Original Research Article

Comparative study for postoperative analgesia in abdominal surgeries by pre-incisional versus post-incisional wound infiltration of bupivacaine

Priyanshu Sharma[1], Jassa Ram Thakur[2], Lalit Mohan Negi[3]

[1]Department Of Health And Family Welfare Hp Government, Operation Theatre Incharge Civil Hospitaltheog ,District Shimla Himachal Pradesh, INDIA.
[2]Department Of Anaesthesia, SLBSMC Nerchok District Mandi (H.P), INDIA.
[3]Senior Resident Department Of OBG Igmc Shimla, INDIA.
Email: ambikanegi88@gmail.com , priyanshusharma27@gmail.com

Abstract

Background: Abdominal surgeries are common worldwide, with variable postoperative outcomes. Postoperative pain is a common concern among patients, surgeons and anaesthetics. Bupivacaine and ropivacaine are commonly used local anesthetics in wound infiltration due to longer duration of action. In present study we compared pre-incisional and post-incisional wound infiltration of bupivacaine for post-operative pain relief in abdominal surgeries. **Material and Methods:** Study design was hospital-based comparative, interventional study, conducted in patients of 19-50 years of age, either sex, belonging to the American Society of Anesthesiologists Grades I and II, undergoing elective lower abdominal surgeries lasting for not more than 2 h under general anesthesia, willing to participate in study. **Results:** In present study 60 patients were randomly divided into two groups (group A and group B). General characteristics such as age (in years), gender (male/female), weight (in kgs), height (in cms) and ASA status (I/II) were comparable in both groups and difference was not significant statistically. Operative characteristics such as operative duration (in mins) and incision length (in cms) were comparable in both groups while time for first rescue dose (in mins) and number of rescue doses in postoperative 24 hrs. were favorable in preincisional group as compared to post-incisional group and difference was statistically significant. At postoperative 4,8,12,18 and 24 hours, VAS score was less in preincisional group as compared to post-incisional group and difference was statistically significant. **Conclusion:** Better postoperative analgesia as measured by the VAS, was noted in pre-incisional wound infiltration as compared to post-incisional group wound infiltration.

Keywords: Bupivacaine, Post-incisional, Post-operative pain, Pre-incisional, Visual analog scale

***Address for Correspondence:**
Dr Ambika Negi, Indira Gandhi medical college shimla Himachal Pradesh, INDIA..
Email: ambikanegi88@gmail.com

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INTRODUCTION

Abdominal surgeries are common worldwide, with variable postoperative outcomes. Postoperative pain is a common concern among patients, surgeons and anaesthetics. Various modalities of providing postoperative analgesia are being used such as intravenous (IV) nonsteroidal anti-inflammatory drugs (NSAIDs) or opioids, epidural analgesia, regional nerve blocks, and also wound infiltration techniques. As significant proportion of surgical pain originates from the surgical wound, it is meaningful or effective to use local anesthetics at the site of surgery to manage perioperative pain.[1,2] Administration of local anesthetic (LA) into the wound before incision (preemptive analgesia) has been found to reduce

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postoperative pain in surgeries.[3] Recently, local infiltration analgesia (LIA) has emerged as a good choice for postoperative analgesia due to its simplicity and low-cost. LIA has been used in various surgeries with favorable outcomes and without major side effects.[4,5] Wound infiltration technique acts by blocking the transmission of pain from nociceptive afferents directly from the wound surface and also decreases the local inflammatory response to injury.[1,2] Local anesthetic agents have a shorter analgesic effect, which lasts for a few hours; they have minimal sedative effects, and also have fewer side effects like nausea and vomiting commonly encountered after general anaesthesia.[6] Bupivacaine and ropivacaine are commonly used local anesthetics in wound infiltration due to longer duration of action.[7] In present study we compared pre-incisional and post-incisional wound infiltration of bupivacaine for post-operative pain relief in abdominal surgeries

MATERIAL AND METHODS

The study was conducted in the department of anesthesiology of a XXX medical college, XXX. Study design was hospital-based comparative, interventional study, conducted for a period of 1 year (October 2019 to September 2020). The institutional ethical committee approval was taken.

Inclusion criteria

Patients of 19-50 years of age, either sex, belonging to the American Society of Anesthesiologists Grades I and II, undergoing elective lower abdominal surgeries lasting for not more than 2 h under general anesthesia, willing to participate in study.

