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ORIGINAL ARTICLE

Comparison of the effectiveness of the WALANT method in soft tissue and bone tissue surgeries in lower extremities

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ABSTRACT

Objectives: This study aims to investigate the effectiveness of wide-awake local anesthesia with no tourniquet (WALANT) technique in both bony and soft tissue procedures in lower extremities.

Patients and methods: Between January 2021 and December 2022, a total of 29 patients (20 males, 9 females; mean age: 34.6±20.2 years; range, 14 to 82 years) who were operated for lower extremity pathologies with the WALANT technique in our clinic were included. The patients were divided into two groups: lower extremity soft tissue surgeries in Group A (n=10) and bone tissue surgeries in Group B (n=19). Postoperative pain onset time, pain score, the amount of intraoperative bleeding, need for additional solution, use of cautery, and the amount of bleeding in the surgical field were compared within groups. The Visual Analog Scale (VAS) was used to evaluate pain.

Results: There was no significant difference between the two groups in terms of age (p=0.265), sex (p=0.107), and surgical side (p=0.700). There was no significant difference between the two groups in terms of intraoperative bleeding at the discretion of the surgeon (p=0.701). There was no significant difference in the use of additional solution (p=0.105), cautery usage (p=0.522), pain onset time (p=0.636), and VAS scores (p=0.735) between the two groups.

Conclusion: Our study results suggest that the WALANT technique is an effective and safe method in selected lower extremity surgeries. It is of utmost importance to apply the technique correctly to prevent complications that may occur.

Keywords: Local anesthesia, lower extremity, wide-awake local anesthesia with no tourniquet.

The wide-awake local anesthesia with no tourniquet (WALANT) technique has become popularized for various extremity procedures in recent years. As the patient remain awake during the procedure, tourniquet-free surgery by injection of lidocaine with epinephrine into the surgical field provides significant advantages.[1,2] However, tourniquet use has been associated with complications such as local ecchymosis, postoperative pain, neurovascular damage, muscle atrophy, thrombosis, and reperfusion injury.[3-5]

As application of the technique continues to grow, the current literature suggests positive outcomes. Firstly, in the upper extremity, the WALANT has been shown to have better surgical outcomes and lower complication rates regarding in both bony and soft tissue procedures.[8-10] Satisfactory results has encouraged its application in the lower extremity. To date, the number of studies on its use in lower extremity surgery is limited.[2,11,12] Concerns regarding causing necrosis in the extremity of epinephrine in hand surgery limit the use of the technique. The series of 3,110 patients by Lalonde et al.[13] and the extensive

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review reported by Denkler[14] confirmed that it was not associated with a concerned complication that much.

In the present study, we aimed to investigate the effectiveness of WALANT technique in both bony and soft tissue procedures in lower extremities.

PATIENTS AND METHODS

This prospective study was conducted at Harran University Medicine Faculty, Department of Orthopedics and Traumatology between January 2021 and December 2022. Patients who were operated for lower extremity pathologies with the WALANT technique in our clinic were screened. Exclusion criteria were as follows: the need for additional anesthesia, non-compliance with treatment, and development of complications not related to WALANT. Finally, a total of 29 patients (20 males, 9 females; mean age: 34.6±20.2 years; range, 14 to 82 years) who met the inclusion criteria were enrolled. The patients were divided into two groups: lower extremity soft tissue surgeries in Group A (n=10) and bone tissue surgeries in Group B (n=19). Time to postoperative pain onset, pain score as assessed by the Visual Analog Scale (VAS), intraoperative bleeding, need for additional solution, use of cautery, satisfaction with the anesthesia method, complications and whether the patients would recommend this method were recorded. The amount of bleeding in the surgical field was at the discretion of the surgeon (1, bloodless; 2, little blood; 3, bloody field but performable; and 4, bloody field).[15]

Application of the WALANT Technique

A total of 50 mL of WALANT solution was used for lower extremity surgeries, consisting of 25 mL of lidocaine (2%), 1 mL of epinephrine (1:100,000), 5 mL of bicarbonate (84.%), and 19 mL of isotonic solution (0.9% sodium chloride). Surgical field was determined using a surgical pen and mark the injection points with 1-cm intervals (Figure 1a). The needle was passed under the dermis perpendicularly and the WALANT solution was infiltrated 1 to 2 mL to each point through the marked points (Figure 1b). If the surgery was related to the bone tissue, we proceeded to the periosteum from the same points and continued the injection (Figure 1c). While the needle was moving, we ensured that the needle did not go forward from the local anesthetic ("blow slow before you go" technique). After applying 1 g of

