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A PROSPECTIVE RANDOMISED STUDY COMPARING THE ANALGESIC EFFICACY OF CONTINUOUS INFUSION OF LOCAL ANAESTHETIC VERSUS INTERMITTENT BOLUS THROUGH THORACIC PARAVERTEBRAL CATHETERISATION IN PATIENTS UNDERGOING ELECTIVE THORACOTOMY SURGERIES

Anaesthesiology

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ABSTRACT

Thoracotomy incision is the most painful surgical incision which causes reduction in FRC and ability to take deep breath and cough out sputum . This results retention of secretions, atelectasis and finally pneumonia.In lateral thoracotomy incision, there is intercostal nerve disruption,pleura and chest wall inflammation which contribute to pain and discomfort. Eventhough thoracic epidural technique is the gold standard for pain relief in thoracotomy surgeries, thoracic paravertebral block has numerous advantages over thoracic epidural as it provides adequate unilateral pain relief with cardiovascular stability.So, this study has been conducted to compare the analgesic efficacy of continuous infusion versus intermittent bolus of bupivacaine in thoracic Paravertebral block for elective thoracotomy surgeries where we have found that continuous infusion of Local Anaesthetic in the paravertebral space provides continuous pain relief with absence of break through pain and better patient compliance to postoperative physiotherapy and ability to cough out sputum.

KEYWORDS

Post Thoracotomy pain relief, Paravertebral block, intermittent Local Anaesthetic dosing, Continuous infusion of local anaesthetic using syringe infusion pump., Visual Analogue Scale for pain assessment.

INTRODUCTION

Thoracic Epidural technique for post thoracotomy pain relief is considered as gold standard for the pain relief in thoracotomy surgeries. Thoracic Paravertebral Block is advantageous in that it provides adequate unilateral pain relief with cardiovascular stability.Paravertebral block was first successfully demonstrated in 1905[2]by Hugo selheim of Leipzig. This technique was initially used for providing postoperative analgesia in the first half of twentieth century, later it was extended to provide pain relief for angina pectoris, cancer pain, rest pain,Herpes zoster neuralgia, renal colic and pain due to cholelithiasis etc.

Eason and Wyatt re-explored Thoracic Paravertebral block by introducing a catheter in paravertebral space which allows repeated injections of local anaesthetic agents and provide analgesia for a longer period than single time injection[4].

Advantages of Paravertebral block:

Easy to perform
Fewer failed blocks
Decreased risk of neuraxial haematomas
No hypotension
No urinary retention
Less neurological problems

Less sedation, nausea, vomiting, constipation compared to epidural opioids.

Paravertebral blocks are considered unilateral epidurals, as they block the spinal nerves on the side of anaesthetic application, although they also have the potential for epidural spread.With the advent of infusion pumps and the concern for local anesthetics toxicity, use of continuous infusion of low dose local anaesthetics has been gaining popularity among the Anaesthesiologist. Continuous infusion techniques also helps to maintain constant pain relief and better patient compliance.

With this background idea, this study was conducted to compare the analgesis efficacy of continuous infusion versus intermittent bolus of Bupivacaine in thoracic Paravertebral block for thoracotomy surgeries.

Thoracotomy incision has been used for the following surgeries:

CMC for stenotic mitralvalve
Lobectomy
Pneumonectomy
Occasionally for oesophageal perforation repair.

Inadequate pain control in these high risk patients will result in splinting ,poor respiratory effort and inability to cough and clear secretions,All these ultimately will lead to airway closure, atelectasis, shunting and hypoxemia.In addition acute pain increases sympathetic tone thereby causing tachycardia, hypertension, increasing myocardial oxygen demand, increased afterload, myocardial dysfunction and arrhythmias.

Inadequate thoracotomy pain relief also delays mobilization resulting in DVT and pulmonary embolism. It also increases ICU stay and overall hospital expenses.

Paravertebral block provides reliable multilevel intercostals blockade which are unilateral and doesnot usually enter into epidural space. But the aanalgesia is equivalent to that of epidural block. Single shot paravertebral block can effectively be used for pain relief during extubation.However with the advent of introducing catheter in Paravertebral space, by which continuous pain relief can be obtained, paravertebral technique has gained popularity.

AIM OF THE STUDY

To compare the analgesic efficacy of thoracic paravertebral block using continuous infusion of local anaesthetic versus intermittent bolus in patients undergoing elective thoracotomy surgeries.

