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Patellar fracture fixation using Wide-Awake Local Anesthesia No Tourniquet (WALANT): A novel method

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Abstract

Aim: Patellar fractures, which account for approximately 1% of all fractures, frequently require surgical intervention for significant displacement. Traditional anesthesia methods pose various risks and complications, especially for patients with comorbidities. This study aims to evaluate the safety and feasibility of wide-awake local anesthesia no tourniquet (WALANT) for patellar fracture fixation.

Materials and Methods: A retrospective evaluation was conducted on a total of 8 patients who underwent patellar fracture fixation using the WALANT technique between 2020 and 2022. Patient demographics, clinical findings, and postoperative outcomes were collected. Peroperative pain was assessed using the Numerical Pain Rating Score (NPRS) and Visual Analogue Scale (VAS). Outcomes, including bleeding, complications, and the Lysholm Knee Score at 12 months postoperatively, were evaluated.

Results: The median age at surgery for a total of 8 patients, 6 males and 2 females, was 56 years (range: 38-73). The median surgery duration was 52 minutes (range, 38-73) , and postoperative pain onset was 160 minutes (range, 130-220). Minimal intraoperative bleeding was observed in most cases. Patient satisfaction with WALANT was high, with median VAS scores of 1 (range, 0-3) at 2 hours and 3 (range, 1-5) at 24 hours post-surgery. The median hospital stay was 2 (range, 1-7) days. One patient experienced a superficial skin infection. At 12 months postoperatively, the Lysholm Knee Score indicated satisfactory functional outcomes.

Conclusion: This study is the first to explore WALANT for patellar fracture fixation. WALANT provides safe, effective anesthesia, high patient satisfaction, effective pain management, and shorter hospital stays. It benefits patients with comorbidities and offers an alternative to traditional anesthesia. Further research is needed to validate these findings and support wider use.

Introduction

Patellar fractures, which occur due to excessive tension through the extensor mechanism or a direct blow, are common injuries, constituting approximately 1% of all fractures [1]. They are predominantly observed within the 20–50 age group, with epidemiological studies indicating a twofold higher incidence in men compared to women [2]. For nondisplaced fractures with an intact extensor mechanism, nonsurgical management is the preferred approach. Surgical fixation, on the other hand, is indicated for fractures that disrupt the extensor mechanism or show >2 to 3 mm step-off and >1 to 4 mm displacement [3,4].

Various options are available for surgical and post-surgical anesthesia, including general anesthesia (GA), spinal or epidural anesthesia, and peripheral nerve block [5–7]. Each technique carries its own benefits and risks, as well as costs and the level of special training [8]. In patients with diverse comorbidities who are not suitable candidates for general, spinal, or epidural anesthesia, alternative methods that are less invasive or have fewer systemic effects should be considered. While the risk of anesthesia-related complications is generally low with peripheral nerve block, other risks include peripheral nerve damage, inadvertent vascular puncture, hematoma formation leading to compression, block failure, surgical site bleeding, and systemic toxicity from local anesthetics. Additionally, this technique poses surgical challenges and may not be feasible in every hospital setting [7,9]. Apart from these, with the COVID-19 epidemic, it has been seen that more importance should be given to alternative anesthesia options [10]. The wide-awake local anesthesia with no tourniquet

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(WALANT) technique, initially employed for minor hand and wrist procedures, has expanded to larger surgeries like distal radius fractures, ulna and olecranon fractures, clavicle fractures, and foot-ankle injuries [11–19]. It offers cost-effectiveness, increased patient satisfaction, and reduced risks linked with systemic anesthesia [20]. Additionally, it may minimize the need for postoperative opioid analgesia due to the prolonged effects of local anesthesia after surgery.

To date, only one conference paper has addressed patellar fracture fixation using the WALANT technique, with no further literature available [21]. This study is the first to examine the WALANT technique's application in patellar fracture fixation. Our center adopted WALANT for such fractures due to its potential advantages, making this the inaugural study to do so. The aim was to evaluate the technique's safety and feasibility, hypothesizing that WALANT would ensure high local anesthesia success, effective pain relief, and serve as a viable alternative to other anesthesia methods.

