

A comparative study of efficacy of epidural versus interpleural bupivacaine for post operative analgesia after open cholecystectomy

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ABSTRACT

Background

The conventional methods of administering the prescribed doses of intramuscular or intravenous analgesics at fixed time intervals results in widely fluctuating and inadequate plasma level leads to poor post operative pain relief. Despite all advances made in the field of medicine, this symptom called "Pain" has not been combated well.

Objective

The present study was carried out to compare the efficacy of epidural verses interpleural administration of bupivacaine(0.5%) with adrenaline for post operative pain relieve in patients undergoing open cholecystectomy.

Methods

We prospectively randomized and compared the post operative pain relieve with the reference of visual analog score (VAS) in patients undergoing elective open cholecystectomy in college of medical sciences-teaching hospital, Bharatpur, Chitwan. Forty adult patients undergoing elective cholecystectomy were divided into two groups. Twenty patients in each group were subjected to a different technique of post-operative analgesia, namely thoracic epidural and interpleural instillation of 0.5% bupivacaine. These two groups were then compared in relation to changes produced in the pain scores, vital parameters and complication and side effects associated with the two techniques. The study was conducted for 24 hour postoperatively.

Observation:

Both thoracic epidural and interpleural instillation of 0.5% bupivacaine compared favorably with regard to analgesia in the present study. In general, the pain relief following thoracic epidural was more complete compared to interpleural but this was not clinically significant.

Conclusion

The present study shows that both the techniques are equally effective in providing analgesia following cholecystectomy. However, neither technique rendered the patients completely pain free at all times during first 24 hours.

Key Words: Analgesics, Bupivacaine, Epidural, Interpleural, Visual analogue score.

INTRODUCTION

International Association for the Study of Pain defined pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage”.^{1,2} Patients undergoing cholecystectomy and other upper abdominal surgeries have severe post-operative pain and it has long been recognized that they suffer from an increased incidence of pulmonary complications after surgery. The adverse effects of pain include decreased respiratory movement after cholecystectomy, decreased functional residual capacity and difficulty in breathing and coughing.³ The conventional methods of administering the prescribed doses of intramuscular or intravenous opioids at fixed time intervals results in widely fluctuating and inadequate plasma level. This results in poor post-operative pain relief.⁴ Also it is not devoid of side effects like nausea, vomiting, postural hypotension, respiratory depression, which may be sometimes of serious nature.⁵

Different centers have tried different techniques and drugs for effective pain relief after cholecystectomies, the intercostal nerve blocks, thoracic extradural opioids or local anesthetics, interpleural injection of local anesthetics, local wound infiltration, different parenteral and oral drugs.^{6,7} Extradural blockade with local anesthetic agents provides excellent analgesia in comparison to extradural opiates. This technique is relatively free from side effects like respiratory depression, pruritis, and urinary retention.^{8,9} Continuing search for an ideal method of post-operative pain relief lead to discovery of interpleural instillation of local anesthetics by insertion of a catheter.¹⁰ The relative ease of performing this procedure and apparently high frequency of adequate post-operative analgesia with minimal adverse effects have

captured the interest of a number of investigators interested in the field of post-operative analgesia. Although this technique is fraught with the risk of pneumothorax, in skilled and experienced hands the incidence of this complication is minimal.¹¹

This study was undertaken to compare the efficiency of interpleural and thoracic epidural administration of 0.5%, bupivacaine with 1:200,000 adrenaline on pain and assessment of undesirable side effects after cholecystectomy.

METHODS

A total of 40 patients were studied after taking informed consent. All the patients were in the age group 20-60 years and belonged to American Society of Anesthesiology (ASA) grade I or II. These patients were scheduled for elective open cholecystectomy in CMS-Teaching Hospital, Bharatpur, Chitwan, Nepal. This study was carried out from January 2013 to July 2013.

All the patients were divided in two groups 20 patients in each at random.

Group I: Thoracic epidural with 0.5% bupivacaine with adrenaline (1:200,000)

Group-II: Interpleural instillation of 0.5% bupivacaine with adrenaline (1:200,000)

The patients in each group were studied for efficacy of post-operative pain relief for 24 hours.

Patients with history of hypersensitivity to local anaesthetics, pleurisy, chronic liver disease, epilepsy and drug addiction were excluded from this study.

