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Original Article

A CLINICAL COMPARATIVE STUDY OF ULTRASOUND-GUIDED POPLITEAL NERVE BLOCK WITH 0.5% BUPIVACAINE HYDROCHLORIDE WITH AND WITHOUT 8MG DEXAMETHASONE FOR KNEE SURGERIES

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ABSTRACT

Objective: This study aimed to see how adding dexamethasone 8 mg to 0.5% bupivacaine affected the length of sensory and motor blockage of the popliteal sciatic nerve in ankle and foot surgeries.

Methods: This prospective randomized clinical comparison trial enrolled 60 patients with American Society of Anesthesiologists (ASA) physical status grades III and IV, aged 50-80 y, scheduled for ankle and foot procedures from March 2023 to July 2023. Patients were assigned into two groups of 30 at random. 28 ml of 0.5% bupivacaine and 8 mg dexamethasone were given to Group D. Group N was given 28 ml of o.5% bupivacaine and 2 ml of NS. Here, 20 ml was used for sciatic nerve block and 10 ml for saphenous nerve block.

Results: The mean onset of sensory block in group D was 23.2±6.8 min, while 21.7±6.9 min in group N (p 0.3999). This was not statistically significant. The onset of motor block was 22.9±7.9 in group D and 22.3±7.1 in group N, which were statistically insignificant (p 0.7581). The duration of the motor block in group D was 11.3±3.2 h, whereas it was 5.9±2.3 h in group N (p 0.0001), which was statistically significant. The length of the sensory block in group D was 14.9±3.8 h, while it was 8.3±3.4 h in group N (p 0.0001), which was also statistically significant. The VAS score in group N was significantly higher than in group D; it began 3 h after surgery and remained at 4 h, 5 h, 6 h, 8 h, 10 h, and 12 h. All 30 patients in Group N required their first rescue analgesia during the first 12 h postoperatively. In contrast, only 12 patients (40%) required their first analgesia within the first 12 h, and 18 (60%) requested their first analgesia within the second 12 h.

Conclusion: Adding 8 mg dexamethasone to 0.5% Bupivacaine hydrochloride in ultrasound-guided popliteal and saphenous nerve blocks for ankle and foot procedures extends postoperative sensory and motor block duration.

Keywords: Popliteal nerve block, Ultrasound-guided, In ASA III-IV high-risk patients, 0.5% bupivacaine hydrochloride with dexamethasone postoperative analgesia

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INTRODUCTION

The popliteal nerve block is a regional anesthetic technique used for various foot and ankle surgeries. This type of anesthetic technique has grown in popularity to reduce postoperative pain, reduce narcotic consumption, and increase patient satisfaction. A popliteal nerve block may be used as an anesthetic technique for foot and ankle surgeries. In medically compromised patients, this can be advantageous. The popliteal nerve block may also provide profound analgesia during both the surgical and post-operative periods, as well as the avoidance of systemic problems such as nausea and vomiting. Other advantages include quicker discharge from the post-anesthesia care unit and lower perioperative opioid intake [1]. There is an increase in the success rate with prolonged duration and a decrease in the incidence of complications associated with peripheral nerve blocks with good knowledge of dermatomes, myotomes, and osteotomes of the lower limbs and the use of ultrasound for precise perineural deposition of local anesthetics [2, 3]. Several adjuvants can be utilized to extend the analgesic effect of peripheral nerve block. To increase the duration of analgesia, dexamethasone may be administered intravenously or perineurally [4]. Steroids cause vasoconstriction, which decreases local anesthetic absorption. Dexamethasone inhibits the activity of nociceptive C-fibers by increasing the activity of inhibitory potassium channels on these fibers' glucocorticoid receptors [5]. Dexamethasone administered extra fascicularly does not harm the nerve in any way. Comparing intrafascicular injection to other steroids like hydrocortisone and triamcinolone, virtually little harm is done [6]. Dexamethasone can be an adjuvant to local anesthetics for peripheral nerve block without risk. It is critical to highlight the presence of the saphenous nerve innervating the distal medial portion of the foot and ankle [7]. This is a cutaneous femoral nerve branch. This region may need to be anesthetized separately when working on the dorsomedial aspect of the foot and ankle [7]. Complications from popliteal nerve blocks are infrequent, with reported rates ranging from 0 to 10% [8].

