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Original Research Article

Effectiveness of Buprenorphine as an Adjuvant to Levobupivacaine for Prolonging Postoperative Analgesia in Popliteal Nerve Block for Below Knee Surgeries

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Abstract

Pain is an expected aspect of the healing process after surgery. This study's objective is to evaluate the postoperative analgesic impact and safety with buprenorphine in lower extremity below knee procedures in addition to levobupivacaine. Sixty patients were split into two groups: Group B (n=30; 24 ml of 0.25% levobupivacaine hydrochloride + 1 ml (300 mcg) of buprenorphine were administered; and Group C (n=30; 24 ml of 0.25% levobupivacaine hydrochloride + 1 ml of normal saline were administered). Each group's postoperative analgesia was examined in terms of the VAS score, the duration of the analgesic, and any complications or side effects. At 16 hours, Group B's VAS score was 38.56±1.79, while Group C's VAS score was 49.46±1.13 (p value 0.001). At 24 hours, the VAS scores for groups B and C were respectively 15.17±1.497 and 15.67±1.714. Hence, we draw the conclusion that buprenorphine is a safe and effective additive to levobupivacaine hydrochloride for the management of postoperative pain.

Keywords: Buprenorphine, Levobupivacaine, Popliteal Nerve Block, Postoperative Analgesia.

Introduction

Unrelieved postoperative pain can have clinical and psychological effects that raise costs, decrease quality of life, and increase morbidity and mortality. A proactive approach combining a variety of therapy modalities is essential to successful and adequate pain management [1]. A benefit of regional anaesthetic is that it provides long-lasting

postoperative pain relief. It is also a cost-effective and safe method. Autonomic, somatic, and endocrine responses are attenuated when postoperative pain is effectively treated. As no one medication has yet been discovered that reduces nociception without causing side effects, it has been standard practice to treat postoperative pain using a multimodal strategy [2,3]. Many medications and adjuvants have been employed, and research is still ongoing to identify new methods and medications that could extend the effectiveness of regional anaesthetic and postoperative pain treatment.

Buprenorphine only partially stimulates opiate receptors as it acts as a partial receptor agonist at the mu receptor. Moreover, it is a mild agonist and antagonist of the delta and kappa receptor, respectively. It has powerful central nervous system analgesic effects [4].

Aim & Objectives

In addition to levobupivacaine, the purpose of the current study was to evaluate the postoperative analgesic impact and safety with buprenorphine following lower limb ankle and foot procedures.

Materials and Methods

After approval from the institutional ethical committee, a prospective study involving 60 ASA grade I and II patients having lower limb ankle and foot procedures was carried out. Patients with ASA physical grades I and II, ages 18 to 65, of either sex, with weights between 50 and 90 kg and heights under 150 cm, who were able to give written informed consent and were scheduled for lower extremity below knee procedures were included.

Uncooperative patients, patients who could not comprehend the pain assessment test, patients with a history of clinically relevant cardiac, respiratory, hepatic, renal, neurological, mental, or metabolic disorder, patients who could not comprehend the VAS assessment, patients with morbid obesity (BMI >35 kg/m2), coagulopathy, patients taking anticoagulants, patients with severe spinal deformities, patients who had an allergy to local anaesthetic, and pregnant patients were excluded from the study.

Groups B of the study cohort received 24 ml of 0.25% levobupivacaine hydrochloride and 1 ml (300 mcg) of buprenorphine, while Group C received 24 ml of 0.25% levobupivacaine hydrochloride and 1 ml normal saline.

Results

In both groups, males made up the majority of the patients (26 in Group C vs. 25 in Group B; p=0.749; not significant).

Patients in Groups B and C were, respectively, 37.90±10.04 and 38.93±12.54 years old on average (p=0.726; not significant).