Duration of the Study: August 2016 to November 2017.

MATERIALS AND METHODS

After getting approval from our institution's ethics committee, this study was conducted among 64 ptients belonging to ASA grade I and II who undergo elective thoracotomy surgeries under general anaesthesia.

Inclusion criteria:

Age: between 18 and 50 years
BMI : between 18 and 30 kg/m^2
ASA: I andII
Surgery: elective
Mallampatti score: I and II

Who have given valid informed consent

Exclusion criteria:

Patient's refusal
Allergy to local anaesthetics
Coagulopathy
Thoracic vertebral disease or deformity
Tumours in the paravertebral space
Systemic or local sepsis
H/O seizures and any neurological deficit
Psychiatric diseases
Patients not satisfying inclusion criteria.

Complications:

Failure
Inadvertent dural puncture
Pneumothorax
In bilateral block epidural spread is more

Common when medial injections are given
Ipsilateral horners syndrome

When complications happen, patients are treated accordingly and excluded from the study.

Materials used:

18 G Tuohy needle, epidural catheter
Loss of resistance syringe
10 ml syringe
1% lignocaine preparation for skin infiltration
Drugs-0.25% Bupivacaine
Continuousinfusion syringe pump system
Sterile drapes
Monitors – ECG, NIBP, SPO2, EtCO2,
Visual Analogue Scale

Group A:

32 patients in this group receieved initial dose of 8 ml of 0.25% Bupivacaine followed by continuous infusion at the rate of 0.1ml/kg/hr of 0.25% Bupivacaine for up to 24 hours after the surgical procedure.

Group B:

32 patients in this group receieved the initial dose of 8 ml of o.25% Bupivacaine followed by intermittent bolus of 0.1ml/kg of 0.25% Bupivacaine hourly for 24 hours after the procedure.

All patients underwent thorough preoperative evaluation.Air way examination was done. Visual Analogue Scale was explained to the patient with pictorial representation.where the score ranges from '0' of no pain to 10 of severe, worst pain imaginable .

After obtaining the informed consent, patients were shifted inside the operation theatre and the monitors were connected. Intra venous access was obtained with 16 G intravenous cannula. Patients were to lateral position with the operating side on top. The patients were made to bend their knees to chest. This position was maintained by an assistant. Under strict aseptic precautions, thoracic spine was palpated and a skin wheel was created at 2.5 cm lateral to T5 Thoracic spine with 1% lignocaine. Tuohy needle was inserted till it hit the corresponding transverse process and then it was moved inferiorly till it reached the lower border of the transverse process and the it was angulated slightly laterally.A change in resistance is felt when the needle pierces superior costotransverse ligament using loss of resistance syringe. Then epidural catheter was inserted through the needle. After adequate skin infiltration with 1% lignocaine tunneling was done and catheter passed through it and fixed.Patient turned to supine position. 8 ml of 0.25% Bupivacaine was given through the catheter after negative aspiration for blood and csf.

Patients were then administered general anaesthesia. .Anaesthesia was maintained with 1% sevoflurane alongwith O2 40% and N2O 60%. Intraoperatively patient's heart rate and blood pressure were noted for every 5 minutes till first hour and then for every 30 minutes till 8 hours and then hourly till 24 hour postoperative period.

Group A patients received continuous infusion of 0.25% Bupivacaine at the rate of 0.1ml/kg/hr, whereas the Group B patients received an intermittent bolus of 0.1ml/kg of 0.25% Bupivacaine for up to 24 hours postoperatively.

After the surgery is over, anaesthesia was terminated, patients were extubated after adequate return of reflexes.Visual analogue scoring was recorded every 30 minutes till 8 hours and then hourly till 24 hours postoperatively. Analgesia was considered as adequate when VAS score ranges from 0 to 4. Inj Tramadol was given for rescue analgesia.Other complications of Bupivacaine were also closely monitored.

All the patients were observed in postoperative intensive care units. Hypotension was defined as MAP declining 30% from its baseline value.

VITALS:

Heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure and VAS score .

SIDE EFFECTS:

Reduction in MAP of >30% of baseline is considered as hypotension and is treated with i.v. fluids and titrated dose of Inj ephedrine 6 mg.