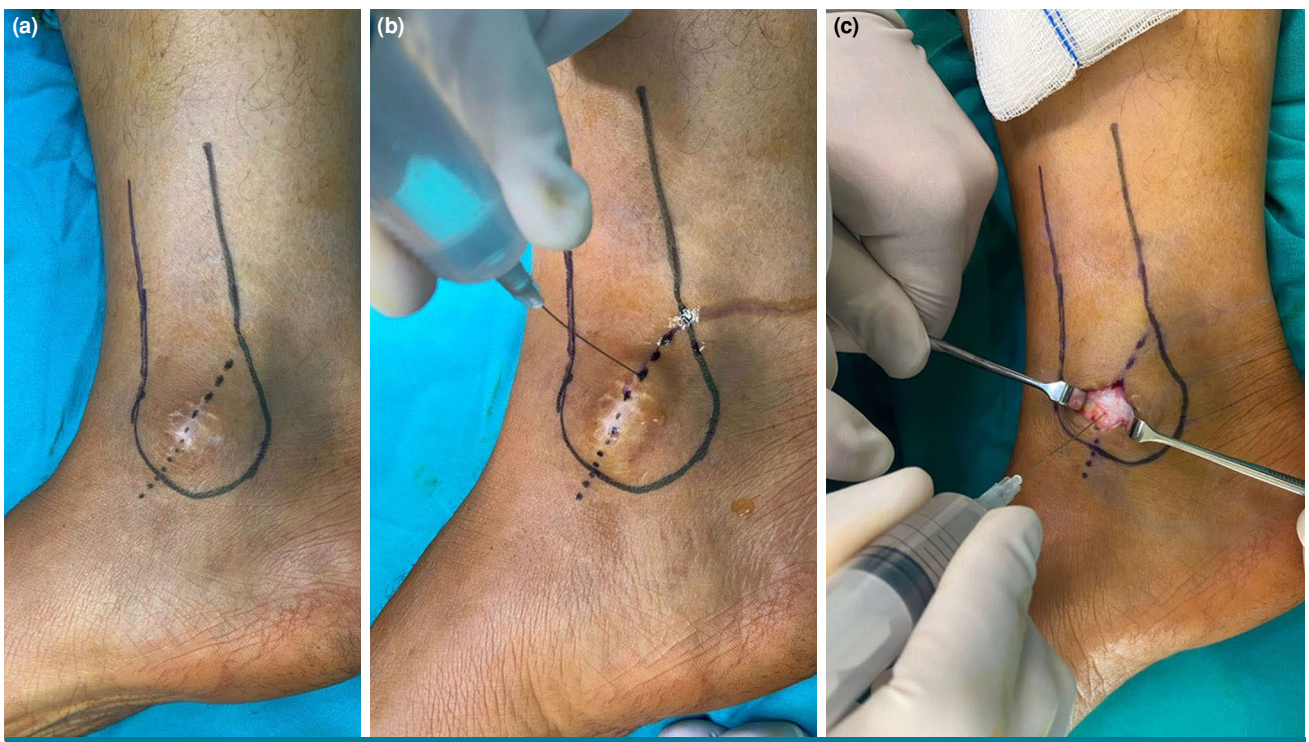

FIGURE 1. Application of the WALANT technique for the fracture of the medial malleolus. **(a)** Marking the surgical field with a surgical pen. **(b)** Infiltration of WALANT solution through the marked points. **(c)** Infiltration of the WALANT solution to the periosteum during surgery.
WALANT: Wide-awake local anesthesia with no tourniquet.

TABLE I
Demographic data and surgeries performed

	Group A (n=10)		Group B (n=19)		
	n	Mean±SD	n	Mean±SD	*p*
Age (year)		39.7±17.9		31.8±21.3	0.265
Sex					0.107
Male	9		11		
Female	1		8		
Side					0.700
Right	6		9		
Left	4		10		
Surgery	Soft tissue		Bone tissue		

SD: Standard deviation.

TABLE II
Surgical indications according to patient groups

	Group A*		Group B†		
	Side	Surgery	Side	Surgery	Complications
1	Foot	Ganglion cyst excision	Ankle	Operated medial malleolus fracture/implant removal	
2	Foot	FHL injury/repair	Foot	Operated 5th metatars fracture/plate and screw removal	Persistent pain and tenderness†
3	Foot	Ganglion cyst excision	Thigh	Osteochondroma excision in the distal femur	
4	Ankle	Foreign body excision	Leg	Osteochondroma excision in the proximal tibia	Numbness*
5	Foot	Foreign body excision	Knee	Patella fracture/fixation with Zuggurtung method	
6	Foot	Foreign body excision	Ankle	Lateral malleolus fracture/fixation with plate and screw	
7	Knee	Soft tissue tumor excision	Ankle	Haglund deformity and calcific Achilles tendinitis/resection of Haglund deformity, debridement and repair of Achilles tendon	Numbness* Necrosis of the skin†
8	Knee	Foreign body excision	Foot	First proximal phalanx fracture/open reduction and fixation with K-wire	Persistent pain and tenderness*
9	Foot	Ganglion cyst excision	Ankle	Lateral malleolus fracture/fixation with plate and screw	
10			Foot	Lisfranc injury/screw fixation	
11			Knee	Patella fracture/fixation with Zuggurtung method	
12			Knee	Operated patella fracture with Zuggurtung method/implant removal	Persistent pain and tenderness†
13			Ankle	Operated lateral malleolus fracture with plate and screw/Implant removal	
14			Foot	Hallux valgus/metatarsal osteotomy with screw fixation	
15			Foot	Hallux valgus/metatarsal osteotomy with screw fixation	
16			Thigh	Osteochondroma excision in the distal femur	
17			Foot	Hallux rigidus/cheilectomy	
18			Ankle	Medial malleolus fracture/screw fixation	
19			Ankle	Lateral malleolus fracture/fixation with plate and screw	
20			Foot	Hallux rigidus/cheilectomy	