Materials and Methods

A retrospective evaluation was conducted on patients with patellar fractures who underwent surgery using the WALANT technique between 2020 and 2022. Approval for the study was granted by the Institutional Review Board (IRB) of Ankara Training and Research Hospital Ethics Committee (Decision number 46/2024-17.04.2024). Demographic and clinical findings were retrospectively evaluated from the patient charts. Patients eligible for the WALANT technique due to patellar fractures were provided comprehensive information about the technique preoperatively. Patients were informed about anesthesia preferences, advantages and disadvantages of the technique, potential side effects or complications, application of the technique, ambient sounds during surgery, pain scoring, and absence of sedation during the surgery. Patients were also informed that if they were unable to tolerate pain or stress during the surgery, the procedure would be converted to GA. The inclusion criteria consisted of patients over 18 years of age who consented to undergo surgery using the WALANT technique. Exclusion criteria included open fractures, fractures in other bones, and polytrauma. Comorbidities such as cardiovascular disease, pulmonary dysfunction, and coronary artery disease were not regarded as contraindications for WALANT. All patellar fracture fixations under WALANT were performed by a single surgeon.

Anesthetic technique

The WALANT solution was prepared by mixing 50 ml of 2% lidocaine, 40 ml of normal saline, 10 ml of 8.4% $NaHCO_3$, and 1 ml of 1:1000 adrenaline, achieving a concentration of 1% lidocaine and 1:100,000 adrenaline. $NaHCO_3$ was added to raise the pH, improving and prolonging the anesthetic's effect [22]. The maximum lidocaine dose with adrenaline was set at 7 mg/kg based on body weight [23]. Phentolamine was kept available to counteract potential necrosis from epinephrine. Initially, 10 ml of WALANT solution was injected subcutaneously along the incision site with a 27-gauge needle, followed by periosteal and subperiosteal injections along the fracture line and patella borders with a 23-gauge needle. In total, 30 ml of solution was injected subperiosteally in a vertical fashion, with 40 ml administered overall. A minimum 20-minute interval between injections and incisions was observed [24]. Pain was assessed by pinching the skin and manipulating the fracture site; surgery proceeded only if the patient reported a Numerical Pain Rating Score (NPRS) [25] of 0. No tourniquet was utilized during the operation (Figure 1). Patients were continuously monitored by an anesthetist throughout the procedure, who was informed beforehand and remained on standby for potential conversion to GA. If intraoperative pain occurred, additional WALANT solution was injected into the affected area. Standard fracture reduction and fixation techniques were applied using tension band wiring. After fixation, the patient actively moved the affected leg to confirm intraoperative stability (Figure 2). Postoperatively, a long leg splint was used for pain control, and during follow-ups, a hinged knee brace allowed passive joint movement. Patients were permitted partial weight-bearing with the brace locked in full extension.

Evaluations

Objective evaluations were conducted using the NPRS during the injection and intraoperative period, and the Visual Analog Scale (VAS) score for pain in the postoperative period. Throughout the surgery, the patients'

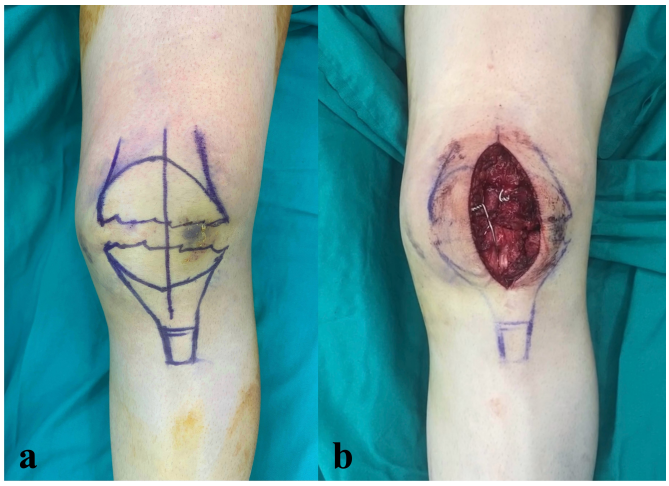

Figure 1. Surgical planning before fixation b. Appearance after fixation.

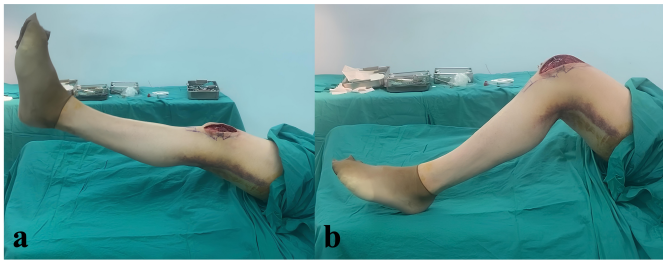

Figure 2. Active knee (a) extension and (b) flexion during surgery.

Table 1. The demographic data of the patients.

