treatment of ankle fractures. Unlike other methods of anesthesia, it does not require highly specialized personnel for its application; In addition, it does not require advanced spinal or general anesthesia, which carry cardiopulmonary risk, nor does it require prolonged postoperative monitoring as the patient remains fully awake and without loss of motor function. Without the use of a tourniquet through the vasoconstrictive properties of adrenaline in this procedure, post-surgical pain is reduced and anesthesia time is multiplied compared to conventional methods, since plasma concentrations of lidocaine remain for longer; therefore, it increases patient satisfaction by facilitating their postoperative recovery, which does not necessarily have to be done in the operating room, thus increasing the availability of operating rooms and dynamics for surgery. It allows savings of more than 50 percent of the medical supplies used in similar surgeries with other anesthetic methods. increases patient satisfaction by facilitating their postoperative recovery, which does not necessarily have to be done in the operating room, thus increasing the availability of operating rooms and dynamics for surgery. It allows savings of more than 50 percent of the medical supplies used in similar surgeries with other anesthetic methods. increases patient satisfaction by facilitating their postoperative recovery, which does not necessarily have to be done in the operating room, thus increasing the availability of operating rooms and dynamics for surgery. It allows savings of more than 50 percent of the medical supplies used in similar surgeries with other anesthetic methods.

Conflict of Interests

The authors declared that they had no conflict of interest in this study.

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