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ORIGINAL ARTICLE

Assessment of Wide Awake Local Anesthesia with No Tourniquet Technique in Treatment of Simple Malleolar Fracture

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Abstract

Background: **Supination-external rotation (Lauge-Hansen SER), one of the most frequent injuries is an ankle fracture of the Weber B type. Whether to operate or manage conservatively depends on how stable the ankle joint is.**

Objective: **To assess the validity of using Wide Awake Local Anesthesia with No Tourniquet (WALANT) anesthetic approach in management of ankle malleolar fracture in limited resources countries.**

Patients and methods: **This cross-sectional trial include 50 patients admitted with ankle fracture that require surgical intervention for reduction and internal fixations who are presented to the Emergency Department of Al-Azhar University hospital. This study take time from May 2022 to April 2023.**

Results: **Regarding type of fracture, 26 patients (52.0 %) were bimalleolar, 12 (24.0 %) patients were medial malleolar, and 12 (24.0 %) patients were lateral malleolar. The mean intraoperative time was 62 min. There was insignificant difference in time of first rescue analgesia, patient satisfaction, discomfort postoperative stay, postoperative complication, and time of first unassisted ambulatory (h). There was insignificant difference as regard total dose of analgesia in 24 h to do NPS less than 3 (opioid or nonopioid). There was insignificant difference as regard to temperature, body temperature, and skin color during surgery and during 24 h follow-up time.**

Conclusion: **WALANT offers a safe and dependable method for managing ankle fractures while simplifying surgical preparation. WALANT differs from other methods of anesthesia in that it does not call for a difficult nerve block technique or sophisticated spinal or general anesthesia, both of which pose a risk to the heart and lungs.**

Keywords: Outcomes, Simple malleolar fracture, Wide awake local anesthesia with no tourniquet

1. Introduction

Some of the most frequent and difficult orthopedic injuries to treat in developing country are ankle injuries. Ankle fractures of the Weber B type with supination-external rotation (Lauge-Hansen SER) are among the most frequent injuries encountered in emergency rooms.[1]

The stability of the ankle joint will determine whether to operate or manage conservatively. Ankle stabilizing structures include the interosseous membrane, tibiofibular ligaments, and the syndesmosis of the ankle. The medial malleolus and deep deltoid ligament work together to maintain the ankle joint under axial pressure.[2]

Because nonoperative therapies have positive clinical results, most surgeons choose conservative therapy for fibular fractures without medial damage.[3] On the other hand, because to the ineffective lateral and medial ankle constraints, a bimalleolar or bimalleolar comparable fracture, which is a fibular fracture with extra deep deltoid ligament rupture, will be unstable and necessitate surgical intervention.[1,3]

It has been shown that the handicap that may follow ankle injuries has a significant impact on the

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production and function of damaged people. Complications from improperly performed surgical treatment of ankle injuries may endanger limbs.[4]

A shift away from tourniquet operation and toward the 'Wide Awake Local Anesthesia with No Tourniquet (WALANT)' approach has occurred recently in the area of ambulatory surgery.

The WALANT method, first proposed by Dr Donald Lalonde in 2005, involves injecting subcutaneous lidocaine and epinephrine directly into the surgical site 26 min before the procedure is scheduled to take place. This eliminates the need for an intraoperative tourniquet by allowing for the impacts of analgesia and vasoconstriction to take place.[5,6]

The WALANT approach offers a variety of advantages, including lower costs and waste, fewer preoperative consultations, a shorter hospital stay, greater patient safety, and the possibility to do active intraoperative mobility assessments. Due to the additional resources and staff needed in the primary operating room, tourniquet usage during surgery to raise expenditures for both the patient and the healthcare system.[7]

There is proof that patients who have WALANT surgery are just as satisfied as those who have traditional tourniquet surgery because they avoid nausea and vomiting, experience less urinary retention, and sedation-induced dizziness, are more independent after surgery because they do not need to utilize facilities, and are more efficient because they require fewer preoperative visits.[8,9]

Therefore, this research aimed to assess the validity of using WALANT anesthetic method in management of ankle malleolar fracture in limited resources countries.

