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Postoperative pain following ankle block and unilateral subarachnoid block for foot surgeries: A randomised controlled trial

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ABSTRACT

Objectives: The aim of this study is to compare the postoperative pain between the ankle block and the unilateral spinal block following foot surgeries.

Material and Methods: Fifty adult patients who were scheduled to undergo elective foot surgeries and met the inclusion criteria were enrolled in the study. They were randomly assigned into two groups, Group A and Group S, of 25 each using computer-generated random numbers. Group A had surgery under the ankle block using 0.5% plain bupivacaine, while group S had surgery under a unilateral subarachnoid block using 0.5% heavy bupivacaine. The postoperative pain intensity was measured using visual analogue scale (VAS) score.

Results: The data were analysed using Statistical Package of Social Science (SPSS) version 25.0 and were presented using relevant tables and figures. The statistical tests of association were performed with a confidence level of 95%, and a P-value less than 0.05 was considered significant. In the first hour, the VAS score for Group A was 0.96 (± 0.74), while for Group S it was 3.48 (± 0.57), P = 0.000. In the second hour, Group A had a VAS score of 1.40 (± 0.645) while Group S had a score of 4.44 (± 0.65), P = 0.000. At the fourth hour, the VAS score of Group A was 1.52 (± 0.51), while it was 5.64 (± 1.04) for Group S, P = 0.000. At twelfth hour, Group A had a lower VAS score [3.00 (± 0.65)] when compared to Group S [7.52 (± 0.77)], P = 0.000; and at 24th hour, the VAS score was higher for Group S [7.92 (± 0.91)] when compared to that of Group A [3.84 (± 0.63)], P = 0.000.

Conclusion: Ankle block is associated with minimal postoperative pain with lower pain intensity scores compared to unilateral subarachnoid block following foot surgeries.

Keywords: Postoperative Pain, Ankle Block, Unilateral Spinal Block, Foot Surgeries

INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.[1] Pain can be divided into two types: nociceptive or neuropathic. The nociceptive pain arises from the actual or threatened damage to non-neural tissue and is due to the activation of nociceptors. Neuropathic pain, on the other hand, is that which is caused by a lesion or disease of the somatosensory nervous system. Pain provides a protective mechanism to individuals from danger. The following are the advantages of adequate perioperative pain management: patient comfort and satisfaction, early mobilisation, fewer pulmonary and cardiac complications, reduced risk of deep venous thrombosis (DVT), reduced expenses, and overall hospital stay. Postoperative pain assessment is very crucial in surgical patient management. Poor pain assessment by the

managing a team usually leads to inadequate pain treatment, and this realisation has led to an increased awareness of the need to use scales for objective pain measurement.[2] Self-reporting and observational or physiological assessment are commonly used in the field of pain assessment. However, self-reporting remains the gold standard for assessing acute pain.[3] This is because self-report tools enable the patient to describe the intensity of his pain. It also eliminates the possibility of bias due to inter-observer variation.

A study by Wels[4] showed that the postoperative pain management system is inadequate in developing countries, and more so in the third world. In their study, it was revealed that only one out of four patients had adequate postoperative pain relief. This could be due to a lack of skilled manpower or appropriate equipment, and due to the unavailability of drugs. A significant percentage of patients in developing countries lack access to the healthcare system, and a very small percentage of these patients who have access to the health facility cannot afford the financial implications of healthcare.

MATERIAL AND METHODS

This is a prospective, randomised, single-blinded study for patients scheduled for elective foot surgery in our Teaching Hospital. The study was carried out from April 2020 to October 2020 after obtaining approval from the Ethics and Research Committee of the Hospital (UDUTH/HREC/2019/803).

After written informed consent, 50 patients with American Society of Anesthesiologists (ASA) physical status I and II, between the ages of 18 and 60 years, scheduled to undergo elective foot surgeries under regional anaesthesia were included in the study.

Any patient who refused the procedure; patients with a history of drug allergy, infection at the site of the block or coagulopathy; those on anticoagulants and distorted anatomy of the foot or spine; and those with compromised vascular supply to the foot were excluded from the study.

The sample size was determined using the figures from a similar study by Urafalioglu *et al*.,[5] and the minimum sample size per group was 23.