All the patients were thoroughly examined and investigated preoperatively. Patients were familiarized with the visual analogue scale for

measurement of pain. Patients were told that '0' signified no pain and '10' the worst pain that one could experience. Patients were told to express the severity of pain by marking on the 10 cm long straight line at a point corresponding to pain.

All patients were premedicated with tab. Diazepam 0.2 mg/kg. All the patients were induced with Inj. Propofol 2mg/kg given intravenously and intubation with an appropriate size endotracheal tube was achieved using Inj. Vecuronium bromide 0.1 mg/kg given intravenously. Anaesthesia was maintained using N₂O+O₂ and Halothane. Controlled ventilation was given using Inj. Vacuronium bromide for muscle relaxation and Inj. Pethidine 1 mg/kg was given. Intraoperatively patients were monitored for vital parameters, BP, PR, ECG, SP02 and blood loss.

Prior to reversal an I8G epidural catheter was placed in lower thoracic spine in patients of Group I and in 8-9 intercostal space in the posterior axillary line for interpleural bupivacaine in patients of Group II.

At the end of surgery neuromuscular blockade was reversed with Inj. Neostigmine 50 mcg/kg and Inj. Atropine 20 mcg/kg and patients were extubated following recovery of protective reflexes. Patients were oxygenated after extubation for 10 min.

Twenty patients in this group I were given thoracic epidural analgesia using 18G catheter placed in situ through a 16G Tuohy needle, introduced between 10-11 thoracic intervertebral space, prior to reversal of the neuromuscular blockade. Patient was placed in left lateral position. Midline puncture of lower thoracic spine is technically difficult to achieve due to steep angulation and overlap of vertebral spines and laminae. Thus a paramedian approach was used. The 16 G Tuohy needle was passed along

the same track with the angle of 120 -130 degree to the back until gentle contact was made with the lamina. The stylet was removed 3 ml air filled in 10 ml syringe was attached. The needle was then walked along the bony surface of the lamina until it was felt to glide over the cranial edge and through the ligamentum flavum. Forward advances were made slowly till epidural space was identified by loss of resistance in the air filled syringe. 18G epidural catheter was introduced, maximum upto 10 cms, cranially, not more than 3-4 cm of catheter was left in thoracic epidural space providing blockade upto T5-T6 dermatome. First dose of 20 ml of 0.5% bupivacaine with adrenaline was given. The amount of adrenaline, which was used, was in the concentration of 1:200,000.

Top ups for analgesia were then given on demand basis or when pain score exceeded 5 in the post-operative recovery room. Dose used for top ups was 8 ml of 0.25% bupivacaine without adrenaline.

Similarly, twenty patients in this group II were given interpleural bupivacaine for post-operative analgesia using 16G Tuohy needle, through which an 18G catheter was placed in situ. Patient was kept in supine position, prior to reversal. Posterior axillary line and 8-9 intercostal space were identified. Complete aspects was ensured prior introduction of the Tuohy needle. After piercing the intercostals membrane, an air filled syringe was attached to the end of the needle. It was then advanced slowly till the parietal pleura was pierced which was detected by loss of resistance in the air filled syringe. Epidural catheter, 18 G. was then threaded through the needle upto 10-16 cms, ensuring that at least 4-5 cms of the catheter was inside the interpleural space. The first dose of 20 ml of 0.5% bupivacaine with adrenaline (1:200,000) was given. As for the first group Top

ups of 8ml of 0.25% bupivacaine without adrenaline were given on demand basis or when the pain score exceeded 5 on VAS.

The study period in both the groups was 24hrs. The patients were evaluated ½ hourly for first 2 hours, then 4hourly for 8 hrs and final reading was taken at 24hrs. Parameters noted were pulse rate, blood pressure, respiratory rate, and pain score. Intervals at which patients require top ups was noted. Any complications like shivering, respiratory depression, hypotension, retention of urine etc were also noted.

Statistical Analysis

Data was analyzed by Z test. Comparison within the group for cardiovascular parameters and respiratory was done using students paired ‘t’ test. For comparison between the two multiple linear regression analysis was undertaken controlling for baseline variables. Statistical significance was taken as p <0.05.