MATERIALS AND METHODS

Patients with ASA physical status III-IV (diabetes, hypertension, hepatorenal disease, ischemic heart disease) aged 50-80 y scheduled for below knee surgeries from March 2023 to July 2023 were enrolled in this prospective study after approval from the Institution's Ethical Committee Government General Hospital, Guntur Medical College Guntur and written informed consent.

Inclusion criteria

1. ASA grade III and IV
2. Age 50-80 y
3. Body Mass Index 18-35 Kg/m^2

Exclusion criteria

1. Patients allergic to local anesthetics
2. Patients on opioids and other analgesics for chronic pain
3. Patients refusal
4. Bleeding diathesis

For the study, 60 patients were allocated and split into two groups of 30 patients each at random. Group D (n=30) received 8 mg of

dexamethasone and 28 ml of 0.5% bupivacaine hydrochloride. Group N (n=30) received 2 ml of NS and 28 ml of o.5% bupivacaine hydrochloride. Here, 10 ml was used to block the saphenous nerve, and 20 ml was utilized to block the sciatic nerve.

Methodology

The popliteal nerve block was performed using the more traditional posterior technique. This procedure includes outlining the popliteal crease and the tendons of the medially located semitendinosus muscle and the laterally located biceps femoris muscle. The midline of the popliteal crease is marked by the semitendinosus and bicep femoris, and the needle entrance point is 7.0 cm proximal and 1.0 cm lateral to the crease [9]. It is vital to remember that the sciatic nerve splits into tibial and common peroneal components 60.5 millimeters, superior to the popliteal fossa [10]. A high-definition ultrasound probe with a frequency range of 5 to 15 megahertz was utilized to outline the anatomy and inject the anesthetic solution circumferentially around the nerve. All patients received a single injection sub sartorial saphenous nerve block and a single injection popliteal sciatic nerve block. With the patient supine, the probe was implanted transversely a few centimeters proximal to the apex of the femoral triangle at the mid-thigh level, which was examined ultrasonographically. The Sartorius muscle was penetrated with a 22G block needle progressed in a plane from the probe's lateral end-10 ml of a local anesthetic mixture with or without dexamethasone, depending on the group. With a short axis view of the sciatic nerve and popliteal vessels, the probe was placed in the popliteal fossa. The sciatic nerve bifurcation was found, and the needle insertion point was indicated on the skin immediately distal. The area where the needle would be inserted was swabbed with 0.5% chlorhexidine in 82% ethanol, and the needle was inserted in-plane from the lateral end of the probe, penetrating the biceps femoris muscle, followed by injection of a total of 20 ml of the local anesthetic mixture with or without dexamethasone, depending on the group.

Monitoring

All the patients were monitored with the following parameters

1. 5 lead ECG
2. SPO2
3. NIBP
4. Respiratory rate
5. VAS score
6. Onset and Duration of sensory and motor Block
7. Time of rescue analgesia

The following parameters were recorded

1. Motor block duration: Following the injection of the complete dosage of LA (time zero), each subject was assessed at the following times. Using the following scale: 0, 5, 10, 15, 20, 30, 60 and 80 min for the onset of motor blockade: (i) No paresis equals 0 points. (ii) 1 point equals paresis. (iii) 2 points equals total paralysis.

2. Sensory block duration: After injection of the solution (time zero), each patient was assessed at the following times: 0,5,10,15,20,30,60, and 80 min for the onset of sensory blockage using the pinprick test (three-point scale): (i) 0 points = painful pinprick sensation (normal sensation). (ii) 1 point = pinprick analgesia (blunted sensation). (iii) 2 dots = pinprick anesthesia (no perception).

