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A Comparative Evaluation of Epidural Block using Bupivacaine and Lignocaine with Adrenaline Mixture for Lower Abdominal and Lower Limb Surgery

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Abstract

Epidural block is the procedure to block the nerve roots outside the dura. It is the method providing analgesia, reflex flaccidity to muscles, degree of hypotension and ischemia secondary to sympathetic blockade while allowing spontaneous respiration to continue relatively unimpaired. This study was done to observe the onset and duration of sensory and motor block and duration of postoperative analgesia. The study was conducted on 90 indoor patients of either sex belonging to ASA-I & ASA-II, aged 20-70 years scheduled for lower abdominal or lower limb surgery, were randomly allocated in 3 groups of 30 patients each. Group 1 received Epidural block with lignocaine and adrenaline 1.5%, Group 2- Epidural block with bupivacaine 0.375% and Group 3 received Epidural block with lignocaine and bupivacaine mixture in ratio of 1:1. Patients were premedicated with Atropine 0.6 mg, Midazolam 2mg and Pentazocine 30mg intravenously after the epidural block was achieved. They were monitored for pulse rate, respiratory rate, blood pressure, onset of sensory loss, motor paralysis and total duration of sensory and motor block. The onset of sensory (11.9±3.16mins) and motor block (13.2±2.1mins)was earliest in group I and duration of block (261±76mins) was longest in group II

Keywords: Epidural Block; Lignocaine with Adrenaline; Bupivacaine; Lower Abdomen; Lower Limb.

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Introduction

Pain is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Pain results in reflex muscle spasm, increased oxygen consumption, lactic acid production and sympathetic nervous system stimulation. Sympathetic stimulation results in tachycardia, hypertension, increased stroke volume and increased myocardial oxygen consumption. Effective pain control is essential for optimal care of surgical patients. Despite advances in knowledge of pathophysiology, pharmacology of analgesics and the development of more effective techniques for perioperative analgesia, many patients continue to experience distressing pain. Failure to relieve pain is moraly and ethically unacceptable approach to provide perioperative analgesia.

Regional anaesthetic techniques is one of the most important component of this multimodal approach. Regional anaesthesia was a term first used by Cushing Harvey in 1901 to describe pain

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relief by nerve blocks. Introduction of lignocaine in 1948 revolutionized the practice of regional anaesthesia. Regional anaesthetic techniques provide positive respiratory, cardiovascular and neuroendocrine effects. It also reduces the thromboembolic complications, blood loss and convalescence period. Additionally, it produces early ambulation and ideal for outpatient surgery. Regional anaesthetic techniques are useful in patients in whom maintenance of stable heamodynamics is critical. The sympathetic blockade and associated vasodilatation, afterload reduction that occur with central neuroaxial blockade are avoided. Regional techniques for anaesthesia and analgesia of lower limb have been historically regarded as more difficult than those of upper limb. Unlike the upper extremity, the nerve supply to lower extremity is widely separate, originates from both the lumber and sacral plexus. Due to the above mentioned factors, epidural and spinal anaesthesia were the most often used regional anaesthetic techniques for lower extremity surgeries. Although effective, they offer little selectivity for the operated side and regional techniques such as spinal anaesthesia is subjected to a number of side effects such as arterial hypotension, urinary retention and spinal headache. These side effects are undesirable, especially in ambulatory surgery. Previously it appeared that etidocaine will fulfill this requirement. But extremely high lipid solubility of etidocaine may result in a greater uptake of this agent by adipose tissue such as in the epidural space, which again comes fewer molecules to be available for neural blockade compared with bupivacaine. Some data suggest that etidocaine has profound motor blockade than sensory block. For these reasons etidocaine is not preferred in epidural analgesia.

Regional anaesthetic technique such as epidural anaesthesia can be adopted for lower abdominal and lower limb surgery without interfering with function of other organs and systems. Hence it is advantageous in the poor risk patients, emergency cases with uncontrolled systemic disease or when general anaesthesia might be unsuitable and hazardous. The technique itself is simple, effective, quite safe and economical for the lower limb surgery. Epidural block may be used for pain relief during and following surgical procedure, for reduction of bleeding by producing hypotension and to provide relaxation of the abdomen without the use of myoneural blocking drugs.

Aims and Objectives

The aim of the proposed work is to observe the onset and duration of sensory and motor block, changes in vitals, post-operative analgesia and related complications.

Material and Method

This study was conducted on 90 indoor patients of either sex, aged 20-70 yrs of ASA grade I and II proposed for lower abdominal and lower limb surgery and were randomly allocated in 3 groups.

Group I- Epidural block with lignocaine with adrenaline

Group II- Epidual block with bupivacaine

Group III- Epidural block with lignocaine with adrenaline and bupivacaine admixture

Thorough pre-anaesthetic assessment of every patient was done and were advised for routine and special investigations, if any. The nature of the procedure was explained and an informed consent was obtained. Sensitivity test for local anaesthetic agent was done. Patients were advised for 6-8 hrs fasting and tablet alprazolam 0.5 mg was given night before surgery.