2. Patients and methods

Our study was conducted on 50 patients with ankle fractures who were hospitalized to the Orthopedics Department of the Faculty of Medicine at Al-Azhar University participated in this study from May 2022 to April 2023. All selected patients were surgical intervention for reduction and internal fixations.

2.1. Ethical consideration

The Al-Azhar University Academic and Ethical Committee gave the research its approval. All of the participants' written informed permission was acquired. While performing this human study, the World Medical Association's Declaration of Helsinki, its code of ethics, was adhered to.

2.2. Inclusion criteria

Ankle fracture (medial malleolus, lateral malleolus) especially patient with comorbidity unsuitable for spinal or general anesthesia.

2.3. Exclusion criteria

Patients with considerable preoperative ischemia and impaired peripheral circulation fractures of the trimalleolar that needed the posterior malleolus fixed proximal fibula fracture and medial malleolar fracture (Maison-neuve fracture). Given the size of the trauma zone's involvement and the likelihood of a subpar anesthetic effect, polytrauma patients, old and open fracture should be considered (extended operating times when difficult fractures or fixation necessitating the utilization of multiple zones are being treated). Hypersensitivity to lidocaine or epinephrine. Uncooperative patient (mental retard, children, and irritable patient).

2.4. Anesthetic technique

The local anesthetic solution is made up of 20 ml of 2 % lidocaine, 1 ml of epinephrine (1 : 1000), and 40 ml of normal saline (1 % lidocaine combined with 1 : 40 000 epinephrine). By administering 3–5 ml of 1 % local anesthetic to the unimalleolar or bimalleolar fracture site, the hematoma was blocked (Fig. 1). After that, 1 cm of a subcutaneous local

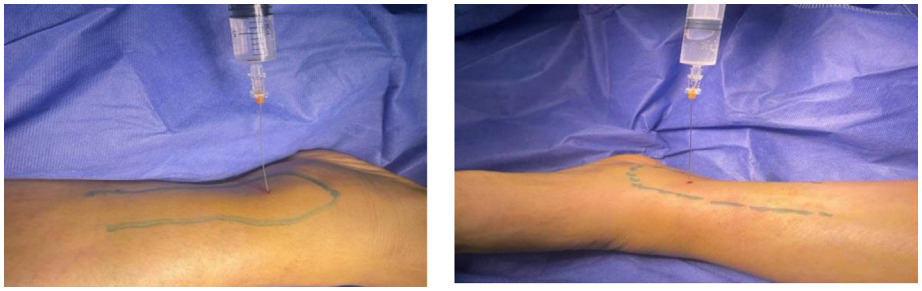

Fig. 1. Blocking a hematoma with 3–5 ml of 1 % local anesthetic.

anesthetic was applied proximally and distally to the location of the intended incision, followed by the subcutaneous injection of 5–10 ml of local anesthesia along one or two incision lines (Fig. 2). To reduce pain at the injection site, 27 G needles were used for subcutaneous injections. It took 18 min for the anesthesia and hemostasis to stabilize. By palpating the fracture before making a skin incision such that the numeric pain rating scale (NPRS) score was 0, the level of anesthesia was evaluated. To block the nerve endings before the needle penetrates further into the tissue, the solution is slowly administered before the needle advances into the tissue. For pain relief, 0.5 ml of the solution was first administered in the subcutaneous layer. Once the patient said they were pain-free, the remaining 0.5 ml of the injection solution was given.

