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COMPARISON OF INTRATHECAL BUPIVACAINE VERSUS BUPIVACAINE & FENTANYL IN LOWER LIMB ORTHOPAEDIC SURGERY FOR HAEMODYNAMIC STABILITY AND POSTOPERATIVE ANALGESIA.

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ABSTRACT

Introduction: Trial of comparison of intrathecal bupivacaine versus bupivacaine & fentanyl in lower limborthopaedic surgery for haemodynamic stability and postoperative analgesia.

Material & methods: Study was conducted in 60 ASA grade I & II patient which were randomized into Group I received 3.0ml Bupivacaine intrathecally and 0.5ml normal saline. Group II Patients received 3.0ml bupivacaine + fentanyl 0.5 ml) intrathecally. Continuous monitoring of HR, BP, RR, SPO2 was done during intraoperative & post-operative period upto first requirement of analgesic.

Results: Duration, of analgesia with Bupivacaine alone was in the range of 150-280 minutes. Duration of analgesia was prolonged by addition of fentanyl. Duration of analgesia in group II was in the range of 440-660 minutes. In majority of patients in group 1 it was in the range of 121-240 minutes (n=21, 70%) while in group II, it was in the range of 481-600 minutes in majority of patients (n=18, 60.00%). The difference in mean duration of analgesia among both the groups (I & II) was statistically significant ($p<0.0001$) indicating that addition of fentanyl prolongs the duration of analgesia.

Conclusion: Intrathecal fentanyl with bupivacaine produces excellent surgical analgesia and extended analgesia in postoperative period.Increases intensity and duration of motor blockade Method of pre emptive analgesia avoids the multiple pricks for analgesia in the immediate postoperative period.Patients were sedated and comfortable throughout surgical procedure.

KEYWORDS : .

INTRODUCTION

Spinal anaesthesia is frequently used for lower limb orthopaedic surgeries unless contraindicated. Low cost, easy to practise & abuts the complications associated with general anaesthesia like respiratory complications, nausea & vomiting. It blunts the stress response to surgery, decreases intraoperative blood loss, lowers the incidence of post-operative thromboembolic events, possibly reduce morbidity in high risk surgical patients & serve as a useful method to extend analgesia into the post-operative period.[1] Besides adequate postoperative pain relief will reduce the incidence of pulmonary complication like hypoxemia, hypercarbia, retention of secretions, atelectasis and pneumonia by allowing the patient to take deep breath and cough effectively.

Various methods of postoperative pain relief have been tried:[2]

- Analgesics – Both narcotics and non-narcotics
- Patient controlled analgesia
- Inhalation of analgesic gases and vapours
- Acupuncture
- Hypnosis
- Relaxation techniques
- Regional techniques viz. continuous epidural analgesia, nerve block, extradural and intrathecal drugs.

Recent concern regarding lidocaine neurotoxicity has prompted efforts to find alternatives to lidocaine spinal anesthesia.Small-dose dilute bupivacaine spinal anesthesia yields a comparably rapid recovery profile but may provide insufficient anesthesia. By exploiting the synergism between intrathecal opioids and local anesthetics, it may be possible to augment the spinal anesthesia without prolonging recovery. Attempts to find a suitable and safer agent and technique have been going on steadily. In recent time various drugs are being used via subarachnoid and epidural route to provide optimum conditions for surgery and postoperative pain relief.There have been many attempts in the past to prolong the duration of spinal anaesthesia. [3,4]

Combination of opioids and local anaesthetics intrathecally has been found to be synergistic for somatic analgesia and to markedly enhance analgesic from sub therapeutic doses of spinal lignocaine and intrathecal opioids when combined with intrathecal local anaesthetics, improves the duration of sensory block.[4]

Fentanyl is a synthetic opioid analgesics acting at specific opioid receptors. These opioids are widely used as analgesics to supplement general anaesthesia for various surgical procedures or as primary anaesthetic agents in very high doses during cardiac surgery. Fentanyl and sufentanil especially are administered via infusion for long term analgesia and sedation in intensive care patients.Opioid analgesics are mainly administered using the intravenous route. However, other techniques of administration, including epidural, intrathecal, transdermal and intranasal applications, have been demonstrated.