However, 25 patients from each group were studied. Fifty (50) patients with ASA physical status I or II were randomly assigned into two groups, Groups A and S, using computer-generated random numbers. Group A represented the ankle block group, while Group S represented the unilateral subarachnoid block group.

All patients were visited a day before the surgery, during which a detailed pre-anaesthetic evaluation was done. The study protocol was explained, and a written informed consent was also obtained from them. These patients were instructed to fast according to the fasting guidelines. Routine laboratory investigations, including full blood count, serum electrolytes, and urinalysis, were reviewed, and when indicated, electrocardiograph (ECG), blood sugar, and coagulation studies were requested for and reviewed.

The material used for these blocks consisted of the following: sterile gloves, sterile packs, and drapes, different sizes of syringes with 25G hypodermic needle for skin infiltration, 0.5% plain bupivacaine (DepoFoam), 1% lidocaine and 0.5% heavy bupivacaine. All necessary equipment and drugs required for resuscitation and conversion to general anaesthesia were kept ready in case of block failure or toxic reaction to the local anaesthetic agent during the procedure.

The following equipments were used for the study: a pulse oximeter (CAS M. California, USA) to monitor pulse rate and peripheral oxygen saturation, non-invasive blood pressure cuff to monitor the blood pressure using Dash 4000 multiparameter monitor (SAKOMED, Laguna Niguel, USA), a stopwatch to measure onset and duration of sensory block and a visual analogue scale (VAS).

On arrival to the operation room, intravenous access on the hand was secured using a wide-bore cannula for fluid administration. Standard monitoring, including peripheral oxygen saturation (SpO_2), non-invasive blood pressure (NIBP) and electrocardiography (lead II and V_5) were set up. The baseline readings were obtained and recorded subsequently at 5-minute intervals throughout the procedure. The patient was positioned according to the technique of anaesthesia for either ankle block or unilateral subarachnoid block. All patients were given a single dose of intravenous midazolam 1 mg as an anxiolytic before the procedure.

Ankle block was performed by placing the patient in a supine position and keeping the pillow underneath the lower leg to improve access to all five nerves, namely the deep peroneal nerve, superficial peroneal nerve, saphenous nerve, posterior tibial nerve, and the sural nerve. The aseptic technique was adopted, and 4 ml of 0.5% plain bupivacaine was used to block each of these nerves using a 25G, 4 cm hypodermic needle after test aspiration.

A unilateral subarachnoid block was performed by placing the patient in a lateral decubitus position depending upon the site of the surgery and under an aseptic technique. The subarachnoid block was performed using a 25G, 9 cm spotted spinal needle in L_3–L_4 intervertebral space and 7.5 mg of 0.5% hyperbaric bupivacaine was used.

At the end of the surgery, the patients were transferred to the recovery room and VAS scores were observed and recorded at the 1st, 2nd, 4th, 8th, 12th, and 24th hours postoperatively.

Statistical analysis of data obtained from the study was performed electronically using SPSS version 25.0 statistical package. The results obtained were expressed as mean ± SD unless stated otherwise. The VAS scores were taken at equal time intervals, at 1st, 2nd, 4th, 8th, 12th and 24th hours, and were compared between the ankle block and unilateral subarachnoid block groups.

Differences in demographic data and postoperative data between the two groups were determined using the x^2 test and unpaired Student's t-test for non-parametric and parametric variables, respectively. The variables were analysed using the unpaired Student's t-test after a logarithmic transformation to ensure normal distribution. P-value ≤ 0.05 was considered as statistically significant.

RESULTS

The differences in the demographic data, age, sex, weight, and ASA classification, were comparable and statistically not significant in both the two groups [Table 1].

Table 2 compared the mean VAS score for the two groups at 1st, 2nd, 4th, 8th, 12th and 24th hours postoperatively, and all these differences were statistically significant, P = 0.000. The VAS scores for the ankle block group were less than four from the first hour until the 12th hour, indicating adequate postoperative analgesia; while in the unilateral spinal block group, the VAS score ranged from 3.48 at first hour to 7.92 at 12th hour, indicating the increased severity of postoperative pain which meant inadequate analgesia as shown in Figure 1.

Table 1: Demographic and ASA values of Group A and Group S.