Exclusion criteria: Patients with organ dysfunction, Allergy to any drug used, Coagulation disorder, Local infection at the site of infiltration.

Preoperatively, all the patients were explained about the study, and written consent was obtained. Then they were explained about the visual analog scale (VAS) to indicate their pain perception by identifying zero as no pain and 10 as worst imaginable pain. Standard preoperative assessment was done. 60 patients were randomly divided into two groups (group A and group B). 20 ml of 0.25% bupivacaine was infiltrated 5 min before incision in group A and 20 ml of 0.25% bupivacaine was infiltrated after skin closure before extubation in group B. A standard general endotracheal anesthesia protocol was used for all patients. The operative procedures performed included were hysterectomy, appendicectomy and hernia repair. All patients were operated by the senior surgeon with minimum experience of 10 years. All patients received one stick of diclofenac suppository postoperatively as per protocol of the center. To evaluate postoperative pain, the patients were asked to rate the intensity of pain using the VAS ranging from 1 (absence of pain) to 10 (worst pain possible) 1 hour after the surgery in the postoperative room and at 3 and 12 hours (Fig. 2). Rescue analgesics injection tramadol 50 mg IM was given when there was severe pain (VAS score >6). The time and dosage of additional analgesia were recorded if administered. Primary outcome was postoperative pain scores using the VAS. Secondary outcomes was additional analgesic requirements. All statistical analysis was done using SPSS version 23. Descriptive statistics, i.e., mean, standard deviation, percentage were described for the variables. To obtain a significant difference for pain scores (VAS) between both groups, both unpaired t test and Chi-square test were used. A p value of 0.05 has been considered as a level of statistical significance.

RESULTS

In present study 60 patients were randomly divided into two groups (group A and group B). General characteristics such as age (in years), gender (male/female), weight (in kgs), height (in cms) and ASA status (I/II) were comparable in both groups and difference was not significant statistically. Operative characteristics such as operative duration (in mins) and incision length (in cms) were comparable in both groups while time for first rescue dose (in mins) and number of rescue doses in postoperative 24 hrs. were favorable in preincisional group as compared to post-incisional group and difference was statistically significant.

Table 1: General and operative characteristics

Parameter	Group A (n=30)	Group B (n=30)	P value
Age (in years)	45.6 ± 11.6	47.1 ± 9.2	0.42
Gender (male/female)	16/14	14/16	0.31
Weight (in kgs)	65.2 ± 11.2	64.2 ± 10.8	0.60
Height (in cms)	164.6 ± 6.9	165.9 ± 5.8	0.67
ASA status (I/II)	19/11	21/9	0.21
Operative duration (in mins)	96.1 ± 19.5	94.4 ± 16.4	0.46
Incision length (in cms)	9.6 ± 3.2	10.2 ± 2.9	0.25
Time for first rescue dose (in mins)	240.3 ± 48.7	152.3 ± 36.67	0.021
Number of rescue doses in 24 hrs.	1.46 ± 0.75	2.45 ± 0.78	0.034

At postoperative 4,8,12,18 and 24 hours, VAS score was less in preincisional group as compared to post-incisional group and difference was statistically significant.

Table 2: Comparison of mean visual analog scale scores

Postoperative time (Hours)	VAS score						*P* value
	Mild (1–3)		Moderate (4–6)		Severe (7–10)		
	Group A	Group B	Group A	Group B	Group A	Group B	
1	30 (100%)	30 (100%)	0	0	0	0	--
4	25 (83%)	19 (63%)	5 (17%)	11 (37%)	0	0	0.012
8	22 (73%)	16 (53%)	7 (23%)	13 (43%)	1 (3%)	1 (3%)	<0.0001
12	17 (57%)	11 (37%)	11 (37%)	15 (50%)	2 (7%)	4 (13%)	<0.0001
18	9 (30%)	5 (17%)	18 (60%)	20 (67%)	3 (10%)	5 (17%)	<0.0001
24	0	0	25 (83%)	17 (57%)	5 (17%)	13 (43%)	<0.0001