The pharmacokinetics of the opioid analgesics can be affected by several factors including patient age, plasma protein content, acid-base status and cardiopulmonary bypass, but not significantly by renal insufficiency or compensated hepatic dysfuntion. In addition, pharmacokinetic properties can be influenced by changes in hepatic blood flow and administration of drug combinations which compete for the same plasma protein carrier or metabolising pathway.

Although comparing specific pharmacokinetic parameters such as half-lives is deeply entrenched in the literature and clinical practice, simply comparing half-lives is not a rational way to select an opioid for specific requirements. Using pharmacokinetic-pharmacodynamic models, computer simulations based on changes in the effect site opioid concentration or context-sensitive half-times seem to be extremely useful for selecting an opioid on a more rational basis.[5]

MATERIAL & METHODS

Present study was conducted in our institutes in a prospective randomized double blinded fashion on 60 ASA grade I & II patient in the age group of 20-50 yrs. Informed consent was obtained from all patients followed by their pre anaesthetic check-up where detailed history was taken, patients were physically examined and relevant routine and special investigations were carried out.

Exclusion criteria:-

- Infection at the site of injection.
- Patient refusal.
- Coagulopathy or other bleeding diathesis.
- Severe hypovolemia.

- Increased intracranial pressure.

After securing a suitable peripheral vein, all patients were administered 15ml/kg of ringer's lactate solution. Baseline pulse rate, blood pressure, respiratory rate, sPO^2 and ECG were recorded. The subjects were randomly allocated to 2 groups of 30 each.
Group I - Patients in this group received 3.0ml 0.5%(H) Bupivacaine intrathecally and 0.5ml normal saline.
Group II - Patients in this group received 3.0ml 0.5%(H) bupivacaine + fentanyl 0.5 ml (25µg) intrathecally.

Under all aseptic precautions, lumbar puncture was performed in L_3-L_4 interspace with patients in sitting or lateral position. The drug was injected intrathecally. Immediately after the injection of the drug the patients was turned supine all patients received oxygen at the rate of 4 L/ min via oxygen mask. Continuous monitoring of HR, BP, RR, SPO_2 was done during intraoperative period. Post-operative HR, BP, RR, SPO_2 was observed upto first requirement of analgesic.

Time of onset sensory blockade/ analgesia Sensory analgesia was tested by pin prick method. Absence of response to pin prick was taken as onset of sensory analgesia. The time taken from injection of drug to absence of response to pin prick was recorded as time of onset of sensory analgesia.

Onset of motor blockade This was taken as the time elapsing from injection to failure to raise the lower limb on command.

Degree of motor bock This was assessed by patient's movement of leg, and feet till no further change was observed. This was classified into four grades, according to criteria described by Bromage P.R. and coworkers in 1962. PR, BP and RR were recorded every 5 min till 30th min and then half hourly till the completion of surgery. In postoperative period they were recorded in immediate postoperative period and thereafter at different time intervals. This was recorded as time taken from the onset of the motor blockade to the time when the patient was able to move leg.

Assessment of postoperative pain and pain relief All parameters were studied before shifting the patient to the ward. Strict instructions were written on paper as follows: No narcotics, analgesics and sedatives to be given. Assessment of pain was done by patients themselves, and for this assessment visual analogue scale (VAS) was used. In this study the duration of pain relief was taken as the time from the onset of analgesia to the time when the patient demanded analgesic supplements.

RESULTS

Variation from the base line value and the difference in pulse rate of both the groups during ½ hour to 2 hour duration was statistically significant (p<0.05) The difference in pulse rate after 2 hour duration was statistically insignificant (p>0.05).Suggest that addition of clonidine had altered the pulse rate significantly for initial two hour duration and then returned to baseline value.