	Group A (n = 23) Mean (± SD)	Group S (n = 25) Mean (± SD)	P
Age (years)	38.52 (± 11.66)	35.96 (± 10.83)	0.425
Sex (M, F)	14 (60.9%), 9 (39.1%)	16 (64%), 9 (36%)	0.564
Weight (Kg)	65.56 (± 8.07)	63.96 (± 9.92)	0.535
ASA Status I/II	13 (56.5%), 10 (43.5%)	17 (68%), 8 (32%)	0.382

P ≤ 0.05; the difference was statistically significant, ASA: American Society of Anesthesiologists, M: Male, F: Female.

Table 2: Postoperative pain intensity score of Group A and Group S using VAS.

	Group A (n = 23) Mean (± SD)	Group S (n = 25) Mean (±SD)	P
After 1st hour	0.96 (±0.74)	3.48 (±0.59)	0.000
After 2nd hour	1.40 (±0.65)	4.44 (±0.65)	0.000
After 4th hour	1.52 (±0.51)	5.64 (±1.04)	0.000
After 8th hour	2.12 (±0.44)	6.24 (±1.01)	0.000
After 12th hour	3.00 (±0.65)	7.52 (±0.77)	0.000
After 24th hour	3.84 (±0.63)	7.92 (±0.91)	0.000

P ≤ 0.5; the difference is statistically significant.

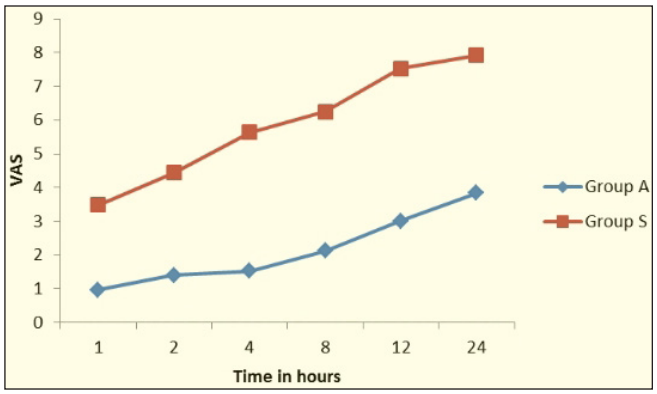

Figure 1: Postoperative VAS score of Group A and Group S.

DISCUSSION

In this study, a good postoperative pain control was achieved by ankle block. The postoperative pain intensity scores were measured using VAS scores at 1st, 2nd, 4th, 8th, 12th and 24th hours postoperatively as shown in Figure 1.

The Visual Analogue Scale is a self-reporting tool used for pain assessment. It is a 10 cm line with two anchors, "no pain" at its start and "worst pain imaginable" at its end. The VAS was originally used by the psychiatrist and was later validated by Huskinson[6] for pain measurement. The patients were guided to place a mark on the VAS at the point that represented their current pain intensity, and the score was determined by the distance between the "no pain" anchor and the patient's mark, which provided a score range of 0–10. The line of VAS can be oriented vertically or horizontally without affecting its sensitivity. A measurement of 0 indicated no pain, 1–3 mild pain, 4–6 moderate pain, 7–9 severe pain, and a score of 10 indicated the worst pain imaginable. A score ≤ 4 is often accepted as indicating adequate analgesia. The VAS is commonly used for pain assessment after surgery because of its simplicity and does not differentiate between the sensory and affective components. The data generated is continuous and, therefore makes analysis easier.

The mean postoperative pain score was significantly lower in Group A compared to Group S (P < 0.05). The relatively lower values of postoperative pain scores in both groups at the 1st and 2nd hours may be due to the residual effect of the anaesthesia, while the relatively higher values at 12th and 24th hours, especially in Group S may be due to the wearing of bupivacaine effect. However, the effect of bupivacaine was expected to have worn out by the 12th hour after the surgery. This could be explained by the fact that almost all patients,

irrespective of the group they belonged to had a dose or more of diclofenac as the first analgesic request.

In this study, lower postoperative pain scores were observed in Group A when compared to Group S at 1st, 2nd, 4th, 8th, 12th and 24th hours, and the difference was statistically significant ($P < 0.05$). These findings were similar to those by Singh *et al*.[7] However, in another study by them,[7] the postoperative pain scores were only recorded at the 2nd, 4th and 6th hours. In contrast to the present study, the postoperativeVAS scores were recorded up to 24 hours postoperatively at intervals. The limitation of measurement of VAS to only 6 hours postoperatively may have affected the outcome of the study by Singh *et al*.[7] Again, there is no information about the type and dose of systemic analgesics used in their study.[7] This is due to the systemic analgesics affecting the VAS scores postoperatively.