3. VAS scores for the first 24 h: The duration of analgesia was recorded according to the visual analog score (VAS) (fig. 1). No pain "0"; Moderate pain "4-6"; Worst pain "9-10". When the patients complained of pain (VAS>4), an IV infusion of Tramadol 1 mg/kg body weight was administered.

4. Time to first analgesic requirement: The time between the administration of the block and the patient's first request for analgesia was recorded.

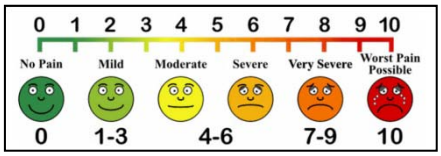

Fig. 1: VAS score

Statistical analysis

The statistical program for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA), was used to analyze the collected data. The mean standard deviation (SD) was used to convey quantitative data. The frequency and proportion of qualitative data were used. If significance was employed while comparing two means, apply an independent-samples t-test. The Chi-square (x2) test of significance was applied to compare the proportions between two qualitative factors. The confidence interval was 95%, while the allowable margin of error was 5%. The P-value of 0.05 was considered significant.

RESULTS

Regarding age, gender, and body weight, there was no statistically significant difference between the two research groups (p>0.05). The onset of sensory block in group D was 23.2±6.8 min, while it was 21.7±6.9 min in group N (p=0.3999). This was not statistically significant. The start of the motor block was 22.9±7.9 in group D and 22.3±7.1 in group N, both of which were statistically insignificant (p 0.7581) (table 2, fig. 2 and fig. 3). The length of the motor block in group D was 11.3±3.2 h, whereas it was 5.9±2.3 h in group N (p=0.0001), which was statistically significant. The length of the sensory block in group D was 14.9±3.8 h, while it was 8.3±3.4 h in group N (p=0.0001), which was also statistically significant. Table 3 and fig. 4 shows the VAS score between the two groups. In group N VAS score was 0.12±0.26 on 3rd postoperative hour and gradually increased to 0.38±0.67, 2.64±1.67, 2.62±1.59, 2.89±1.82, 3.9±1.80, 2.5±1.32, 3.6±1.9, 3.79±1.82. on 4^{th}, 5^{th}, 6^{th}, 8^{th}, 10^{th}, 12^{th}, 16^{th}, 20^{th}, 24^{th} h postoperative period respectively. The VAS was considerably greater in group N compared to group D at 3 h, 4 h, 5 h, 6 h, 8 h, 10 h, and 12 h following surgery. Table 4 and fig. 5 illustrates the duration of analgesia as measured by the visual analog scale (VAS). All 30 patients in Group N required their first rescue analgesia during the first 12 h postoperatively. In contrast, only 12 patients (40%) required their first analgesia within the first 12 h, and 18 (60%) requested their first analgesia within the second 12 h.

Table 1: Demographic data

		Group D (n=30)	Group N (n=30)	p-value
Age	Mean±SD	44.10±8.05	46.40±6.78	>0.05
Gender	Male	20	18	>0.05
	Female	10	12	
Weight	Mean±SD	72±6.4	67±5.3	>0.05

Table 2: Onset and duration of sensory and motor block

	Group D (n=30) mean±SD	Group N (n=30) mean±SD	t-value	p-value
The onset of sensory block (min)	23.2±6.8	21.7±6.9	0.8481	0.3999
The onset of motor block(min)	22.9±7.9	22.3±7.1	0.3094	0.7581
Duration of motor block (hrs)	11.3±3.2	5.9±2.3	7.5053	<0.0001
Duration of sensory block (h)	14.9±3.8	8.3±3.4	7.0895	<0.0001