RESULTS

This study was conducted in forty adult patients divided into two groups of 20 each. Both the groups were subject to a different post-operative analgesic regime, namely thoracic epidural with bupivacaine (Group I) and interpleural bupivacaine (Group II). All the patients belonged to ASA I and II and Demographic data are statistically not significant. There was an insignificant increase in average pulse rate 24 hours, in both the groups compared to preoperative values. However, there was no statistically significant difference between the two groups, as regards change in pulse rate at all times.

Both the groups were comparable as regards preoperative B.P. was concerned. However postoperative systolic B.P. difference was significant in both the groups at all the times. Patients in Group-I showed a fall in B.P. which was not marked in Group-II.

Table 1: COMPARISON BETWEEN TWO GROUPS AS REGARDS CHANGES IN SYSTOLIC BLOOD PRESSURES

	POP	½ hr	1 hr	1.1/2 hr	2 hr	6 hr	10 hr	24 hr
Group-I								
Mean	126	108	106	107	106	108	110	111
S.D.(æ)	8.2	7.78	6.31	6.47	7.03	5.69	7.03	8.37
Group-II								
Mean	124	119	122	121	114	120	116	116
S.D. (æ)	10.7	8.43	9.71	9.59	10.39	9.48	10.17	9.81
T	0.66	4.3	8.37	5.57	2.5	9.2	2.64	2.77
P	>.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05

But the difference between the two groups was not statistically significant as regards changes in diastolic B.P. at any time during 24 hour interval.

Table 2: COMPARISON OF TWO TECHNIQUES AS REGARDS CHANGES IN DIASTOLIC BLOOD PRESSURES

	POP	½ hr	1 hr	1.1/2 hr	2 hr	6 hr	10 hr	24 hr
Group-I								
Mean	77	76	75	75	75	76	76	76
S.D (æ)	14.4	10.03	4.89	4.6	4.52	4.73	4.78	4.79
Group-II								
Mean	76	75	76	76	75	75	75	75
S.D.(æ)	11.56	9.05	4.83	4.9	4.85	4.77	4.72	4.65
T	00	0.07	0.65	0.67	00	0.67	0.67	0.67
P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

Both the groups showed an increase in respiratory rate compared to preoperative values. However there was no statistically significant difference between the two groups as regards changes in respiratory rate.

Table 3: COMPARISON OF TWO TECHNIQUES AS REGARDS CHANGES IN RESPIRATORY RATE

	POP	½ hr	1 hr	1.1/2 hr	2 hr	6 hr	10 hr	24 hr
Group-I								
Mean	16	17	15.65	15	15	15.8	15.7	16.4
S.D.(æ)	2.06	1.9	1.81	1.7	1.49	1.43	1.55	1.81
Group-II								
Mean	15	17	15.6	15	15	15.5	15.85	16.65
S.D.(æ)	1.82	1.6	1.90	1.90	1.97	1.98	1.53	1.69
T	1.16	00	00	00	00	0.6	0.16	0.45
P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

There was no significant difference in the pain scores at all times in both the groups. However the pain relief was marginally better in patients receiving thoracic epidural with bupivacaine.

Table 4: COMPARISON OF TWO TECHNIQUES AS REGARDING PAIN RELIEF VISUAL ANALOGUE SCALE (VAS)

	½ hr	1 hr	1.30 hr	2 hr	6 hr	10 hr	24 hr
Group-I							
Mean	0.19	00	0.39	0.56	1	1.68	2.63
S.D.(æ)	0.40	00	0.58	0.72	1.02	0.9	1.04
GROUP-II							
Mean	0.35	0.1	0.45	0.6	1.4	2.15	3.15
S.D.(æ)	0.48	0.30	0.75	0.59	0.82	0.98	1.3
T	1.14	1.6	0.28	0.2	1.4	1.5	1.5
P	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05	>0.05

The present study also evaluated the important side effects, which could affect the utility of the technique. Patients in Group I showed a fall in systolic B.P. during the period of study. However, none of these patients required any intervention for correction of B.P. This, hypotension which is a potential complication of epidural block was not found to be so in the present study. None of the patient in Group II however had significant fall in the B.P. at any time in the recovery period. Three patients in Group I had urinary retention in the follow up period. These patients were required to be catheterized. None of the patients in Group II had any such problem. Pneumothorax is a dreaded complication of interpleural techniques. However, none of the patients in present study had any clinical evidence of pneumothorax .No signs of systemic toxicity of bupivacaine were noticed in any patients of either group. Thus in conclusion none of the two techniques used in present study had any complication, which could undermine the utility for post-operative analgesia.