Table-1: Comparison of Heart Rate, Blood Pressure & Respiratory Rate

	Variation of Pulse Rate (per minute)		Variation of B.P. (mm Hg)		Variation in Respiratory rate (per minute)	
Period of observation	Group I	Group II	Group I	Group II	Group I	Group II
Preoperative	84.66±9.45	83.86±9.42	126.67±12.13	125±12.52	16.06±0.837	16.47±0.98
½ hour	83.40±9.44	69.73±7.60	114.±11.80	107.4±10.63	16.63±0.67	16.60±0.88
1 hour	84.86±6.39	72.06±7.22	117.33±11.46	109.66±10.25	16.57±0.56	16.07±0.67
2 hours	84.53±6.38	79.86±8.28	120.33±9.99	110.33±9.44	16.73±0.66	16.33±0.67
4 hours	83.60±7.26	81.33±8.39	121.33±8.19	115.67±7.74	16.70±0.59	16.37±0.62
6 hours	83.93±7.03	81.60±7.94	123.33±8.44	118.33±9.49	16.67±0.67	16.33±0.66
8 hours	84.53±6.47	82.73±7.32	124.66±8.99	122.66±8.69	---	----

Variation from the baseline value and the difference in BP of both the groups during ½ hour to 2 hour duration was statistically significant (p<0.05) The difference in BP after 2 hour duration was statistically insignificant (p>0.05).Suggest that addition of fentanyl had altered the BP significantly for initial two hour duration and then returned to baseline value . Variation from the baseline value and the difference in respiratory rate of both the groups during different time interval was statistically insignificant (p>0.05) dictating that addition of fentanyl had not altered the respiratory rate

Table -2: Onset of sensory blockade

On set seconds	Group I		Group II	
	No	%	No.	%
61-120	1	3.33%	3	10%
121-180	18	60.0%	20	66.67%
181-240	10	33.33%	6	20%
241-300	1	3.33%	1	3.33%
Mean	181.16±37.35		172.33±37.17	
Range	100-300		90-280	
T = 1.33 P> 0.05				

Onset of sensory blockade was in the range of 121-180 seconds in majority of patients (n=18, 60%) in group I and (n=20, 66.67%) in group II. The difference in mean onset of analgesia among both the groups was statistically insignificant (p>0.05), indicating that addition of fentanyl had not shortened the onset of sensory blockade.

Table 3:- Onset of motor blockade

On set seconds	Group I		Group II	
	No	%	No.	%
121-180	2.	6.67	2	6.67
181-240	1	3.33	4	13.33
241-300	17	56.67	17	56.67
301-360	5	16.67	5	16.67
361-420	5	16.67	2	6.66
Mean	302±57.97		288.3±53.84	
Range	180-420		180-400	
T = 0.94 p> 0.05				

Onset of motor blockade was in the range of 241-300 seconds in majority of patients in both groups (n=17, 56.67%) in group I and (n=17, 56.67%) in group II. The difference in mean onset of motor blockade among both the groups was insignificant statistically (p>0.05) indicating that addition of fentanyl had not shortened the onset of motor blockade.

Table 4:- Mean visual analogue scale VAS Score

Duration in hours	Group I	Group II
2 hours	15.83±5.58	0±0
4 hours	47.83±6.61	1.67±2.50
6 hours	73±7.83	7.167±8.97
8 hours	83.86±5.45	18.83±16.01

Mean VAS score was significantly lower in group II as compared to group I. The difference between the mean VAS score at different time, among both the groups, was statistically significant (P < 0.001).

Table 5:- Duration of motor blockade

Duration (minutes)	Group I		Group II	
	No	%	No.	%
61-120	1	3.33%	0	0

121-180	19	63.33%	2	6.67%
181-240	10	33.33%	13	43.33%
241-300	0	0	15	50%
Range	150-200		180-300	
Mean	167.5±23.44		244±32.55	
T =10.44 , p > 0.0001				

In majority of patients in group I (n=19, 63.33%) had duration of motor blockade in the range of 121-180 minutes, while only (n=2, 6.67%) patients in group II had motor blockade within this range. In group II majority of patients had duration of motor blockade in the range of 241-300 (50 %).The difference in the mean duration of motor blockade among both the groups was significant statistically (p< 0.00l) indicating that addition of fentanyl prolongs the duration of motor blockade.