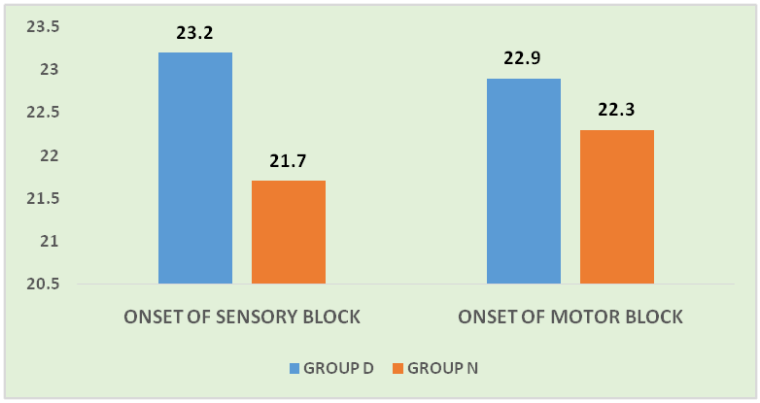

Fig. 2: Onset of sensory and motor block (Min)

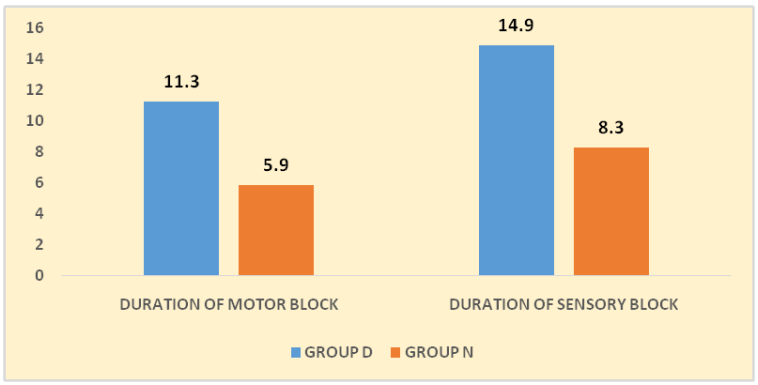

Fig. 3: Duration of motor and sensory block (h)

Table 3: Postoperative vas score between group D and group N

VAS score	Group D (n=30) mean±SD	Group N (n=30) mean±SD	p-value	t-value
1h	0.0±*0.0*	0.0±*0.0*	-	-
2h	0.0±*0.0*	0.0±*0.0*	-	-
3h	0.0±*0.0*	0.12±*0.26*	-	-
4h	0.0±*0.0*	0.38±*0.67*	-	-
5h	0.0±*0.0*	1.21±*1.02*	-	-
6h	0.18±*0.37*	2.64±*1.67*	<0.0001	7.877
8h	0.89±*0.64*	2.62±*1.59*	<0.0001	5.5284
10h	1.92±*1.02*	2.89±*1.82*	0.01	2.5465
12h	2.8±*1.7*	3.9±*1.80*	0.01	2.4335
16h	2.9±*1.6*	2.5±*1.32*	0.29	1.0562
20h	3.2±*1.8*	3.6±*1.9*	0.06	1.8838
24h	3.82±*1.8*	3.79±1.82	0.94	0.0642

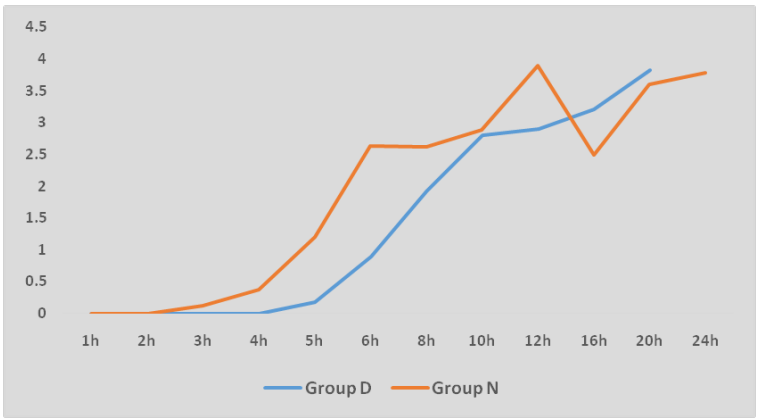

Fig. 4: Postoperative VAS score between group D and group N

Table 4: Comparision of the rescue of analgesia in two groups

The first requirement of analgesia	Group D (n=30)	Group N (n=30)
6h	0	10
8h	0	8
10h	3	9
12h	9	3
16h	13	0
20h	2	0
24h	3	0