FHL: Flexor Hallucis Longus; * Soft tissue; † Bone tissue.

TABLE III
Comparison of the results of the WALANT technique during and after surgery

	Group A (n=10)		Group B (n=19)		
	n	Mean±SD	n	Mean±SD	*p*
Postoperative pain onset time (min)		151.0±73.25		160.0±74.73	0.636
Visual Analog Scale pain score		0.60±096		0.44±0.70	0.735
Intraoperative bleeding		1.0±0.66		1.17±1.33	0.701
Additional solution					0.105
+	3		1		
–	7		18		
Use of cautery					0.522
+	3		7		
–	7		12		
Satisfaction with the anesthesia method					0.655
+	10		18		
–	0		1		
Patient's recommendation					0.655
+	10		18		
–	0		1		
Complications					0.633
+	3		3		
–	7		16		
Tourniquet	None		None		

SD: Standard deviation.

cefazolin, we waited for 30 min for the solution to exert its effect, and monitored the patient and started the surgical procedure.

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 23.0 software (IBM Corp., Armonk, NY, USA). Continuous variables were expressed in mean ± standard deviation (SD), while categorical variables were expressed in number and frequency. The Mann-Whitney U test was used for the comparison of paired groups. The Pearson chi-square test was used to compare categorical variables. A p value of <0.05 was considered statistically significant with 95% confidence interval (CI).

RESULTS

Demographic data of the patients and surgery types are shown in Table I. There was no significant difference between the two groups in terms of age (p=0.265), sex (p=0.107), and surgical side (p=0.700). Surgical procedures performed in both groups are given in Table II.

In both groups, surgeries were completed without using a tourniquet. There was no significant difference between the two groups in terms of the amount of intraoperative bleeding at the discretion of the surgeon (p=0.701). Additional solution was needed in three patients in Group A and one patient in Group B (p=0.105). Cautery was used during surgery in three patients in Group A and seven patients in Group B (p=0.522) (Table III).

There was no significant difference in the postoperative pain onset time (p=0.636) and VAS scores (p=0.735) between the groups. All patients in Group A and in Group B, except for one patient in Group B, were satisfied with the anesthesia method (p=0.655).

In Group A, numbness was observed in two patients, and persistent pain and tenderness were observed in one patient in the field where the WALANT was applied. In Group B, skin necrosis developed in one patient, persistent pain and tenderness were observed in two patients. The patient who developed skin necrosis needed flap surgery, and the complaints of the other patients regressed within six months. Complications and surgical indications are also shown in Table II.

DISCUSSION

In this current study, the WALANT technique provided a low bleeding rate without tourniquet and

high patient satisfaction in lower extremity both soft tissue and bone surgeries. It also maintained its effect in the early postoperative period and increased the patient comfort.

The WALANT technique is a valuable method owing to its fast and easy application, patient satisfaction, and reduced health costs.[10] Ahmad et al.[7] included high-risk patients in terms of general anesthesia and obtained good surgical results. Abitbol et al.[6] compared the WALANT technique with regional anesthesia in bone surgery and reported a reduced need for analgesia and a shorter hospital stay. Arık et al.[1] considered the WALANT an alternative method due to favorable surgical results and the absence of possible complications, such as postoperative tourniquet pain and palsy. In addition to these bone surgery studies, on tendon repairing and carpal tunnel syndrome, this technique has been reported as safe and reliable.[8,9]

Thanks to favorable results of WALANT in upper extremity surgery, it has also been used in lower extremity surgery. Pamuk et al.,[2] in a comparative study with regional anesthesia, applied the technique in metatarsal osteotomies and achieved adequate anesthetic efficacy with acceptable pain scores. Bilgetekin et al.,[11] in foot and ankle surgery, achieved good pain control and shorter hospital stay. Simple foot and ankle injuries were managed successfully with WALANT through adequate hemostasis without a tourniquet. In another study, that WALANT could be used in ankle surgery as a safe and reliable method that simplified the preoperative preparation.[12]