Krobot *et al*.[8] also compared pain scores and side effects of unilateral spinal block and popliteal nerve block in patients scheduled for foot surgery and reported that popliteal nerve block provided better postoperative analgesia compared to unilateral spinal block.

Urfalioglu *et al*.[5] also reported similar observations at 6th, 12th and 24th hours postoperatively. However, there were no records of postoperative pain scores at 1st, 2nd, 4th and 8th hours postoperatively. The findings of lower values of postoperative VAS score in patients who had ankle block compared to those who had unilateral spinal block are in agreement with the study findings by Zeineb *et al*.,[9] who evaluated 60 co-operative diabetic patients scheduled for elective foot surgery. In their study, patients who had sciatic nerve block had lower postoperative VAS scores when compared to those who had a unilateral spinal block. In their study, a higher dose, 30 ml of 0.5% bupivacaine was used. In contrast to the present study, 3 and 20 ml of 0.5% bupivacaine were used for unilateral spinal block and ankle block, respectively. The higher dose of bupivacaine in their study may be responsible for lower postoperative VAS scores and prolonged postoperative analgesia. Also, in keeping with this study, VAS was used as a pain assessment tool.

The differences observed between the two studies in pain intensity may be due to the extent of surgical stimulation and painful stimulus associated with a particular procedure because all patients are subjected to a different procedure. For instance, both toe amputation and debridement are foot surgeries, however, the extent of surgical manipulation and painful stimulus is not the same. Therefore, this could be the reason for differences in postoperative pain severity amongst the patients. The findings in this study confirmed that ankle block reduced postoperative pain and minimised the use of systemic analgesics and their complications. It also reduced the complications associated with general anaesthesia.

Karaarslan *et al*.[10] compared the effect of peripheral nerve block and unilateral subarachnoid block for foot surgeries. The postoperative pain scores of patients at 2nd, 4th, 6th, 12th and 24th hours following anaesthetic intervention were assessed using VAS. The VAS scores for the patients at 2nd, 4th, 6th and 12th hours were significantly lower, and these findings were similar to that of the present study. However, the staff nurses were involved in pain assessment. This meant that different people were involved in pain assessment, which may result in significant inter-observer variation and may affect the outcome of the results. In the present study, only one anaesthetist performed pain assessment using VAS, and therefore the chances of inter-observer variation is unlikely in our study.

Muhammed *et al*.[11] performed a similar study where they compared the effects of unilateral subarachnoid block with combined sciatic-femoral nerve block for foot surgeries. The findings were similar to that obtained in our study. However, in their study, they used 0.5% of levobupivacaine and limited their measurement of postoperative pain to only 12 hours. Whereas in our study, we used 0.5% bupivacaine and extended the measurement of postoperative VAS to 24 hours.

Spasiano *et al*.[12] also performed a similar study and obtained similar results. They used a Numerical Rating Scale (NRS) for assessment of postoperative pain scores in contrast to our study where we used VAS. Another difference is that they used a sciatic-femoral block and we used an ankle block.

A similar study Davarci *et al*.[13] compared the effects of unilateral subarachnoid block with peripheral nerve block for foot surgeries. They found that the postoperative VAS scores at 4th, 6th 12th and 24th hours were significantly lower for peripheral nerve block compared to unilateral subarachnoid block, and hence the former required less postoperative systemic analgesia. However, in contrast to the current study, they used 0.5% levobupivacaine while we used bupivacaine.

CONCLUSION

Ankle block is associated with minimal postoperative pain with lower pain intensity scores compared to unilateral subarachnoid block following foot surgeries. We, therefore, recommend it to all patients who are undergoing or scheduled to undergo foot surgeries, provided there are no contraindications.

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Ethical approval

The research/study is approved by the Ethics and Research Committee at UDUTH, number UDUTH/HREC/2019/803.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)–assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)–assisted technology for assistance in writing or editing of the manuscript, and no images were manipulated using AI.

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