2.5. Surgical procedure

ORIF was carried out according to protocol. If a syndesmotic screw was subsequently necessary, 5–10 ml of 1 % lidocaine mixed with 1 : 40 000 epinephrine was inserted into the syndesmosis area from the front part of the fibula (Fig. 3). During the procedure, the surgeon may speak with the patients to discuss postoperative instructions and ways to prevent problems; the patients could also express any discomfort or traction. Throughout the procedure, vital signs and NPRS scores were recorded every 10 min. Without going beyond the safe limit of 7 mg/kg for lidocaine with epinephrine, an additional 3–5 ml of local anesthesia was administered into the surgical field if NPRS score rise was seen throughout the procedure. At the fracture site, the patients could sense tugging and movement, which was typical. To assess stability, they might execute dorsiflexion and plantar flexion as directed by the operator.

2.6. Method of evaluation

Motor evaluation was assessed using MRC grade for motor power assessment, as our patients has undergo an operation in the ankle so the movement was dorsi and planter flexion. Sensory evaluation was conducted using modified Hollmen scale for sensory block. Postoperative pain was evaluated using NPRS in 1, 12, 24, 48 h postoperatively.

The NPRS is an 11-point scale scored from 0 to 10: ‘0’ = no pain and ‘10’ = the worst ache you can imagine.

Patients orally choose a figure that best describes the level of pain they have had during the last 24 h. The numeric values 0–10 are also commonly spelled out in a textual form. Need for analgesia was reported as a part of management to postoperative pain.

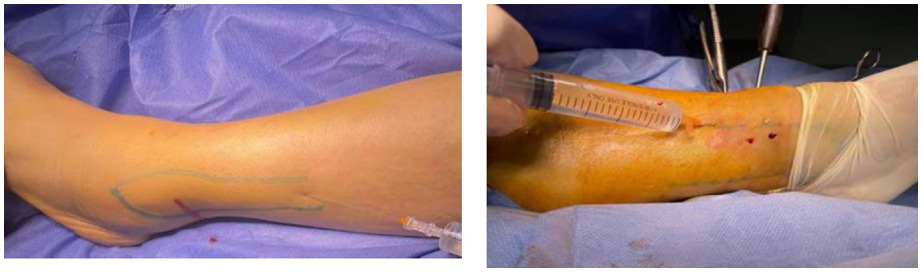

Fig. 2. A 5–10 ml administered through subcutaneous injection into the medial and lateral malleolar. Each injection location is 1 cm apart from the proximal and distal ends of the incision.

(a) (b)

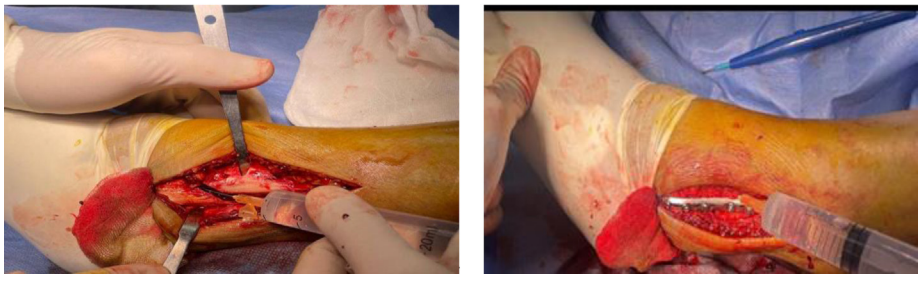

Fig. 3. Surgical technique showing periosteum infiltration.

Patient's satisfaction was evaluated using 7-questiones survey that assess patients experience during anesthesia.

Discomfort was used as binary variables (Yes/No) to assess discomfort during operation. Postoperative stay was documented in hours.

2.7. Statistical analysis

The Statistical Package for the Social Sciences (SPSS, version 20.0, SPSS Statistics, IBM Company, United States of America) software was utilized to analyze the data after they were first imported into Microsoft Excel. Quantitative data is grouped and represented by mean ± SD whereas qualitative data is represented as numbers and percentages. Variations between quantitative independent multiples using Kruskal–Wallis or analysis of variance. *P* value was chosen at less than 0.001 for very significant findings and less than 0.05 for outcomes that were significant.