In the literature, the successful results of the technique in both soft tissue and bone surgeries in upper and lower extremity studies are encouraging. In this study, we compared the comfort and safety provided by the technique in soft tissue with bone tissue. One of our motivations in the study, was the novel coronavirus disease 2019 (COVID-19) pandemic, which was considered appropriate, as the technique allowed procedures to be performed in an outpatient setting and reduced the anesthesia preparation time.[10]

During the operations, adequate hemostasis was achieved with the appropriate technique without the use of a tourniquet. There was no bleeding that could not be controlled with cautery in both groups. During and after the operation, acceptable pain control was achieved. After the operation, a pain-free period of 3 h on average was provided, while the patient was awake, thereby reducing the need for analgesia. Pain scores and patient satisfaction of soft tissue and bone surgery patients were found to be comparable.

In surgeries where the WALANT technique is applied, additional solution usage may be needed to continue the painless surgery. Li et al.[12] used the WALANT technique in 13 patients with ankle fractures, and additional solutions were needed in two patients. Similarly, we used additional solution in a patient who was operated for a lateral malleolar fracture. The reason for this may be applying the solution to the contralateral cortex of the fibula in the lateral malleolus fracture as described by Bilgetekin et al.[11] is difficult in the preoperative period. In the current study, in Group A, additional solution was needed in three of the foreign body removal surgeries. This was due to the uncertainty of the surgical intervention site and as the foreign body was mobile, and additional solution was required as the procedure progressed into the deep soft tissue.

Complications after the use of WALANT in the lower extremities have been rarely reported. Pamuk et al.[2] reported one superficial infection in 15 patients who underwent metatarsal osteotomy using the WALANT technique. Bilgetekin et al.[11] reported no complications related to the WALANT technique in foot and ankle injuries, Similarly, Li et al.[12] did not report any complications related to the WALANT technique in the treatment of ankle fractures. In the present study, numbness was observed in one of the two patients who underwent foreign body removal, and persistent pain and tenderness were seen in the other. In another patient, numbness developed after removal of the soft tissue tumor. In the group who underwent bony procedures, persistent pain and tenderness developed after the implant removal surgery of a patient who was operated for the patella fracture using the Zuggurtung method and after removal of the plate and screws of a patient who was operated for a fifth metatarsal fracture. Skin necrosis requiring further flap reconstruction surgery developed in one patient who underwent debridement and repair due to Haglund's deformity and calcific tendonitis in the Achilles tendon. Unlike the literature, this is the only case that developed necrosis in the incision site. However, this patient previously underwent surgery due to trauma from the same region, and the previous incision line was used for surgery. Therefore, we believe that the necrosis may have occurred due to the lack of healing capacity of this region, not due to the WALANT technique.

The vasovagal reaction previously reported in the literature may complicate the application of WALANT technique, leading to the patient to reject this method.[16] This is usually due to the discomfort caused by the penetration of the needle. As reported by Li et al.,[12] this complication can be prevented with the "blow slow before you go" technique. Since we applied the same method, we encountered no vasovagal complications. However, it is important to inform the patient in detail before the procedure and to perform it in the preoperative preparation section of the operating room to quickly manage the side effects that may occur.

Nonetheless, this study has some limitations. First, surgeries performed within the groups differ and are not homogeneous. However, our study includes the results of the anesthesia technique, not the results of the surgery. Second, although the operations were performed by different surgeons, the amount of bleeding and other variables were compiled by a single physician. Additionally, the effect of the duration of the surgery on the amount of bleeding or pain was unable to be evaluated. Patients were selected cautiously among patients whose surgeries were thought to be relatively simple and would take shorter time. However, even if the same surgical procedure is applied, it may not be possible to determine this exactly, as the durations of the same surgeries may also differ.

In conclusion, our study results suggest that the WALANT technique is an effective and safe method in selected lower extremity surgeries. It is of utmost importance to apply the technique correctly to prevent complications that may occur. Further large-scale, prospective studies are needed to draw more reliable conclusions on this subject.

Ethics Committee Approval: The study protocol was approved by the Harran University Clinical Research Ethics Committee (date: 04.01.2021, no: E-76244175-050.04.04-4549). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from the parents and/or legal guardians of the patients.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Idea/concept, materials, writing the article, critical review, analysis and/or interpretation, literature review: B.V.Ç.; Design, writing the article, critical review, analysis and/or interpretation, literature review: A.Y.K.; Analysis and/or interpretation, critical review: Ö.O.; Control/supervision, analysis and/or interpretation: M.A.A.; Control/supervision, data collection and/or processing: N.A.; Materials, data collection and/or processing: S.D., M.D.

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