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Efficacy of pre-emptive peripheral nerve block using 0.25% bupivacaine for postoperative analgesia in patients undergoing maxillofacial surgeries under general anesthesia

Lini Srivastava[1], Soumyadip Pal[2], Saikat Majumdar[3], Soma Chakraborty[4], Kaushal Kabir[5], Manabendra Sarkar[6], Jati Sankar Rudra[7]

[1,2]Senior Resident, [3]Associate Professor, [6,7]Professor, Department of Anesthesiology, Nilratan Sircar Medical College, [4]Associate Professor, Department of Anesthesiology, IPGME and R/SSKM Hospital, Kolkata, West Bengal, [5]Associate Professor, Department of Anesthesiology, M.G.M. Medical College and Hospital, Indore, Madhya Pradesh, India

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ABSTRACT

Background: Conventional analgesia using non-steroidal anti-inflammatory drugs not only provides inadequate pain relief but also can produce a multitude of systemic adverse effects. During oral and maxillofacial surgeries, inhibition of central sensitization by pre-incision nerve blocks with local anesthetic can reduce postoperative pain, may curtail analgesic requirement, and thereby can provide better patient comfort. **Aims and Objectives:** This study aimed to evaluate the effectiveness of pre-incisional peripheral nerve block using 0.25% bupivacaine over placebo for postoperative pain relief in patients undergoing oral and maxillofacial surgery under general anesthesia. **Materials and Methods:** One hundred and twenty patients of 18–35 years of either sex, American Society of Anesthesiologists physical status class I and II had undergone oral and maxillofacial surgeries were divided into two groups to receive bupivacaine 0.25% (Study group, n = 60) normal saline (Control group, n = 60) for nerve block before surgical incision. Postoperative pain was assessed by Visual Analog Scale (VAS) score and verbal response scale (VRS) score. The number of rescue analgesia was required in the first 24 h and the incidence of any complications associated with this agent was documented. **Results:** The VAS score was found considerably lower in the bupivacaine group compared with the control group in the first 24 h of postoperative period ($P < 0.05$). A similar trend was observed with VRS score in the first 16 h of postoperative period ($P < 0.05$). The number of rescue analgesia required in the control group was much higher in comparison with the study group. There was no serious adverse event in both the groups. **Conclusion:** Bupivacaine 0.25% as pre-emptive analgesia can be used to reduce postoperative pain and analgesic requirements in maxillofacial surgeries.

Key words: Pre-emptive; Visual analogue scale; Verbal response scale; Maxillo-facial surgery

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INTRODUCTION

Maxillofacial surgeries are quite common in daily dental practice. These surgeries are relatively invasive and are often associated with postoperative pain, swelling, and trismus which are often frustrating for both patients and surgeons. In particular, postoperative pain increases the suffering and anxiety and can disrupt the circulatory homeostasis and endocrine systems in patients. A conventional method of non-steroidal anti-inflammatory drugs (NSAIDs) not only provides inadequate pain relief but also is associated with several systemic side effects. In these oral and maxillofacial surgeries, central sensitization due to tissue damage can be inhibited by pre-incision nerve blocks with a local anesthetic, thereby reducing post-operative pain and analgesic requirement and providing better patient comfort.

Address for Correspondence:
Dr. Soma Chakraborty, Associate Professor, Department of Anesthesiology, IPGME and R/SSKM Hospital, Kolkata, West Bengal, India.
Mobile: +91-9547032006. **E-mail:** drsoma.chakraborty@gmail.com

Aims and objectives

The present study aimed to evaluate the effectiveness of pre-incision peripheral nerve block using 0.25% bupivacaine over normal saline (placebo) for postoperative pain relief in patients undergoing oral and maxillofacial surgery under general anesthesia. Additionally, any adverse event would be compared.