Table 1: Intra-operative parameters between the groups

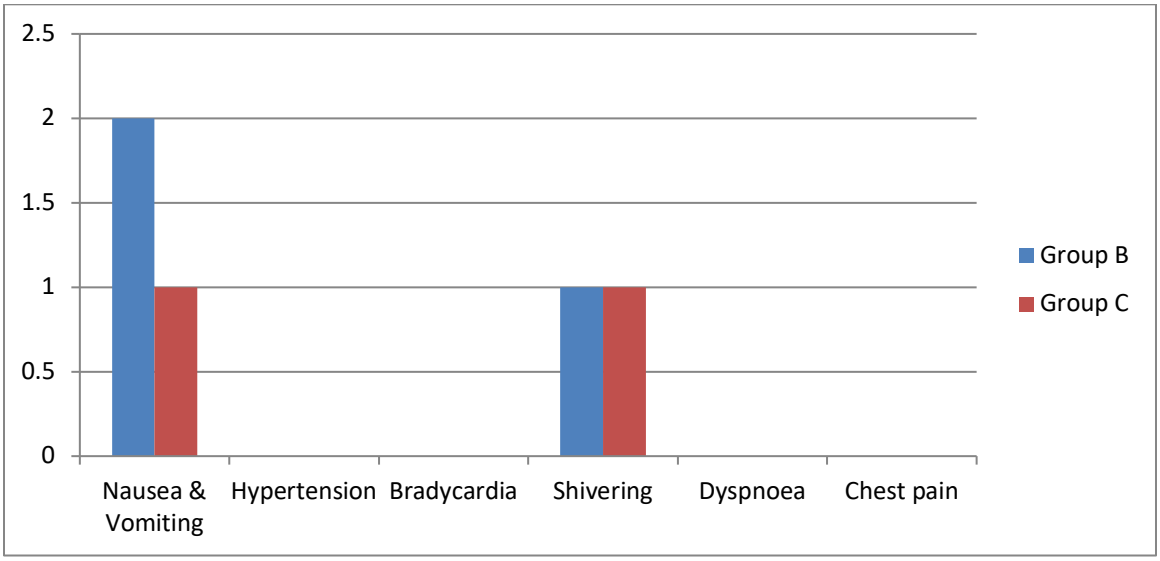
Intra-operative parameters	Group B (n=30) (Mean±SD)	Group C (n=30) (Mean±SD)	P value
Pulse rate (bpm)	86.75±4.20	91.52±15.80	0.115 (NS)
SBP (mmHg)	117.45±23.23	118.74±27.61	0.845 (NS)
DBP (mmHg)	85.53±5.37	86.62±7.61	0.524 (NS)
MAP (mmHg)	82.33±4.91	82.70±5.61	0.786 (NS)
SpO2 (%)	98.57±12.75	97.22±7.08	0.614 (NS)

NS- Not Significant

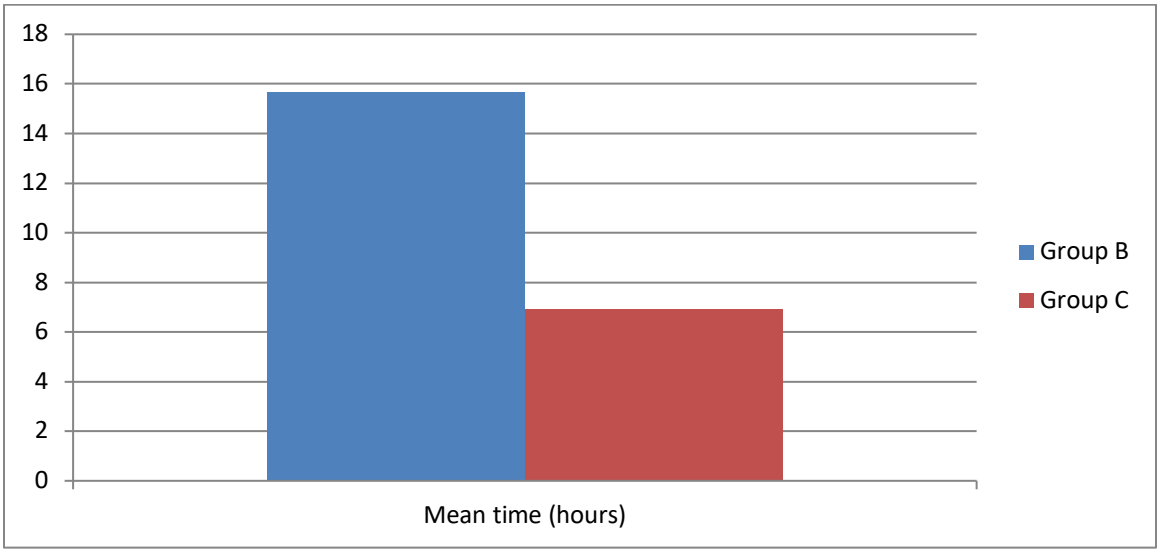
Table 2: Post-operative parameters between the groups