Table 5: COMPLICATIONS ASSOCIATED WITH TWO TECHNIQUES

	Group-I	Group-II
1 HYPOTENSION	SLIGHT FALL IN ALL	NIL
2 URINARY RETENTION	3	NIL
3 PNEUMOTHORAX	NIL	NIL
4 SEIZURES	NIL	NIL
5 RESPIRATORY DEPRESSION	NIL	NIL
6 OTHERS	NIL	NIL

In this study the complications seen in two groups were negligible.

DISCUSSION

Post-operative pain relief is essential not only on humanitarian grounds but is a must to reduce physical morbidity following surgery. It is a well-established fact that with cholecystectomy, the post-operative pain is severe, thereby increasing pulmonary complications. Patients do not cough or breathe out deeply or expectorate for fear of aggravating pain.¹² Good pain relief not only reduces pulmonary complications but also improves mobility, thereby reducing the incidence of deep vein thrombosis. In present study the surgery performed in all the cases was elective cholecystectomy through a subcostal incision. Bupivacaine was the local anaesthetic used in both the groups because of its long duration of action and absence of tachyphylaxis associated with repeated doses. Adrenaline was used with bupivacaine as the peak plasma concentration measured was less when bupivacaine was used with adrenaline. It was found that duration with plain bupivacaine was about 20% shorter than with adrenaline containing solution.¹³ As we know the Post-operative period is marked with anxiety, apprehension and pain. This results in tachycardia and increase in systolic blood pressure. The reversal of these parameters to normal in post-operative period is an indirect indicator of pain relief.¹⁴ There was an insignificant increase in average pulse rate 24 hrs, in both the groups compared to preoperative values. This could be explained by the fact that the patients were not completely pain free at all times. However, there was no statistically significant difference between the two groups, as regards change in pulse rate at all times.^{15,16} Similarly after abdominal surgery, there is a definite change in respiratory pattern and rate of breathing. It was pointed out that post operatively; patients have rapid and shallow breathing. In the present study

patients in both the groups showed an increase in respiratory rate compared to preoperative values. However there was no statistically significant difference between the two groups as regards changes in respiratory rate. Our findings were similar to those of other workers.^{17,18}

There was a statistically significant difference as regards change in systolic B.P. between the two groups. There was a definite fall in B.P. in patients receiving bupivacaine through epidural route whereas such a fall was not observed in Group II. Our finding corroborates with those of other workers. Fall in systolic B.P. after extradural bupivacaine administration was reported by some workers. However, none of the patients in the study required correcting measures for hypotension.^{19,20}

Huskisson has described visual analogue scale of pain evaluation to be the most sensitive except when patient is drowsy, uncooperative or confused.²¹ All the patients in this study were able to understand and cooperate in performing this test and it was satisfactory indicator of analgesic efficacy. There was no significant difference in the pain scores at all times in both the groups. However the pain relief was marginally better in patients receiving thoracic epidural with bupivacaine. Brismar et al found that interpleural bupivacaine considerably reduced post-operative pain after cholecystectomy.²²

Neither regime used in the present study, however, rendered all patients completely pain free at all times. The reason for less than ideal analgesia using either technique in most likely due to multiple different nerve pathways involved in the innervations of upper abdomen. Rosenbert and colleagues found that pain relief was disappointing after 20 ml of 0.5% bupivacaine intrapleurally in

thoracotomy patients.²³ However, Selzer and colleagues used 30ml with more satisfactory results. In the present study 20ml of 0.5% bupivacaine was found to be satisfactory for pain relief.²⁴

CONCLUSION

Present study shows that both the techniques are equally effective in providing analgesia following cholecystectomy. Neither technique rendered the patients completely pain free at all times during first 24 hours. In general, the pain relief following thoracic epidural was more complete compared to interpleural but this was not clinically significant. Both the techniques were associated with negligible side effects.

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