3. Results

In the current study, we included 50 participants. Among enrolled patients, as regard age and sex 22 (44.0 %) were male and 28 (56.0 %) were female. We found the mean type of fracture was 52.0 % bimalleolar while 12.0 % medial malleolar, and 12.0 % lateral malleolar. There was insignificant variation between both groups as regard age or sex (Table 1).

There was insignificant difference in MRC grade for motor power assessment and modified Hollmen scale for sensory block (Table 2). There was insignificant difference in numerical pain scale for patient during 24 h (Table 3).

Table 1. Demographic information about analyzed instances.

	N = 50
Age	
Mean ± SD	56.76 ± 12.22
Range	17–72
Sex [*n* (%)]	
Female	28 (56.0)
Male	22 (44.0)

Table 2. MRC grade for motor power assessment and modified Hollmen scale for sensory block.

	n (%)
MRC	
MRC 4	12 (24.0)
MRC 5	38 (76.0)
Modified Hollmen scale	
Recognized as light touch	34 (68.0)
Sensation under 30 %	16 (32.0)

Table 3. Numerical pain scale for patient during 24 h.

NPS	*N* = 50
Before operation	
Median (IQR)	0 (0–0)
Range	0–1
4 h postoperative	
Median (IQR)	0 (0–1)
Range	0–1
12 h postoperative	
Median (IQR)	0 (0–1)
Range	0–2
Highest NPS during 24 h	
Median (IQR)	0 (0–1)
Range	0–2
Friedman test	4.875
P value	0.087 (NS)

Regarding type of fracture, 26 (52.0 %) patients were bimalleolar, 12 (24.0 %) patients were medial malleolar, and 12 (24.0 %) patients were lateral malleolar. The mean intraoperative time was 62 min (Table 4).

There was insignificant difference in time of first rescue analgesia, patient satisfaction, discomfort postoperative stay, postoperative complication, and time of first unassisted ambulatory (h) (Table 5).

There was insignificant difference as regard total dose of analgesia in 24 h to do NPS less than 3 (opioid or nonopioid). Twenty-eight (56.0 %) of patients need 1 g/100 ml solution intravenous paracetamol/8 h, 10 (20.0 %) patients need 5 cm from nalufen dilute with 10 cm normal saline, 30 (60.0 %) patients need 75 mg/amp/24 h diclofenac sodium intramuscular, eight (16.0 %) patients need 75 mg diclofenac sodium intramuscular/24 h, and 12 (26.0 %) patients need 150 mg diclofenac sodium intramuscular/24 h.

There was insignificant difference as regard blood pressure during 24 h. There was insignificant difference as regard toe temperature, body temperature, and skin color during surgery and during 24-h follow-up time (Table 6).

Table 4. Type of fracture; intraoperative time and bleeding in all studied patients.

	N = 50
Type of fracture [*n* (%)]	
Bimalleolar fracture	26 (52.0)
Medial malleolar	12 (24.0)
Lateral malleolar	12 (24.0)
Bleeding (ml)	
Mean ± SD	9.80 ± 3.06
Range	5–15
Surgery time (min)	
Mean ± SD	62.00 ± 20.92
Range	40–105

Table 5. Time of first rescue analgesia, patient satisfaction, discomfort postoperative stay and complication and time of first unassisted ambulatory (h).

	$N = 50$
First rescue analgesia	
Mean ± SD	5.20 ± 1.91
Range	3–10
Patient satisfaction	
Median (IQR)	1 (1–1)
Range	1–2
1 [*n* (%)]	38 (76.0)
2 [*n* (%)]	12 (24.0)
Discomfort [*n* (%)]	
No	50 (100.0)
Postoperative stay [*n* (%)]	
24 h	50 (100.0)
Postoperative complication [*n* (%)]	
No	50 (100.0)
Time of first unassisted ambulatory (h)	
Median (IQR)	2 (1–3)
Range	0–6

Table 6. Vital sign during 24-h postoperative.