	N=8
Age (years)	56 (38-73)
Gender	
Male	6 (75)
Female	2 (25)
Operated side	
Right	5 (63)
Left	3 (37)
Dominant side	
Right	7 (88)
Left	1 (12)
AO/OTA classification	
34 C1	5 (63)
34 C2	2 (25)
34 C3	1 (18)
Comorbidities	
Diabetes mellitus	4 (50)
Hypertension	5 (63)
Cerebrovascular accident	1 (12)
Chronic heart failure	1 (12)
Chronic kidney disease	2 (25)
Time to operation in days	2 (1-3)
Follow-up duration in months	18 (12-30)

Data are presented as n (%) or median (range).

Table 2. Outcomes of the WALANT technique.

	N=8
Duration of surgery (minutes)	52 (38-73)
Postoperative pain onset time (min)	160 (130-220)
Intraoperative bleeding	1 (1-3)
1	6
2	1
3	1
4	0
Satisfaction with the anesthesia method	
Yes	7
No	1
Complications	
Infection	1
Neuropraxia	0
Exchange to general anesthesia	0
Perioperative cardiovascular event	0
Necrosis	0
VAS score	
Postoperative 2nd hour	1 (0-3)
Postoperative 24th hour	3 (1-5)
NPRS	0 (0-3)
Lysholm Knee Score	88 (75-95)
Duration of hospital stay (days)	2 (1-7)
Union time (weeks)	10 (9-14)

Data are presented as n (%) or median (range).

NPRS scores were recorded every 10 minutes, with the highest values accepted as the NPRS score. VAS scores were recorded at the 2nd and 24th hours after surgery. Data recorded included surgery time, onset of postoperative pain, intraoperative bleeding, satisfaction with the anesthesia method and complications. The amount of bleeding in the surgical field was assessed at the discretion of the surgeon (1, bloodless; 2, little blood; 3, bloody field but performable; and 4, bloody field) [25]. Furthermore, the Lysholm Knee Score was assessed and recorded at 12 months postoperatively.

Statistical analysis

Statistical analysis was conducted using SPSS version 22.0 (IBM Corp., Armonk, NY). The Shapiro-Wilk test was employed to assess the normality of continuous data. Since all continuous variables exhibited a non-normal distribution, they were presented as median and range. Due to the descriptive nature of this study, no statistical significance tests were performed.

Results

Eight patients with patellar fractures, including six men and two women, were enrolled in the study. The median age was 56 years (range, 38-73), and the median follow-up period was 18 months (range, 12-30). The average time from trauma to surgery was 2 days (range, 1-3). According to the AO/OTA classification, the initial radiographic examination categorized 5 patients as 34 C1, 2 patients as 34 C2, and 1 patient as 34 C3. Five patients had comorbidities, including diabetes mellitus, hypertension, cerebrovascular accident, chronic heart failure, and chronic kidney disease. The demographic data of the patients are detailed in Table 1. The median surgery duration was 52 minutes (range, 38-73). The median onset time of postoperative pain was 160 minutes (range, 130-220). When the amount of bleeding was observed, it was seen that it was bloodless in six patients, little blood in one patient, and bloody field but performable in one patient. The median VAS scores at the 2nd and 24th postoperative hours were 1 (range: 0-3) and 3 (range: 1-5), respectively. The median hospital stay was 2 days (range: 1-7). One patient developed a superficial skin infection, which was treated with antibiotics, leading to discharge on the 7th postoperative day. No other complications were observed. Seven out of eight patients expressed satisfaction with the anesthetic method used. The only patient who was dissatisfied with the anesthesia method was the one who developed a superficial skin infection, resulting in an extended hospital stay. The outcomes of the WALANT technique are presented in Table 2.

Discussion

The most significant finding of this study is that the WALANT technique can be used effectively and safely in patients with patellar fractures, yielding good clinical re-

sults without causing serious complications.

Originally utilized in upper extremity surgeries, the WALANT technique has also demonstrated success in lower extremity procedures. In a study involving 13 patients, Li et al. reported favorable outcomes with the WALANT technique during open reduction and internal fixation of ankle fractures, noting rapid healing without complications [12]. Pamuk et al., in a comparative study with regional anesthesia, applied the WALANT technique in metatarsal osteotomies and achieved sufficient anesthetic efficacy with acceptable pain scores [26]. Similarly, Wright et al. compared WALANT to general anesthesia in forefoot surgeries, finding that the WALANT technique was well-tolerated by patients and associated with significantly reduced postoperative pain and anxiety [14]. Bilgetekin et al. reported effective pain control and shorter hospital stays with the WALANT technique, providing adequate hemostasis without the need for a tourniquet in surgeries for simple foot and ankle injuries [15]. Bajuri et al. demonstrated that the WALANT technique is a safe and effective method for various lower extremity surgeries, including both soft tissue and bone procedures, with good pain management [27]. In a related study, Çetin et al. confirmed the safety and efficacy of the WALANT technique in soft and bone tissue surgeries of the lower extremity, achieving effective results with low complication rates [28]. In the present study, consistent with prior studies, patellar fracture fixation was safely achieved using the WALANT technique, resulting in short hospital stays and favorable perioperative pain scores. Furthermore, the functional scores obtained at the 1-year follow-up were satisfactory.