MATERIALS AND METHODS

After approval by the Institute's Ethics Committee, written informed consent was obtained from each patient. One hundred and twenty patients of 18–35 years of age having either sex, conforming to American Society of Anesthesiologists (ASA) physical status class I and II, scheduled for oral and maxillofacial surgeries were divided into two groups to receive bupivacaine 0.25% (Study group, n=60) normal saline (Control group, n=60) for nerve block before surgical incision. Allocation concealment was done using "sealed envelope" method.

Exclusion criteria

Patients allergic to study drugs, those having a local or systemic infection, severe cardiac and hepatic diseases, smokers, pregnant and lactating women, those who received analgesics or anti-inflammatory drugs 24 h before surgery were excluded from the study. Similarly, those who are very anxious, or having psychiatric illness and thus unable to assess pain according to Visual Analog Scale (VAS) or verbal response scale (VRS) scale were excluded from the study.

The objectives of the study, details of the procedures, and the use of VAS score and VRS score were explained to the patient before the surgery. An allergic test of the local anesthetic was done in the study group. All patients were premedicated with tablet alprazolam 0.25 mg and tablet ranitidine 150 mg night before surgery and kept on fasting for 8 h preoperatively. After shifting the patient to the operating room ASA standard monitor was attached and baseline heart rate, blood pressure, and oxygen saturation (SpO_2) were recorded. After securing a good i.v. access with 18-G cannula injection Ringer's lactate was started. The patient was induced with an injection Propofol 1–2 mg/kg i.v. till abolition of verbal response. Nasotracheal/orotracheal intubation was done after muscle relaxation with succinylcholine 1.5 mg/kg followed by loading dose of atracurium i.v. 0.3–0.5 mg/kg. The patient was maintained with nitrous oxide, oxygen, isoflurane and maintenance doses of atracurium 0.1 mg/kg. Injection Fentanyl 2 μg/kg i.v. was given before induction and 1 μg/kg hourly in the intraoperative period.

The study group received the pre-emptive analgesic 2 mL of 0.25% bupivacaine each in the form of a preincision nerve block appropriate to the type of surgery to be performed. The blocks given were infraorbital nerve block, posterior superior alveolar nerve block, and greater palatine nerve block for the maxillary procedures and mandibular nerve block and inferior alveolar nerve block for the mandible surgery. The control group received a similar injection using 0.9% normal saline. Both injections were given 10 min prior to the planned surgical procedure.

During the surgical procedures oxygen saturation, ECG, heart rates and blood pressure were monitored. All patients were extubated using standard criteria after reversal with neostigmine and glycopyrrolate.

Pain intensity scores on VAS score and VRS score were recorded every 2, 4, 6, 8, 12, 16, and 24 h postoperatively in the surgical ward. Pain intensity at rest and during the function was evaluated using an 11-point VAS ("0"=no pain, 10=worst pain) Since pain is purely a subjective phenomenon in which psychological factor also plays an important role, a five-point VRS was also used to assess the severity of the pain. (0 – No pain, 1 – mild pain, 2 – moderate pain, 3 – severe pain, 4 – very severe pain). If any patient's VAS score was ≥4 then injection diclofenac 75 mg was given deep i.m. as "rescue analgesic" for first 24 h. The number of such rescue analgesia was recorded.

Postoperative adverse events such as nausea, vomiting, gastric acidity, and numbness at the surgical site were recorded.

Statistical analysis

Chi-square test was applied for gender and ASA physical status. Hemodynamic parameters within the group were analyzed with paired t-test. The rest of the variables were analyzed using unpaired t-test. $P<0.05$ was considered statistically significant.

RESULTS

The study spanned over a period of 12 months from April 2015 to March 2016 (EC/MGM/March 15/459) Data from all 120 patients were available for analysis. The demographic parameters were found comparable between the groups (Table 1).

Patient's demographic profile, ASA physical status (Table 1), and baseline hemodynamic variables were statistically comparable in both groups ($P\geq0.05$).