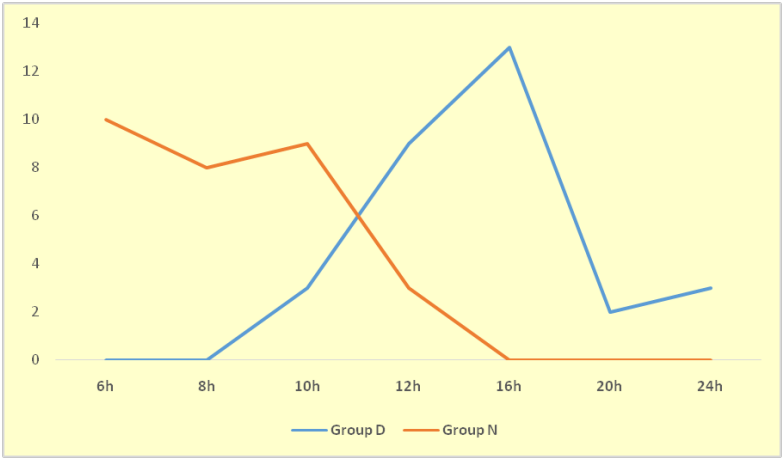

Fig. 5: Comparision of rescue of analgesia in group D and group N

DISCUSSION

Our study's objective was to ascertain if giving patients having ankle and foot procedures dexamethasone 8 mg in addition to 0.5% bupivacaine enhanced the effectiveness of popliteal nerve blocks. Based on the time of the first rescue analgesia demand, the results showed that adding 8 mg of dexamethasone to a solution of 0.5% bupivacaine during popliteal nerve block increased the length and quality of postoperative analgesia. In managing perioperative anesthesia, high-risk patients with sepsis, multi-organ failure, cellulitis, coagulopathy, and other concomitant severe diseases provide a unique challenge. Due to coagulopathy and the instability of hemodynamic parameters, neuraxial blocks can be fatal [11-13]. High morbidity from general anesthesia might include cardiac depression, severe hypotension, and difficulties with mechanical breathing. Several additives have been investigated to extend the duration of nerve blockage. Dexamethasone, for example, has demonstrated encouraging results in postoperative analgesia. Dexamethasone at dosages ranging from 4 to 12 mg has been examined via intravenous and perineural routes, with 8 mg being the most commonly utilized perineurally [11, 12].

In our study, the onset of sensory block was 23.2±6.8 min in group D and 21.7±6.9 min in group N (p 0.3999). This was not statistically significant. The start of the motor block was 22.9±7.9 in group D and 22.3±7.1 in group N, both of which were statistically insignificant (p 0.7581). The length of the motor block in group D was 11.3±3.2 h, whereas it was 5.9±2.3 h in group N (p 0.0001), which was statistically significant. The length of the sensory block in group D was 14.9±3.8 h, while it was 8.3±3.4 h in group N (p 0.0001), which was also statistically significant. Our findings are very well correlated with the results of Hauritz *et al.* [12] studies, which compared the postoperative duration of sensorimotor blockade with either dexamethasone or saline added to bupivacaine-epinephrine. They found that adding 8 mg dexamethasone to 0.5% bupivacaine-epinephrine significantly prolongs the time of sensorimotor popliteal sciatic nerve blockage. Dexamethasone administration considerably extends the duration of analgesia in patients getting low-volume supraclavicular brachial plexus block, according to Alarasan *et al.* [14]. Zhang *et al.* [15] determined that dexamethasone added to local anesthetics in ultrasound-guided transversus abdominis plane (TAP) block was a safe and effective strategy for postoperative analgesia in adult patients undergoing abdominal surgery.

CONCLUSION

To summarize, adding dexamethasone 8 mg to 0.5% Bupivacaine in ultrasound-guided popliteal and saphenous nerve blocks for ankle and foot procedures extends the duration of postoperative sensory and motor block.

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Nil

CONTRIBUTION OF AUTHORS

All authors have contributed equally.

CONFLICTS OF INTERESTS

Declared none

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