	$N = 50$
Pulse during 24 h	
Mean ± SD	79.96 ± 6.02
Range	71–90
SBP during 24 h	
Mean ± SD	127.60 ± 13.00
Range	100–160
DBP during 24 h	
Mean ± SD	81.20 ± 8.33
Range	70–100
Toe temperature during 24 h [*n* (%)]	
Normal toe temperature	25 (100.0)
Body temperature during 24 h	
Mean ± SD	36.96 ± 0.14
Range	36.6–37.2
Skin color during 24 h [*n* (%)]	
Normal skin color	50 (100.0)

Regarding syndesmosis injection, 28 (56.0 %) patients need no syndesmosis injection and 22 (44.0 %) patients need syndesmosis injection.

A case of male patient 62 years old, from Cairo, twisted right ankle at work and developed lateral malleolus fracture of the right ankle. No other injuries. Known as cardiac, diabetic, and previous operations for right distal end fracture 22 years ago. The surgery was done on the second day from trauma. The treatment modality was three-open reduction and fixation by one-open reduction and fixation by one tubular palate. We postponed partial weight-bearing until 6 weeks after surgery and advocated postoperative programs that included vigorous exercises while in bed. At 8 weeks, full loading commenced. One day was the whole postoperative stay. After surgery, the patient was monitored for 1, 2, and 3 months. No infection and a united and cemented fracture were the final outcomes. Excellent postoperative walking level with complete range of motion and little ankle discomfort.

Table 1 shows that there was insignificant difference between both groups as regard age or sex.

Table 2 shows that there was insignificant difference in MRC grade for motor power assessment and modified Hollmen scale for sensory block.

Table 3 shows that there was insignificant difference in numerical pain scale for patient during 24 h.

Table 4 shows that the 26 (52.0 %) patients were bimalleolar, 12 (24.0 %) patients were medial malleolar, and 12 (24.0 %) patients were lateral malleolar, main bleeding volume was 9.80 3.06 ml and the time ranged from 40 to 105 min.

Table 5 shows that there was insignificant difference in time of first rescue analgesia, patient satisfaction, discomfort postoperative stay, postoperative complication, and time of first unassisted ambulatory (h).

Table 6 shows that there was insignificant difference as regard blood pressure during 24 h and that there was insignificant difference as regard toe temperature, body temperature, and skin color during surgery and during 24 h follow-up time.

4. Discussion

WALANT has gained widespread acceptance in recent years for wrist and hand procedures like tendon transfer, skin grafting, carpal ligament release, and finger fracture.[10,11] Due to the extraordinarily extensive and diverse sensory innervation of the periosteum, it can be difficult to successfully provide local anesthesia to the distal radius bone.[12]

Through subperiosteal injection or hematoma block, the use of WALANT has been extended during the last 2 years to include distal radius fractures and basal joint arthritis.[13,14] Acute physiological disturbances brought on by anesthesia and surgery may lead to decompensation in elderly people with severe chronic diseases. Additionally, prolonged application of a tourniquet for a hemostatic effect might induce nerve damage and result in postsurgical tourniquet pain[15].

Since the hemostatic action of WALANT is only present in the surgical area and the injection site, no complaints of tourniquet discomfort or nerve damage have been made. Therefore, in addition to streamlining surgical preparation, WALANT could shorten and lower the cost of hospital stays.[11] Despite these benefits, WALANT is rarely used for

ankle and foot procedures and infrequently utilized in hand and wrist surgery.