Graph 1 is showing the comparison of the mean VAS score between the two groups at different time intervals. The

VAS was noted at 2 h, 4 h, 6 h, 8 h, 12 h, 16 h and 24 h. In the bupivacaine group, the mean VAS score at 2 h was 2.70±0.67, at 4 h it was 2.32±0.83, at 6 h it was 2.00±0.96, at 8 h it was 2.05±1.02, at 12 h it was 1.55±0.81, at 16 h it was 1.45±1.19 and at 24 h it was 0.93±0.82. In the control group, the mean VAS score at 2 h was 5.77±1.27, at 4 h it was 3.82±0.54, at 6 h it was 4.47±1.11, at 8 h it was 4.52±1.09, at 12 h it was 3.32±0.77, at 16 h it was 2.98±0.43 and at 24 h it was 3.45±0.75. Comparison of VAS scores at different time intervals between the bupivacaine and control groups was found statistically significant (P<0.05), with a higher VAS score in control group than the bupivacaine group.

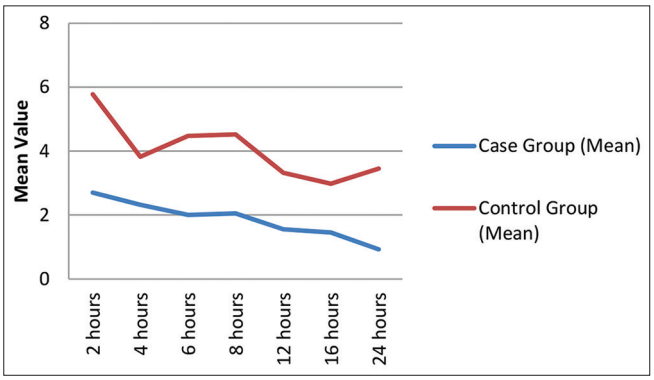
Graph 2 shows a comparison of VRS scores at different time intervals between the bupivacaine and control groups which were found statistically significant (P<0.05) for all the times except for 16 h, with a higher VRS score in control group in comparison to bupivacaine group.

Graph 3 shows the comparison of number of demands of analgesia between the two groups. In the bupivacaine group, the analgesic requirement was nil in 57 (95%) of the patients, 1 time analgesia requirement was seen in 3 (5%) patients. In control group, 9 (15%) patients had required rescue analgesia at 1 occasion, 47 (78.3%) required rescue analgesia at 2 occasions, and 4 (6.7%) patients required rescue analgesia on 3 occasions. The number of analgesia requirements in the control group was much higher than the bupivacaine group.

Table 1: Distribution of patients according to age, gender, and ASA grading in both the group

Parameters	Study group (n=60)	Control group (n=60)	P-value
Age	30.30±7.46	29.95±7.77	0.802
Gender (F/M)	9/51	9/51	1.0
ASA (I/II)	55/5	56/4	0.73

P<0.05 was considered as statistically significant



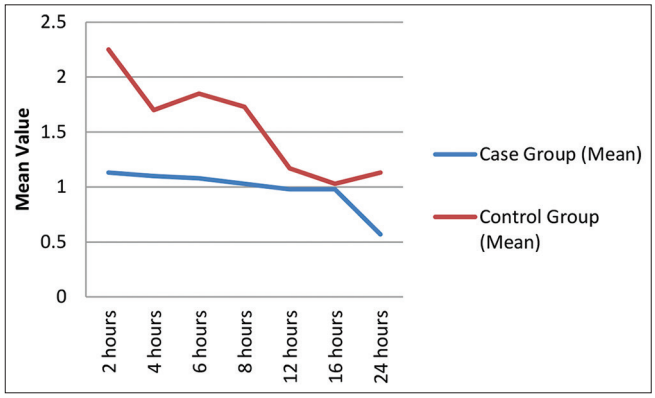
Graph 1: Line diagram showing comparison of VAS score at different time intervals between the two groups. Unpaired t-test applied. P<0.05 was taken as statistically significant