Fall in heart rate to 40/mt was considered as bradycardia and treated with inj Atropine 0.6mg

RESULTS AND DISCUSSION:

Descriptive statistics was done for all data and suitable statistical tests of comparison were done.Continuous variables were analysed with the unpaired t test and categorical variables were analysed with chi-square test and Fischer extract test. Statistical significance was taken as P >0.05.

Age: The association between the intervention groups and age distribution is considered to be not statistically significant since p>0.05 as per unpaired t test, as the patients belonged to the same age groups in both the groups ,the mean age being 34.31 years.

Gender distribution: this also is not statistically significant since p>0.05 as per Chi squared test.

PERIOPERATIVE HEART RATE

Time	Number	Group A mean	Group B mean	P value
B.I	32	82.06	82.09	0.0902
A.I	32	82.13	84.25	0.4072
5 min	32	82.56	80.19	0.3858
10min	32	81.91	78.97	0.3155
15min	32	81.25	77.63	0.2227
20min	32	81.09	77.78	0.2526
25min	32	81.59	79.28	0.2677
30min	32	82.03	80.88	0.4467
40min	32	81.34	83.88	0.7137
50min	32	81.53	82.06	0.3876
1 hr	32	82.22	80.19	0.8608
1.15hr	32	81.09	77.78	0.4803
1.30hr	32	82.50	84.13	0.6666
2hour	32	81.53	81.53	0.5771
2.30hr	32	83.09	83.69	0.8974
3hr	32	83.70	85.29	0.8382
3.30hr	32	87.25	87.87	0.6135
4hr	32	81.09	77.78	0.8722

The association between the intervention groups and perioperative heart rate is considered to be not statistically significant since p>0.05 as per unpaired t test.

PERIOPERATIVE SYSTOLIC BP

Time	Number	Group A mean	Group B mean	P value
B.I	32	123.59	128.13	0.0795
A.I	32	126.69	131.28	0.0437
5 min	32	123.50	130.09	0.0064
10min	32	121.44	128.50	0.0045
15min	32	119.84	128.72	0.0010
20min	32	120.16	127.94	0.0013
25min	32	121.16	128.50	0.0023
30min	32	121.31	128,31	0.0044
40min	32	124.13	128.34	0.0949

50min	32	127.22	128.38	0.6192
1 hr	32	129.75	127.81	0.4051
1.15hr	32	119.63	126.38	0.1113
1.30hr	32	119.91	127.47	0.0038
2hour	32	125.06	126.44	0.5760
2.30hr	32	118.34	126.28	0.0037
3hr	32	124.91	125.50	0.8199
3.30hr	32	122.33	124.89	0.3953
4hr	32	124.87	125.88	0.7750

The association between the intervention groups and perioperative systolic blood pressure is considered to be statistically significant between A.I., 30 minutes, Isthour thirty minutes and 2nd hour thirty minutes since p<0.05 as per unpaired t test indicating a true difference among intervention groups and the difference is significant.

The systolic blood pressure perioperatively was meaningfully less in continuous infusion intervention group compared to intermittent bolus intervention group by 7.19mmHg. So we can conclude that preoperative paravertebral block with continuous infusion of Bupivacaine significantly reduces systolic blood pressure perioperatively compared to preoperative paravertebral block with intermittent bolus of bupivacaine when used in patients undergoing elective thoracotomy surgeries.

PERIOPERATIVE MEAN ARTERIAL PRESSURE

Time	Number	Group A mean	Group B mean	P value
B.I	32	93.18	95.58	0.3658
A.I	32	96.08	100.11	0.0906
5 min	32	93.25	97.86	0.0610
10min	32	91.81	95.92	0.0988
15min	32	90.47	95.59	0.0348
20min	32	90.59	95.29	0.0391
25min	32	95.08	91.01	0.0722
30min	32	94.52	91.52	0.1967
40min	32	94.95	92.81	0.3875
50min	32	94.19	94.61	0.8511
1 hr	32	94.08	97.04	0.2087
1.15hr	32	93.33	90.67	0.3057
1.30hr	32	93.95	92.24	0.4669
2hour	32	92.96	97.23	0.0700
2.30hr	32	92.64	91.76	0.6761
3hr	32	92.23	97.41	0.0313
3.30hr	32	91.43	94.49	0.2502
4hr	32	92.92	97.53	0.2132

Preoperative paravertebral block with continuous infusion of Bupivacaine significantly decreases mean arterial pressure perioperatively compared to preoperative paravertebral block with intermittent bolus of Bupivacaine when used in patients undergoing elective thoracotomy surgeries. Statistically significant difference in mean arterial pressure is noted between the groups at 15-20 minutes and at 3 hours with p value less than 0.05.