Table 6:- Duration of analgesia

Duration (minutes)	Group I		Group II	
	No	%	No.	%
121-240	21	70%	0	0
241-360	9	30%	0	0%
361-480	0	0	03	10%
481-600	0	0	18	60%
601-720	0	0	9	30%
Range	150-310		440-660	
Mean	219±38.45		574±63.17	
T= 26.29; p< 0.0001				

Duration, of analgesia with Bupivacaine alone was in the range of 150-280 minutes. Duration of analgesia was prolonged by addition of fentanyl. Duration of analgesia in group II was in the range of 440-660 minutes. In majority of patients in group 1 it was in the range of 121-240 minutes (n=21, 70%) while in group II, it was in the range of 481-600 minutes in majority of patients (n=18, 60.00%). The difference in mean duration of analgesia among both the groups (I & II) was statistically significant (p<0.0001) indicating that addition of fentanyl prolongs the duration of analgesia.

DISCUSSION

By exploiting the synergism between intrathecal opioids and local anesthetics, it may be possible to augment the spinal anesthesia without prolonging recovery. Attempts to find a suitable and safer agent and technique have been going on steadily. In recent time various drugs are being used via subarachnoid and epidural route to provide optimum conditions for surgery and postoperative pain relief.There have been many attempts in the past to prolong the duration of spinal anaesthesia.

Present study was a prospective randomized double blinded fashion on 60 ASA grade I & II patient in the age group of 20-50 yrs. The subjects were randomly allocated to 2 groups of 30 each.

Group I - Patients in this group received 3.0ml 0.5%(H) Bupivacaine intrathecally and 0.5ml normal saline.
Group II - Patients in this group received 3.0ml 0.5%(H) bupivacaine + fentanyl 0.5 ml (25µg) intrathecally.

Continuous monitoring of HR, BP, RR, SPO_2 was done during intraoperative period. Post-operative HR, BP, RR, SPO_2 was observed upto first requirement of analgesic.Parameters noted were :

1. Time of onset sensory blockade/ analgesia
2. Onset of motor blockade
3. Degree of motor bock
4. Assessment of postoperative pain and pain relief

Similar studies with other adjuvents have been done by many researchers .Gupta R, Verma R et al did a comparative study of intrathecal dexmedetomidine and fentanyl as adjuvants to bupivacaine. Shukla D, Verma A et al did a comparative study of intrathecal dexmedetomidine with intrathecal magnesium sulfate used as adjuvants to bupivacaine.They also studied the onset of sensory and motor responceand compared duration of analgesia .Results were comparable tour studies.[6,7]

Kanazi GE, Aouad MT et al saw effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Mahendru V, Tewari A et al did a comparison of intrathecal dexmedetomidine, clonidine, and fentanyl as adjuvants to hyperbaric bupivacaine for lower limb surgery .It was a double blind controlled study.Theystudied thesame parameters and their resultswere in concensus with ours.[8,9]

In another similar study Buvanendran, Asokumar MD; McCarthy et al studied how intrathecal Magnesium prolongs fentanyl analgesia.It was a prospective, randomized, controlled trial Fifty-two patients requesting analgesia for labor were randomized to receive either intrathecal fentanyl 25 µg plus saline or fentanyl 25 µg plus magnesium sulfate 50 mg as part of a combined spinal-epidural technique. The duration of analgesia of the intrathecal drug combination was defined by the time of patient request for additional analgesia. There was significant prolongation in the median duration of analgesia (75 min) in the magnesium plus fentanyl group compared with the fentanyl alone group (60 min). In a similar study Choi DH et al studied bupivacaine-sparing effect of fentanyl in spinal anesthesia for cesarean delivery. [10,11]