In operation theatre, before any block is attempted, an open vein must be guaranteed (by indwelling cannula and drip etc). No block must be attempted without this supremely important precaution. The extradural space may be entered from the midline or laterally with the patient either on the sides or sitting. In midline approach, great care must be taken to insert the needle in sagital plane to minimize injury to extradural veins. Seletion of the needle depends on individual preference, the the *Tuohy* needle is preffered when a catheter is to be inserted. The greater the gauge of the needle, the easier it is to appreciate loss of resistence, but the greater the hole if an inadvertent dural puncture occurs. The tuohy needle is less likely to puncture the dura than a sharper pointed needle. Any easily palpable interspace belowL1/ L2 was chosen, a subcutaneous weal was raised by infiltrating local anaesthetic solution and epiduaral needle was inserted attached with resistance free syringe to appreciate the sudden loss of resistance while advancement of the needle.

Following Points Suggest that the Needle is in the Epidural Space

- Sudden loss of resistance to advancing needle as it leaves the dense ligamentum flavum. (advocated in the study of Dawkins CJM[1]-1969)

- Withdrawal of hanging drop of saline on hub of needle(**Gutierrez's sign**)
- Sudden ease of injection of a little amount of air or liquid from a freely running syringe attached to the needle. If the tip of needle is in ligamentum flavum, the plunger rebounds; if it is in the space, it can be easily pushed. (Sicard and Forestier 1921, Dogliotti 1931)
- Movement of bubble on Odom's indicator, which can be attached to hub of needle.
- By Macintosh's extradural space indicator
- Ultrasonic localization
- Oxford epidural space indicator

Once the epidural space was identified, **test dose** or initial injection of 1ml lignocaine was injected following aspiration test. If there is no evidence of intradural block(inability to move the feet), the main injection was given.

The patient was then turned supine with slight foot end raised, a pillow was placed under the shoulders to achieve the required level of block. Loss of temperature was tested by cold and warm saline in test-tubes. Loss of pain sensation was tested by pin-prick technique. Motor block was tested by deep tendon jerks and it was assessed by using Bromage scale and graded from I-IV

Grade I- free movement of thighs and feet Grade II- just able to move knees, with free movement of feet

Grade III- unable to move knees, with free movement of feet

Grade IV- unable to move legs and feet

Patients were medicated with atropine 0.6mg, midazolam 2mg and pentazocine 30mg. Pulse rate, respiratory rate and blood pressure were observed intraoperatively and in the immediate postoperative period. Follow-up was continued for 3-5 postoperative days to check for side effects and complications, if any.

Observations

Table 1 shows maximum patients were in the age group of 30-40 yrs. Minimum operations were in the age group of 60-70 yrs.

Table 1: Age distribution

Age in yrs	Group I	Group II	Group III
20-30	9	9	7
30-40	13	12	12
40-50	5	6	7
50-60	2	2	4
60-70	1	1	-

Table 2: Sex distribution

	Average weight	Dose (mg/kg)
Group I	48.1 kg	6.25mg/kg
Group II	47.7 kg	1.7mg/kg
Group III	46 kg	3.8mg/kg

Table 3: Average weight and average dose

Sex	Group I No. of cases	%	Group II No. of cases	%	Group III No. of cases	%
Male	10	33.33%	8	26.66%	12	40%
Female	20	66.66%	22	73.33%	18	60%
	30	100%	30	100%	30	100%

Table 4: Changes in pulse rate

	Group I	Group II	Group III
Basal	76.1±5.2	74.6±8.1	75.3±7.4
1 min	81.7±7.28*	74.6±8.1	
5 min	81.7±7.28*	82.1±6.53**	81.9±5.9**
10 min	81.7±7.28*	81.6±8.24**	81.9±5.9**
15 min	80.7±9.6***	81.0±7.6**	81.9±7.43**
20 min	80.7±9.6***	76.3±8.2**	75.8±7.4*
30 min	74.0±7.8*	76.3±8.2**	75.8±7.4*
45 min	66.84±4.1*	72.84±5.9*	72.9±4.9*
End of surgery	66.84±4.1*	72.84±5.9*	72.9±4.9*

***denotes very highly significant(P<0.001)
**denotes highly significant(P<0.01)
*denotes significant(P<0.05)

Table 5: Changes in mean arterial pressure

	Group I	Group II	Group III
Basal	98.89±12.27	98.9±13.4	103.24±13.4
1 min	103.83±11.02	99.7±14.15	100.04±9.05
5 min	95.96±9.15	99.3±14.12	92.5±11.23
10 min	92.69±8.56	95.3±14.60	90.17±11.84
15 min	91.83±8.59	95.03±12.71	95.4±11.65
20 min	92.22±9.04	94.04±10.56	91.04±9.25
30 min	91.97±9.09	93.7±11.27	87.31±14.83
45 min	88.77±7.33	89.4±11.01	93.15±14.83
End of surgery	91.11±9.09	90.9±8.79	91.77±14.13

