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Original Research Article

Pain management and bupivacaine

Anupam Nath Gupta[1]*, Paras Nath[2]

[1]Department of Pharmacology, North Bengal Medical College, Darjeeling, West Bengal, India
[2]Department of Obstetrics and Gynaecology, Siliguri District Hospital, Darjeeling, West Bengal, India

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***Correspondence:**
Dr. Anupam Nath Gupta,
Email: nathguptadranupam@yahoo.com

ABSTRACT

Background: Pain is an unpleasant experience associated with tissue damage. Peripheral tissue injury results in functional disturbances in the nervous system. Modern anaesthesiologists are not only concerned about preoperative and intraoperative care of the patient but also with postoperative welfare of the patient.
Methods: In present study we have compared the efficacy of injection bupivacaine 0.25% infiltration preoperatively versus postoperatively on duration of postoperative analgesia, VAS (visual analogue scale) at the onset of pain, total analgesia requirement in 24 hours. 150 patients belonging to ASA (American society of anesthesiologists) class I and II between the age of 15 and 75 who underwent lower abdominal surgeries belonging to either sex were included in the study. The patients were randomly allocated to three groups. Control group (C) received 20 ml normal saline, preoperative group (A) received 0.25% bupivacaine before incision, postoperative group (B) received 0.25% bupivacaine before closure.
Results: Duration of analgesia, VAS score at the time of first request of analgesia and total doses of analgesia over 24 hours were recorded. The total analgesia requirement was reduced over 24 hours in the group B in which the infiltration was done postoperatively.
Conclusions: The postoperative infiltration with 0.25% bupivacaine produces longer duration and better quality of analgesia as compared to preoperative infiltration.

Keywords: Pain, Postoperative, Bupivacaine

INTRODUCTION

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage.[1] Peripheral tissue injury results in functional disturbances in the nervous system. There is peripheral sensitization by reducing the threshold of tissue noiception (hyperalgesia) and a central sensitization by increasing the excitability of spinal neurons. These two changes together contribute to the tissue injury pain, which manifests as hypersensitivity state found after peripheral tissue injury.[2] Inhibition of these changes (pre-emptive analgesia) has possible role in prevention of postoperative pain.[3] Modern anaesthesiologists are not only concerned about preoperative and intraoperative care of the patient but also with postoperative welfare of the patient.[1] Bupivacaine is a local anaesthetic drug belonging to the amino amide group.[4] Bupivacaine is indicated for local infiltration, peripheral nerve block, sympathetic nerve block and epidural and caudal blocks. It is sometimes used in combination with epinephrine to prevent systemic absorption and extend the duration of action.[5] It is the most commonly used local anaesthetic in epidural anaesthesia during labor as well as in postoperative pain management.[6]

In present study we have compared the efficacy of injection bupivacaine 0.25% infiltration preoperatively versus postoperatively on duration of postoperative analgesia, VAS at the onset of pain, total analgesia requirement in 24 hours.

METHODS

This was a prospective study done in North Bengal Medical College, Darjeeling from March 2019 to July 2019. After obtaining written consent from the 150 patients belonging to ASA class I and II between the age of 15 and 75 who underwent lower abdominal surgeries which included hernioraphy, cholesystectomy, appendicectomy, hysterectomy, LUCS and laparotomies belonging to either sex were included in the study.

Patients were given tablet ranitidine 150 mg and tablet diazepam night before the surgery. On the day of surgery the patients were randomly allocated to either group by a sealed envelope method. In the operating room an IV access was secured and ringer lactate solution was started. A multichannel monitor was attached which recorded the basal NIBP, ECG, SpO_2. All the cases were conducted under general anaesthesia. Induction was done with injection propofol in a dose of 2 ml/kg, tracheal tube was facilitated with injection scoline and anaesthesia was maintained with O_2, N_2O and injection vecuronium, injection tramadol IV was used for intraoperative analgesia. Drug was drawn by one of the team member and surgeon was requested to infiltrate normal saline (control group), injection 0.25% bupivacaine preoperatively (group A), injection 0.25% postoperatively (group B). At the end of the procedure the patients were shifted to the postoperative room and monitored for 24 hours by the staff on duty. Patients were evaluated hourly for first eight hours and then two hourly thereafter for 24 hours for pain, haemodynamics and adverse effect if any. Assessment of analgesia was done on visual linear analogue scale and five point pain score. Duration of analgesia noted on 1st request for analgesia and the time taken was noted. Total dose analgesics was recorded during 24 hours.

The groups were as follows. They were group A: preoperative bupivacain 0.25% infiltration; group B: postoperative bupivacain 0.25% infiltration and group C: control patient getting normal saline.

The demographic profile of the patients were comparable with regards to age and sex. The distribution as per ASA class and type of surgery were similar and comparable in both the groups.

Student t test was applied to calculate the statistical significance.

RESULTS

Table 1 shows that preoperative infiltration with 0.25% bupivacaine provided analgesia for 3.26±0.42 hours. 72% of the patients had analgesia for 4 hours. But none of them had analgesia for more than 9 hours. Duration of analgesia between the control group (group C) and the group A was significant ($p<0.05$). Whereas postoperative infiltration provided analgesia for 5-24 hours in 88% of the patients and 12% were found have analgesia for >24 hours. The mean duration of pain (14.28 hours) as compared to control (2.36 hours) was highly significant ($p<0.001$).

Table 1: Duration of analgesia.

Duration (hrs)	Control		A		B	
	No.	%	No.	%	No.	%
0-4	23	92	18	72	0	0
5-8	02	08	07	28	9	36
9-12	0	0	0	0	4	16
13-24	0	0	0	0	9	36
>24	0	0	0	0	3	12
Mean±SD	2.36±0.36		3.26±0.42		14.28±7.91	
P value			<0.05		<0.001	

Table 2: VAS score at the onset of pain.