In another study by Kuusniemi et al used bupivacaine and fentanyl for spinal anesthesia for urologic surgeryThey evaluated the effect of 25 µg of fentanyl added to bupivacaine on sensory and motor block. By using a double-blinded study design, 80 men undergoing urologic surgery were randomized into the following four groupsNeural block was assessed by using pinprick and a modified Bromage scale. The degree of motor block was more profound in Group II compared with Group I at the end of operation. In Group IV, there was no motor block at the end of operation in any of the patients. The median level of the upper limit of the sensory block was higher than T_7 in all groups before the start of surgery.The results were found to be comparable with our study. **[12]**

Kararmaz A, Kaya S, Turhanoglu S, Ozyilmaz MA et al did their study on low-dose bupivacaine-fentanyl spinal anaesthesia for transurethral prostatectomy. They evaluated the effect of low-dose bupivacaine plus fentanyl administered intrathecally in elderly patients undergoing transurethral prostatectomy The addition of fentanyl 25 µg to plain bupivacaine 4 mg provides adequate analgesia for transurethral prostatectomy with fewer side-effects in elderly patients when compared with the conventional dose of bupivacaine.By using very small doses of local anaesthetic, one can limit the distribution of spinal block, but low dose bupivacaine cannot provide an adequate level of sensory block. Intrathecal opioids enhance analgesia from subtherapeutic dose of local anaesthetic and make it possible to achieve successful spinal anaesthesia with lower doses.[13]

Ben- David, Bruce Md; Solomon et al used intrathecal fentanyl with small-dose dilute bupivacaine and concluded that it provides better anesthesia without prolonging recovery.
They randomized fifty patients undergoing ambulatory surgical arthroscopy into two groups receiving spinal anesthesiawith 3 ml 0.17% bupivacaine in 2.66% dextrose without (Group I) or with (Group II) the addition of 10 micro g fentanyl. Median block levels reached T7 and T8, respectively (P = not significant [NS]). Mean times to two-segment regression, S2 regression, time out of bed, time to urination, and time to discharge . The addition of 10 micro g fentanyl to spinal anesthesia with dilute small-dose bupivacaine intensifies and increases the duration of sensory blockade without increasing the intensity of motor blockade or prolonging recovery to m icturition or street fitness.[14]

SpencerS. Liu, MD; HughW. Allen, MD et al saw the effect **of *Analgesia with Bupivacaine and Fentanyl on Hospital Wards* .It**

was a Prospective Experience with 1,030 surgical patientshigh-quality postoperative pain relief is a goal of both national health policy and the specialty of anesthesiology. In comparison, previous prospective surveillance studies determining the efficacy and safety of conventional epidural analgesia techniques have enrolled 614–4,227 patients. .[15]

Similar studies were done by Glass, P. S. A. MB, BCh; Estok, P. MD; Ginsberg, et al who Used Patient-Controlled Analgesia to Compare the Efficacy of Epidural to Intravenous Fentanyl Administration. Fentanyl, unlike morphine, is highly lipophilic and rapidly diffuses out of the epidural space. Respiratory depression is, therefore, unlikely when fentanyl is given epidurally There were also no significant differences in the cumulative dosage of fentanyl within each group (epidural vs IV) or between the groups. [16]

CONCLUSSION

1. Intrathecal fentanyl with bupivacaine 0.5% heavy produces excellent surgical analgesia and an extended analgesia in postoperative period.It also increases intensity and duration of motor blockade.
2. This method can be considered as a method of pre emptive analgesia avoids the multiple pricks for analgesia in the immediate postoperative period.
3. Fentanyl treated patients were sedated and comfortable throughout the surgical procedure, thus avoidance of any other medication.
4. Intrathecal fentanyl causes clinically significant reduction in pulse rate and mean blood pressure intraoperativelywhich returned to baseline value after 2hrs.
5. By exploiting the synergism between intrathecal opioids and local anesthetics, it may be possible to augment the spinal anesthesia without prolonging recovery.

Thus on the basis of our study we advocate the use of injection fentanyl 25µg with injection bupivacaine 0.5% intrathecally for prolonged postoperative analgesia in lower limb surgeries with minimum side effects and better patient comfort.

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