DISCUSSION

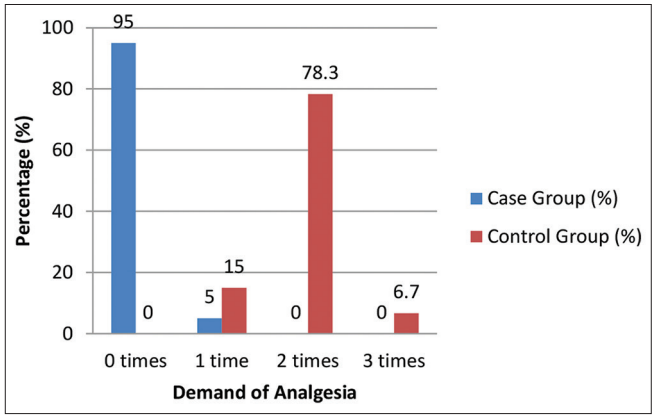
Maxillofacial surgeries are relatively invasive and are often associated with postoperative pain and if treated inadequately or inappropriately, can cause patient discomfort and anxiety.

This study was designed to test the currently popular belief that preoperative measures are helpful in the prevention or modification of the post-operative pain. The use of local anesthetics opiates and NSAIDs have been suggested for this purpose. This benefit of pre-emptive analgesia is not accepted by all because of a lack of clear evidence from clinical studies.[1-3]

In this study, the local anesthetic agent was used as they block nerve conduction in a specific, temporary and reversible manner without affecting the patients' consciousness. Bupivacaine was used as it is easily available, has an intermediate onset of action, long duration of action, allowing slow return to normal sensation which



Graph 2: Line diagram showing comparison of VRS score at different time intervals between the two groups. Unpaired t-test applied. P<0.05 was taken as statistically significant



Graph 3: Bar diagram showing comparison of number of rescue analgesia between the two groups. Z test for two sample proportion applied. P<0.05 was taken as statistically significant (*significant P-value)

has been associated with gradual onset of pain. It has been suggested that long-acting local anesthetics such as bupivacaine could provide additional analgesia time called "rescue analgesia" and minimize the duration of post-operative pain facilitating post-operative care and maintenance of proper oral hygiene. No patients have reported any side effects or cardiotoxicity. Hence, it is safe. The long-acting anesthetics are increasingly finding wide acceptance in oral and maxillofacial surgeries.

Danielsson et al.,[4] compared bupivacaine, lidocaine, and etidocaine as pre-emptive analgesia in oral surgery and concluded that bupivacaine and etidocaine as well as lidocaine were highly effective and without significant difference with regard to pain blocking during surgery, however both long-acting agents were significantly superior to lidocaine in providing the extended duration of post-operative pain control. Comparing the 2 long-acting agents, patients in the bupivacaine group had a significantly longer pain-free period than patients in the etidocaine group. Dionne et al.,[5] conducted a study which supported these findings where, long-acting local anesthetics had an upper hand in the duration of analgesia.

Pain is such a subjective experience that it is extremely difficult to convey or assess its severity. In this study, we have used Visual Analog Scale and a Verbal Rating Scale, which are accepted methods of assessing post-operative pain.[6] Verbal rating scale is simple, more accurate, and suitable particularly for elderly patients or illiterate patients. Compliance is better compared to other complicated tools.

Actual time of onset of block could not be accounted, as the patient was under general anesthesia. So incision was given 10 min after giving the nerve blocks.

Gordon et al.,[7] in their study used 0.5% bupivacaine as pre-emptive analgesia in oral surgery, and VAS score used for assessment of post-operative pain. They had concluded that post-operative pain and analgesia requirements were significantly less in 0.5% bupivacaine group at 48 h. Younessi and Punnia-Moorthy[8] compared between preoperative and postoperative nerve block using 20 mL 0.5% bupivacaine and 1:200000 adrenaline in healthy individuals between age 16 and 40 years presenting for removal of four third molar teeth. Pain assessment was done immediately postoperatively at 4, 8, 16, 24, 48 and 72 h using VAS score. Although the observed pain at 24 h was less in the preoperative nerve block than postoperative nerve block, it was not statistically significant.