Post-operative parameters	Group B (n=30) (Mean±SD)	Group C (n=30) (Mean±SD)	P value
Pulse rate (bpm)	97.61±2.82	97.95±0.91	0.532 (NS)
SBP (mmHg)	105.53±5.37	107.62±7.61	0.224 (NS)
DBP (mmHg)	72.31±5.57	74.88±5.67	0.081 (NS)
MAP (mmHg)	97.58±2.82	97.95±0.91	0.496 (NS)
SpO2 (%)	97.57±12.75	98.22±7.08	0.808 (NS)

NS- Not Significant



Graph 1: Postoperative complications between groups (data is expressed as number of patients)



Graph 2: Time for first rescue analgesia between groups

At 16 hours, Group B's VAS score was 38.56±1.79, while Group C's VAS score was 49.46±1.13 (p value 0.001). At 24 hours, the VAS scores for groups B and C were respectively 15.17±1.497 and 15.67±1.714. (P=0.233, insignificant)

Discussion

According to reports, pain is the most frequent medical reason for post-ambulatory surgery delays in recovery and discharge, which ultimately results in unanticipated admission and a later delay in returning to work. It is crucial to treat postoperative pain following surgery using traditional medications, such as the maximum dosage of paracetamol, non-steroidal anti-inflammatory medicines, and oral or intravenous opioids with painkillers. However, this has side effects such nausea, sedation, hypotension, decreased lung function, and increased cardiac load. All of these side effects prevent early discharge and recovery [5].

Participants in Group B & Group C had mean ages of 37.90 ±10.04 and 38.93±12.54 years, respectively. Patients in both groups had nearly equal mean (±SD) ages (P>0.05). The mean (±SD) age of the individuals participating in this study was in excellent accordance with that of previous research [6,7]. In the current study, it is clear that men are more likely to have accidents than women, possibly as a result of the nature of their jobs. The investigation was only carried out during regular business hours because all patients were only brought for surgery after the preanesthetic evaluation.

The average intra-operative pulse rate, systolic, diastolic BP and mean arterial pressure, and SpO2 levels were determined to be steady between groups and insignificant statistically (P> 0.05). Due to the withdrawal of the analgesic effects of intraoperatively administered medications, the mean post-operative pulse rate, systolic and diastolic blood pressure, and mean arterial pressure in the groups increased over time but were not statistically significant (P> 0.05). This outcome was consistent with the research done by Jejani *et al*. to determine the efficacy of intrathecal buprenorphine providing postoperative analgesia following caesarean delivery. They discovered that there was no discernible difference between intraoperative and postoperative hemodynamics [6]. The highest VAS score in this study's Group B was at 16 hours (38.56), while the highest VAS score in Group C was at 8 hours (49.46). These results are consistent with those of Seervi *et al*., who investigated the impact of adding buprenorphine or dexamethasone with levobupivacaine for postoperative analgesia in ultrasound-guided transversus abdomen plane blocks. In comparison to perineural dexamethasone, they discovered that levobupivacaine combined with perineural buprenorphine in a TAP block following unilateral inguinal hernioplasty facilitated extended analgesia and decreased need for rescue analgesics, without noticeable adverse effects [7].

This analgesic action of buprenorphine has been attributed to a number of potential modes of action. Buprenorphine is categorized as an antagonist with high binding affinity for the δ and κ-opioid receptors, a partial agonist with weak binding affinity for the opioid receptor 1, and an agonist with high binding affinity for all three. Instead of providing partial analgesia, partial agonism somewhere at μ-opioid receptor produces analgesia comparable to that of full agonists of the μ-opioid receptor. Buprenorphine may also play a special role in mediating analgesic signaling at spinal opioid receptors while having less of an impact on brain receptors than full -opioid receptor agonists, potentially limiting the adverse effects of traditional opioids like euphoria, addiction, or respiratory depression [8]. Buprenorphine's pharmacokinetic characteristics are especially helpful in a clinical context because it can be used by people who need to take other medications, are elderly, have kidney or liver problems, or require concomitant medications due to their metabolic and excretory pathways [9].

It took 15.64 ±4.34 hours and 6.92± 1.24 hours, respectively, to receive first rescue

analgesia in the buprenorphine and control groups. This difference was bigger in the buprenorphine group ($p < 0.01$). In our investigation, we discovered that both groups experienced nausea and vomiting. There were two patients in the buprenorphine group and one in the control group. The incidence was quite similar between the two groups. One patient in each of the groups receiving buprenorphine and the control received intravenous Ondansetron 4 mg to treat postoperative shivering.

Conclusion

Buprenorphine is a good additive for post-operative pain control given in popliteal nerve block along with Levobupivacaine hydrochloride compared to Levobupivacaine alone for post-operative analgesia with minimal post-operative squeals.

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