DISCUSSION

Effective pain control encourages early ambulation, which significantly reduces the risk of deep vein thrombosis and pulmonary embolism (PE); enhances patient's ability to take deep breaths to decrease the risk of pulmonary complications (e.g., atelectasis and pneumonia); and decreases the incidence of tachycardia and unnecessary investigations related to it. There may also be an increase in the systemic vascular resistance, cardiac work, and myocardial oxygen consumption induced by the stress response. So, improving postoperative pain control has become an increasingly important issue for the surgeon and anesthesiologist.[8,9] The reasons for using LA agents perioperatively are both to block peripheral nociceptive excitation after tissue damage and to prevent the sensitization of the central nervous system. There are two main approaches to local anesthetic wound infiltration. The first is a preemptive model which applies the anesthetic prior to surgical incision. The second model applies the anesthetic immediately prior to surgical closure at the end of the surgical case. The use of continuous infusion of local anesthetics, that is to say a continuous infusion into the surgical site, has been shown to be effective, in the studies examined, but often requires inpatient hospitalization and special infusion devices and thus is more costly.[10,11] With local infiltration or infiltration in the pain sensitive planes, afferent impulses from the site of incision and injury are reduced. This reduces the sensitisation and consequent hyperalgesia. The risks associated with parenteral administration of analgesics, risks associated with central neuraxial block and the injury and injection to surrounding structures in nerve and plexus blocks are avoided. Bupivacaine blocks the generation and conduction of nerve impulses. Therefore bupivacaine was used for infiltration of surgical incisions. Local infiltration of drugs into surgical wounds is considered to be an effective measure in reducing postoperative pain, and a safe method because it does not exert the hemodynamic effects of the drug when administered intravenously.[12] Ejlersen E *et al.*,[13] compared preincisional infiltration with lignocaine with post-incisional administration, and found that preincisional infiltration provide better relief (although insignificantly) from early post-operative pain in elective inguinal hernia procedures. The authors also proposed that inhibition of peripheral sensitisation may have a major role in impeding development of acute pain and thus prevention could be more useful in attenuating post-operative pain. Yashod SD[14] compared efficacy of pre-incisional and post-incisional wound infiltration of bupivacaine for the relief of post-operative pain. The mean duration of surgeries , mean duration of analgesia (time for the requirement of the first dose of analgesic) and mean analgesic requirement (diclofenac sodium, in the post-operative period) were comparable in both groups and difference was not statistically significant. The mean pulse rate, mean SBP and mean respiratory rate were overall significantly less in pre-incisional group as compared to post-incisional group, from 8 h onward. The severity of pain, as measured by the VAS, was significantly less than pre-incisional group than in post-incisional group. Similar findings were noted in present study. In study by Sheetal S J,[15] up to 6 hours all the patients in pre-incisional group and post-incisional group had no pain to mild pain but after 8 hours all patients in pre-incisional group while only 6 patients in post-incisional group had mild pain which was statistically significant. After 10 hours statistically, significant no. of post-incisional group patients had moderate to severe pain compared to pre-incisional group . The mean duration of analgesia in pre-incisional group was 9.6 ± 1.1 hours while it was 8 ±0.8 hours in post-incisional group which was statistically significant. Total no. of analgesic doses required post-operatively was 1.5 ± 0.34 in pre-incisional group while it was 2.4 ± 0.3 in post-incisional group which was again statistically significant. Similarly, the studies by Olanipekun *et al.*[16], Kato *et al.*[17], and Lohsiriwat *et al.*[18] found better analgesia in the pre-incisional infiltration group than in the post-incisional infiltration group. Local anesthetics used in wound infiltration block afferent pain signals from incision site and reduce sensitization of spinal dorsal horn neurons.[19,20] Local anesthetics can inhibit sensitization of nociceptive receptors that can cause inflammatory response. Various studies have shown that infiltration with local anesthetics may reduce interleukin levels and increase substance P in the wound.[21] Neurological toxicity is a manifestation of the cerebral concentration of local anesthetic, and it is thus, caused by

direct intravascular injection or rapid absorption. The maximally tolerated dose before manifestation of central nervous system toxicity is 12–25%, which is much higher than the usual dose that is used for local infiltration.[22] Wound infiltration, administered at the end of surgery during wound closure, results in immediate postoperative pain relief that provides the peak action of infiltrated local anesthetics after extubation. Recent understandings in pre-emptive analgesia have defined it as an intervention given before incision or surgery, given that it is more effective than the same treatment administered after incision or surgery. It is important to remember the timing of pre-emptive analgesia in that it is an antinociceptive treatment given prior to incision or surgery.[23,24]

CONCLUSION

Wound infiltration is safe, effective and inexpensive method of post-operative pain control. It provides immediate analgesia lasting for few hours without major side effects. Better postoperative analgesia as measured by the VAS, was noted in pre-incisional wound infiltration as compared to post-incisional group wound infiltration.

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