Throughout the operations, sufficient hemostasis was accomplished using the appropriate technique without employing a tourniquet, and there was no uncontrollable bleeding. Using a tourniquet for hemostasis can lead to postsurgical tourniquet pain and potential nerve injury if applied for extended periods, whereas the WALANT technique confines hemostasis to the surgical field and injection site, thereby avoiding these complications. Pain related to tourniquets is a recognized contributor to postoperative discomfort in lower extremity surgeries [29]. Effective pain management was achieved both during and following the procedures. After the operations, patients experienced an average of 2,5 hours of pain-free relief while awake, which minimized the need for further analgesia. This period corresponds to approximately 4-6 hours after the initial WALANT injection. Research on the use of WALANT for trigger finger surgeries has shown pain relief lasting an average of 6.86 hours [30]. The avoidance of a tourniquet when employing the WALANT technique may contribute to the observed low postoperative pain scores. Besides the favorable outcomes in terms of pain and functional scores, the most significant advantage of WALANT may be its potential to reduce healthcare costs and shorten waiting times for surgery. An American study comparing the costs of WALANT to general anesthesia (GA) for carpal tunnel syndrome surgery reported an average saving of USD 1320 in healthcare costs. This savings encompassed anesthesia, preoperative, and postoperative expenses [31,32].

Complications associated with the use of WALANT in lower extremity surgeries have been infrequently reported. Pamuk et al. documented only one case of superficial infection among 15 patients who underwent metatarsal osteotomy using the WALANT technique [26]. Bilgetekin et al. reported no complications associated with the WALANT technique in the treatment of foot and ankle injuries, and similarly, Li et al. did not observe any complications in the management of ankle fractures using the same technique [12,15]. In the study by Çetin et al., skin necrosis necessitating a flap procedure was observed in one patient, while a total of six complications, including numbness and tenderness, were observed in five other patients. The skin necrosis was reported to be unrelated to the WALANT technique and attributed to a previous surgery [28]. In the present study, only one patient developed a superficial infection, which required hospitalization for one week, after which the patient was discharged upon completion of the treatment. Furthermore, 7 out of 8 patients in the study were satisfied with the WALANT technique.

One of our driving factors for conducting this study was the increase in surgical waiting times and the accommodation challenges that arose following the 2019 coronavirus pandemic. By utilizing the WALANT technique, patients were discharged sooner, which in turn reduced the occupancy rate of hospital services [33]. Additionally, WALANT offers specific benefits in the surgical treatment of patellar fractures. Since patients remain awake, the surgeon can assess the stability of the fixation under physiological forces and during active knee flexion and extension. This intraoperative evaluation of fixation success is invaluable. However, despite these advantages, surgeons must assess each patient before surgery, as WALANT is not suitable for individuals with psychological disorders or high anxiety levels.

Although WALANT is a new technique for the surgical treatment of patellar fractures, this study had several limitations. Firstly, we did not include a control group using other anesthesia methods. It should be noted that this study represents the first and only case series published in the existing literature; however, it is limited by a small sample size. Further research with larger series is necessary to thoroughly evaluate this anesthesia method. Although there are a minimum of one-year functional follow-up results, the follow-up period does not impact the evaluation of the anesthetic method's success. Nevertheless, good functional scores were obtained at the one-year follow-up. Despite the advantages of the technique, surgeons must assess each patient before surgery, as WALANT is not suitable for individuals with psychological disorders or high anxiety levels. Additionally, five patients in our study had various comorbidities, indicating the need for randomized controlled trials to assess the effects of WALANT in patients with such conditions. Despite these limitations, our findings suggest that patellar fracture fixation under WALANT is a viable anesthesia technique with a high success rate and good patient satisfaction.

Conclusion

The current study is the first in the literature to examine the use of the WALANT technique in patellar fracture fix-

ation. WALANT is a safe and effective technique for the fixation of patellar fractures, offering numerous advantages such as ease of application, cost-effectiveness, and minimal bleeding. Additionally, it is suitable for patients with comorbidities and contributes to shorter hospital stays. However, comparative studies with other anesthesia methods are needed to provide more comprehensive information about the technique's effectiveness.

Ethical approval

Approval was obtained from the Ankara Training and Research Hospital Ethics Committee for this study (Decision number: 46/2024-17.04.2024).

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