For ORIF of ankle fractures, there are several surgical, there are several types of analgesia, including local anesthesia with intravenous sedation, popliteal nerve block, spinal anesthesia, and general anesthesia. Because it has less dangers than other types of anesthesia. The popliteal fossa nerve block has become more widely used. Popliteal block, as opposed to spinal anesthesia, targets the operative side specifically and promotes earlier after surgical mobilization without increasing the chance of dural damage and the subsequent after surgical headache.[16] In comparison to general anesthesia, popliteal nerve block had fewer negative impacts on cardiorespiratory function, postoperative nausea, and vomiting.[17] Previous research has indicated that there is little risk associated with popliteal nerve blocks. In a study involving 1001 patients, Borgeat and colleagues revealed the rates of several sequelae, such as paresthesia (0.5 %), blood aspiration (0.4 %), and uncomfortable feelings while under anesthesia (0.8 %). Their research revealed that popliteal block is generally harmless, with only a few minor side effects.[18]

On the other hand, Anderson and colleagues performed a retrospective review on 1014 patients who received popliteal nerve blocks for foot and ankle procedures, and this analysis suggested that, compared with earlier findings, the likelihood of neuropathic problems following popliteal block was noticeably greater.[19]

Furthermore, popliteal block requires skilled ultrasound supervision with high technical and instrumental requirements. Some local hospitals lack the necessary equipment or experts with the necessary skills. WALANT offers an alternate approach in this circumstance though. For patients who are inappropriate for general anesthesia, spinal anesthesia, or intravenous sedation due to several comorbidities such as cardiovascular problems and deteriorated pulmonary health, other techniques should be taken into account WALANT's effectiveness in forefoot surgery[20] and the restoration of the extensor hallucis longus has been shown in studies.[19,21]

This research, in our opinion, represents the first evaluation of the WALANT method for ankle fractures. We employed the treatment in instances with lateral malleolar fracture, bimalleolar equivalent, or bimalleolar fracture without the need for posterior malleolar fixation. Due to the risk of an insufficient anesthetic effect, cases requiring posterior fixation were eliminated. Contrary to the usual needs during procedural anesthesia, intrafracture site hematoma block has been employed extensively for accomplishing closed reduction of ankle fractures at emergency departments.[22]

In the current trial, we paired WALANT with a hematoma block before subcutaneous injection to successfully provide an anesthetic. The false notion that epinephrine usage is hazardous for necrosis and cyanosis concerns led to the loss of fingers and toes starting in the 1950s. However, procaine (also known as novocaine, which was utilized until the invention of lidocaine in 1948, gave rise to this misconception.[23]

Procaine initially has a pH of 3.6, however after extensive storage, the pH drops to 1. Although finger and toe necrosis may result from such acidity, epinephrine use is not linked to this effect.[24] Since epinephrine injection does not cause necrosis, it is safe to administer to fingers and toes. Previous research on WALANT mentioned the administration of 1 % lidocaine and 1 : 100 000 epinephrine. More than 25.9 min of the maximum cutaneous vasoconstriction were experienced.[13,25]

To reduce the amount of time needed to wait for the anesthetic effect to start, we can change the technique to use 1 : 40 000 epinephrine and 1 % lidocaine.[14] Phentolamine is said to be able to counteract the vasoconstrictor effects of epinephrine; however, this is rarely essential in clinical settings because finger necrosis has never been clinically documented, even when highly doses of epinephrine (1 : 1000) were accidently administered.[6,26]

In our trial, no patient needed phentolamine to reverse the vasoconstrictor effect, and necrosis or cyanosis complications were not observed. As a result, it is safe to use our 1 : 40 000 epinephrine solution. Additional negative effects of WALANT not previously stated. Studies have been done on adrenaline rush (such as agitation and tremor), which is reversible in patients with modest symptoms, as well as vasovagal reactivity in response to needle penetration.[27] However, by pinching proximally at the injection site and employing the 'blow slow before you go' injection approach, we produced sensory noise.