VAS	Control		A		B	
	No.	%	No.	%	No.	%
0-2	0	0	1	4	5	20
2.1-4	3	12	4	16	18	72
4.1-6	3	12	15	60	1	4
6.1-8	15	60	3	12	1	4
8.1-10	4	16	2	8	0	0
Mean±SD	6.6±1.73		5.08±1.77		2.84±1.28	
P value			<0.05		<0.001	

Table 3: Total dose of analgesic in 24 hours.

Dose	Control		A		B	
	No.	%	No.	%	No.	%
0	0	0	0	0	7	28
1	0	0	6	24	8	32
2	7	28	9	36	10	40
3	18	72	10	40	0	0
Mean±SD	2.72±0.23		2.16±0.80		0.72±0.90	
P value			<0.001		<0.001	

Table 4: Mean 5 point pain score.

Mean score	Control		A		B	
	No.	%	No.	%	No.	%
1	0	0	6	24	10	40
2	0	0	13	52	12	48
3	5	20	6	24	3	12
4	17	68	0	0	0	0
5	3	12	0	0	0	0
Mean±SD	3.92±0.57		2.48±0.86		1.72±0.67	
P value			<0.001		<0.001	

Table 2 shows that in group C, VAS score at the onset of pain was 6.6±1.732 and 60% of the patients had the score in the range of the postoperative infiltration not only provided longer duration of analgesia but also reduced the VAS score (2.84±1.28) at the time of first request of analgesia as compared to preoperative infiltration (5.08±1.77).

Table 3 shows that the total analgesia requirement was reduced over 24 hours in the group B in which the infiltration was done postoperatively. In the control group (C) 72 % of the patients required 3 doses of analgesia in 24 hours. The mean requirement was 2.72±0.23. In group A 40% of the patients required 3 doses while 24% required just 1 dose. The mean requirement was 2.16±0.80 which was significant ($p<0.01$) as compared to control group (2.72±0.23). In group B none of the patient required 3 doses of analgesia while 12% patients no analgesia. The difference is highly significant ($p<0.001$) as compared to control group.

DISCUSSION

The main aim of postoperative pain relief was to provide subjective comfort, in addition to inhibiting nociceptive impulsive caused by trauma and to blunt autonomic as well as somatic reflexes to pain. Subsequently this might enhance restoration of function by allowing the patient to breathe, cough and to ambulate easily and early. There were many techniques and drugs which were commonly used to provide postoperative pain relief. The use of wound infiltration with local anaesthetic for postoperative pain relief may be an alternative because of its simplicity, safety and low cost. However it was still used inconsistently and randomly by many surgeons and anaesthetists. Despite the number of articles published there was little consensus whether infiltration should be done before the incision or postoperatively. The concept that, infiltration of local anaesthetic before the surgical trauma occurred can reduce the postoperative pain by reducing the central sensitization emerged in 1980s.[8] Since then the technique was widely studied in a vast range of surgical procedures, with conflicting results. Pre-emptive analgesia has been to be effective in limb surgery, arthroscopy and gynaecological laparoscopy.[9,10] It was found to be not so effective in appendectomy, hysterectomy and cervical spine surgery.[11-13] It seemed that results depended upon the anatomical location and depth of the structure.[14] In some cases it can even attenuate postoperative pain.[15] Apart from local infiltration of surgical wound, NSAID, intravenous opioids, ketamine, intra-peritoneal instillation of local anaesthetic and epidural morphine also had been used to demonstrate pre-emptive analgesia. Keeping the concept of pre-emptive analgesia the present study was conducted on various lower abdominal surgeries. The incision line was infiltrated with bupivacaine 0.25% preoperatively and postoperatively. Postoperative pain arose from the interplay of three factors: impulses generated from injured nerve fibers innervating the site of incision/retraction/sutures; inflammatory mediators which were elevated at the surgical site and sensitize uninjured and injured nerve fibers; sensitization of pain transmitting circuits in the spinal cord which increased their responsiveness to painful and non-painful stimuli.

The trauma of incision, compression and stretch from surgical retraction induced impulse firing in peripheral neurons. Tissue damage, bleeding and release of chemo-

attractants from injury sites will foster local inflammation. It also stimulated keratinocytes (the predominant cells of skin) which led to secretion of cytokines and other neuro-active agents causing sensitivity of peripheral tissues and nociception.[7] Blocking of these peripheral nerves innervating the surgical site by local infiltration was a traditional approach for postoperative pain control.[7] Bupivacaine blocked the nerve conduction by decreasing entry of Na+ ions during upstroke of action potential. As the concentration of the LA was increased the rate of rise of AP and maximum depolarization decreased, causing slowing of conduction. Binding of LA prolonged the inactivated state. The channel took longer to recover so the refractory period of the fibre was increased. Arresting nerve was rather resistant to blockade. Blockade developed rapidly when the nerve was stimulated repeatedly. The degree of blockade was frequency dependent, that is, greater blockade occured at higher frequency of stimulation. The result of present study corroborated with the above explanation. There were limitations of individual variation of response to any drug, so further studies were required.

CONCLUSION

In this study we too found that the postoperative infiltration with 0.25% bupivacaine produces longer duration and better quality of analgesia as compared to preoperative infiltration. Bupivacaine block the nerve conduction by decreasing entry of Na+ ions during upstroke of action potential. It decreases postoperative requirement of analgesic drugs. The study will help to further explore the actions of bupivacaine in clinical uses.

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