VRS scoring was also recorded at the same time intervals as VAS. Comparison of VRS scores at different time intervals between study and control groups was found to be statistically significant ($P<0.05$) for all times except for 24 h with a higher VRS score in control group in comparison to the study group.

The study by Radhika et al.,[9] also concluded that the bupivacaine group patients suffered lesser pain compared to control group but in terms of postoperative VAS score only. Furthermore, the study was carried out on a relatively small sample of 25 patients. In this study, there was no need of rescue analgesia in 95% of patients in the bupivacaine group as compared to 100% rescue analgesia requirement in the control group, which was found to be statistically significant. The findings of this study is corroborative with Radhika et al.,[9] where rescue analgesia was given to 5 (50%) patients in the bupivacaine group 1 time while 10 patients (100%) received analgesia in control group. In the present study 3 patients in the case group (5%) required analgesia 1 time. Whereas in the control group 9 patients (15%) required rescue analgesia at single occasion, 47 patients (78.3%) required rescue analgesia at two occasions and 4 patients (6.7%) required rescue analgesia at 3 occasions.

Mandal et al.,[10] used 2% lidocaine+adrenaline (1:200,000) with and without adjuvant dexmedetomidine via local wound infiltration, 5 min before skin incision for postoperative analgesia for unilateral traumatic maxillofacial surgeries. The study has found that rescue analgesic requirement was significantly earlier in the dexmedetomidine devoid group than the dexmedetomidine group which is similar to our study. Venkatraman et al.,[11] compared the efficacy of pre-emptive and postoperative ultrasound-guided mandibular nerve block using ropivacaine 0.5% for postoperative analgesia in mandibular fracture surgeries (n=60). VAS score was used for pain assessment and time for a request for rescue analgesic was recorded. They found a considerable reduction in VAS scores in preemptive block compared with postoperative block from 8 to 20 h postoperatively. The time for a request for a rescue analgesic was significantly prolonged in pre-emptive block group than postoperative block group. Rescue analgesic consumption was significantly reduced in pre-emptive block than postoperative block. These study findings are corroborative with our studies.

Limitations of the study

The limitation of the technique is that bupivacaine interferes with vasoconstriction required for better operation in surgical field and that it is of less use in patients with emergency surgeries due to presence of tissue edema and inflammation.

CONCLUSION

It is concluded that pre-incisional nerve block with 0.25% bupivacaine is a safe, easily administered, and effective

method to reduce post-operative pain and analgesic requirements in maxillofacial surgeries.

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Authors Contribution:
LS- Literature search, data collection, data analysis, first draft; **SP**- Concept, design, data analysis; **SM**- Study design, analysis and interpretation; **SC**- Concept, design, logical conclusion, revision of first draft; **KK**- Concept, design and daily guidance; **MS**- Literature search and preparation of figures; **JSR**- Coordination and manuscript revision.

Work attributed to:
Department of Anesthesiology, M.G.M. Medical College and Hospital, Indore, Madhya Pradesh, India.

Orcid ID:
Lini Srivastava - https://orcid.org/0009-0008-9032-8072
Soumyadip Pal - https://orcid.org/0009-0001-3236-3039
Saikat Majumdar - https://orcid.org/0000-0002-4368-9990
Soma Chakraborty - https://orcid.org/0000-0003-0253-5183
Kaushal Kabir - https://orcid.org/0000-0002-5141-0187
Manabendra Sarkar - https://orcid.org/0009-0002-9060-1661
Jati Sankar Rudra - https://orcid.org/0009-0006-1892-8773

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