We hypothesize that this effort to lessen penetrating discomfort decreased the risk of a vasovagal reaction. Even with highly doses of epinephrine (1 : 1000), the likelihood of epinephrine-induced myocardial ischemia has only occasionally been described.[28]

Following careful discussion to the patients before to the surgery, no overt side effects or severe discomfort were noticed throughout the anesthesia treatment in this study. Blood loss during surgeries

without the use of tourniquets while using WALANT has been a major source of worry.

Ankle fractures typically require the use of a tourniquet for reducing blood loss and establishing a single, unobstructed surgical field; this makes ORIF simple to execute. The use of a tourniquet, however, might cause thigh pain and swelling after surgery, especially when treating complex fractures or requiring the usage of more than one zone (such as bimalleolar). Tourniquets, although ensuring a simple process, also add agony and raise the possibility of problems. Additionally, general or spinal anesthesia is required to cover up the discomfort caused by tourniquet pressure during operation.[9,29] Few complaints of postoperative tourniquet pain and local edema are made when a tourniquet is not used.

According to Huang and colleagues, the typical blood loss in distal radius fractures is 18.9 ml when no tourniquet is applied. Due to the blood leaking that takes place after tourniquet release, the conventional tourniquet group may experience substantially more blood loss than the WALANT group.[8]

WALANT for ORIF offers some clear benefits in ankle fractures. While completely conscious, the patients were able to actively conduct dorsiflexion and plantar flexion, which allowed the operator to check the stability of the ankle after fixation under physiological strains. Despite these benefits, surgeons should assess each patient before the procedure; WALANT is not recommended for people with psychological issues or worried dispositions. General or spinal anesthesia should be taken into consideration for those who are not suitable for usage of the awake technique. No sedation is the safest form of sedation, therefore this increases safety. In the past, patients only required sedation during hand surgery for two medical reasons: tolerating the tourniquet's discomfort and the discomfort of the local anesthetic injection.

These justifications are no longer valid because it is now possible to inject local anesthetic with little discomfort.

Significant cost reduction, surgery on the hands is not expensive and costly safe sedation is involved.

If the sedative component is removed, even low-income individuals can afford hand surgery.

Since anamnestic do not affect the patients' memory or ability to learn, they can receive information from their surgeon and therapist during the procedure (see Patient Education, Chapter 7). Patients who are conscious, in no pain, and able to cooperate may move their freshly repaired limbs through their full range of motion during surgery and recall how well it functions.

To enhance the results, the surgeon can make adjustments while doing the treatment. These actions are very important when transferring tendons, making sure there is no gaping and that the tendons fit through the pulleys after flexor tendon restoration, and verifying the stability of the fixation with intraoperative active movement after fracture reduction. Aside from that, we chose patients who had certain fracture types, including lateral malleolar, bimalleolar, and bimalleolar comparable. This study did not analyze open, Maisonneuve, or trimalleolar fractures with posterior fixation.

Finally, individuals with illnesses like dementia, psychological disorders, sensitivity to injection pain, and behaviors like being easily agitated, worried, or depressed who were thought to have trouble following directions at surgery were excluded from this study.

4.1. Conclusion

WALANT offers a safe and dependable method for managing ankle fractures while simplifying surgical preparation. WALANT differs from other methods of anesthesia in that it does not call for a difficult nerve block technique or sophisticated spinal or general anesthesia, both of which pose a risk to the heart and lungs.

Without the usage of a tourniquet during this treatment, postoperative tourniquet pain is typically decreased; as a result, patient satisfaction is raised and the usage of local anesthesia with pain reduction makes recovery easier.

4.2. Limitation

Our study conducted on small sample size, contained certain inclusion criteria, this study needs longer period for follow-up postoperation. Patient cooperation is highly important, and patients should be selected carefully. The patient must be aware of the operation and its consequences.

4.3. Strength

Our technique and methods were very efficient and suitable. Also we have done the operation with experienced surgeons. This study provided a safe anesthetic technique.

Conflicts of interest

There are no conflicts of interest.

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