Table 6:

	Group I	Group II	Group III
Onset of block (min)	11.9±3.16	21.8±3.54	14.3±2.27
Loss of pain sensation (min)	11.3±2.73	18.8±3.20	14.1±1.95
Loss of touch sensation (min)	12.6±2.84	21.7±2.70	14.9±2.70
Loss of cold temp sensation (min)	7.6±1.77	13.0±2.13	10.7±1.51
Loss of warm temp sensation (min)	9.6±1.94	15.6±2.09	12.5±2.16
Duration of block (hrs)	2.35±0.23	4.45±0.83	2.75±0.61

Ratio of male and female patients was 1:2 in this study (Table 2).

This Table 5 shows there was very high significant change in mean arterial pressure in group I after medication and at 45 mins, and at the end of surgery in group I and II.

This Table 6 shows onset which was observed earliest in group I and maximum duration of block in group II.

Discussion

With the increasing age, there is decreased efficiency of various organs in the body due to aging process and by various diseased processes. To avoid the morbidity and mortality rate due to these processes and to avoid hazards of general anaesthesia, regional anaesthesia is the best technique for the various types of operations. Anaesthesia and analgesia is important during intraoperative and postoperative period, as patients undergoing any type of surgical procedure wants painless surgery. Increasing use of local analgesia can be a great help in such circumstances. Various types of blocks for lower abdominal and lower limb surgery are in common use such as field block or regional block, lumber intradural and extradural block.

An ideal local anaesthetic agent should contain properties of quick onset, prolonged duration of analgesia, potent analgesic, should be free from local irritation and with less systemic toxicity. Inspite of availability of several local anaesthetic agents, none of them can be said as an ideal. Hence everlasting search for suitable local anaesthetic agent is continued.

It was observed in this study that dose of local anaesthetic does not depend upon age, sex and height of the patient. The average dose of lignocaine with adrenaline in group I was 6.25mg/kg, while in group II, average dose of bupivacaine was 1.8mg/kg and in group III, average dose of admixture of both drugs was 3.8mg/kg.

The onset of analgesia, defined as time from drug injection to the loss of pain, touch and temperature sensation which was 11.9±3.16 mins in group I, 21.8±3.54 mins in group II and 14.3±2.27 mins in group III. Seow LT et al. (1982) [2] observed analgesia within 12 mins with lignocaine, 16 mins with bupivacaine and 10 mins with mixture of these drugs. Seow LT(1982), DeflqueRJ and Stoelting VK [3] advocated the use of lignocaine with bupivacaine for shortening the latency of long acting local anaesthetic. Magee et al. (1983) [4] observed that the combination of lignocaine and bupivacaine shortened the time to onset of action, compared to bupivacaine alone This observation was well evident in this study as the onset of analgesia in all three groups is almost nearer to the study of Seow et al and Magee et al.

The onset of motor block is defined as the time from the injection of local anaesthetic to onset of motor blockade. The extent of blockade may be complete, partial or nil. Complete motor block was

when the muscles were completely paralysed, partial when the muscular movement persists but are sluggish and nil when there was no muscle paralysis. The mean injection to motor paralysis time in group I was 13.2±2.1 mins, 23.4±2.3 mins in group II and 15.9±2.21 mins in group III. Seow et al. observed time of onset of motor block for lignocaine was 8 mins, 14 mins for bupivacaine and 10 mins for mixture of both drugs. Poor muscle relaxation observed after epidural block with bupivacaine and good muscle relaxation obtained when lignocaine was combined with bupivacaine which have been reported by Braz et al. (1978) [5] and Covino(1986) [6]. There was significant changes in these groups may be due to use of less concentration of drugs in this study.

The quality and extent of sensory and motor block in this study are quite similar to the results of Seow et al[1] showing wide and long lasting acceptance of mixture of both drugs.

The average duration of analgesia in this study was 141±13.98 mins in group I, 261±76 mins in group II and 165±36.74 mins in group III.

In this study, more than one drug was used in combination to take advantage of the useful properties of each drug as it was observed in the studies of Brodsky JB and Brock-Utne JG [7](1978), Moore et al. [8] (1972) and Cunningham and Kaplan [9] (1974).

The requirement of volume of anaesthetic drug is found to be less in caesarean sections and in old age patients in compare to healthy adult patients which was found similar to the study of Bromage PR [10] (1969).

There was no significant change seen in mean pulse rate and respiratory rate in all the three groups. There was highly significant changes in systolic, diastolic and mean blood pressure just after performing epidural block in group I and group III, but no significant change in group II.

Conclusion

It is feasible to conclude by this study that mixture of lignocaine with adrenaline and bupivacaine (equal volume) is superior to bupivacaine alone in epidural block for lower abdominal and lower limb surgery as it has early onset, prolonged analgesia, least toxic and safe.

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