POSTOPERATIVE HEART RATE

Most of the continuous infusion group patients had mean postoperative heart rates ranging from 85.07 and 85.10 between 0-24 hours postoperatively. Similarly the intermittent bolus group patients had mean heart rates ranging from 84.10 to 89.20 , 0-24 hours postoperatively. So this association between the groups is not statistically significant.

POSTOPERATIVE SYSTOLIC BP

Time	Number	Group A mean	Group B mean	P value
0hour	32	124.67	127.63	0.0865
0.5hr	32	124.50	134.33	0.1785
1 hr	32	124.37	126.60	0.0001
2 hr	32	124.00	127.10	0.0285
3 hr	32	123.43	129.50	0.0053
4 hr	32	123.43	128.13	0.0338
5 hr	32	123.30	126.37	0.0036
6 hr	32	123.93	127.73	0.0692
12 hr	32	122.23	127.33	0.0015
17hr	32	120.07	127.43	0.0059
20 hr	32	122.67	124.93	0.0455
22 hr	32	121.67	125.63	0.0032
24 hr	32	121.53	121.90	0.8228

The association between the treatment groups and postoperative systolic blood pressure is considered to be statistically significant at 1st hour, 2nd hour, 3rd hour,4th hour, 5th hour, 12th hour, 17th hour, 20th hour and 22nd hour since p<0.05 as per unpaired t test.indicating a true difference among intervention groups and the difference is significant.

The systolic blood pressure postoperatively was meaningfully less in continuous infusion intervention group compared to intermittent bolus intervention group .

POSTOPERATIVE DIASTOLIC BLOOD PRESSURE

The diastolic blood pressure postoperatively was meaningfully less in continuous infusion intervention group compared to intermittent bolus intervention group by 9.60 mmHg from 0 minutes to 24 hours with a p value of less than 0.05. So preoperative paravertebral block with continuous infusion of Bupivacaine significantly decreases diastolic blood pressure postoperatively.

POST OPERATIVE MEAN ARTERIAL PRESSURE

Time	Number	Group A mean	Group B mean	P value
0hour	32	89.16	97.73	0.0000
0.5hr	32	91.13	98.72	0.0001
1 hr	32	91.43	102.09	0.0000
2 hr	32	91.31	99.73	0.0001
3 hr	32	90.48	98.50	0.0000
4 hr	32	91.24	98.84	0.0004
5 hr	32	90.47	99.64	0.0000
6 hr	32	90.20	97.27	0.0001
12 hr	32	89.26	100.28	0.0000
17hr	32	90.33	99.08	0.0001
20 hr	32	89.83	97.49	0.0001
22 hr	32	89.07	97.14	0.0000
24 hr	32	88.51	92.32	0.0204

The mean arterial pressure postoperatively is meaningfully less in continuous infusion group compared to intermittent bolus group by 7.38 mm Hg on the average.So it is concluded that continuous infusion of bupivacaine has definitely reduced the stress response by reducing the mean arterial pressure significantly, with a p value of less than 0.05,in the postoperative period.

POSTOPERATIVE VISUAL ANALOGUE SCALE

Time	Number	Group A mean	Group B Mean	P value
0hour	32	1.60	1.77	0.0170
0.5hr	32	1.60	2.00	0.0003
1 hr	32	1.60	0.86	0.0000
2 hr	32	1.60	2.33	0.0000
3 hr	32	1.63	2.13	0.0006
4 hr	32	1.63	2.43	0.0000
5 hr	32	1.63	2.53	0.0000
6 hr	32	1.67	2.27	0.0003
8 hr	32	1.73	2.10	0.0481
12 hr	32	1.90	2.13	0.1120
17hr	32	2.17	2.30	0.4646
20 hr	32	2.33	2.13	0.1942
21 hr	32	2.40	2.00	0.0093
22 hr	32	2.50	2.13	0.0279
24 hr	32	2.70	1.73	0.0000

The association between the intervention groups and postoperative visual analogue scale score is considered to be statistically significant between 0 minutes to 3 hours, 4-8 hours and 21-24 hours since p<0.05 as per unpaired t test indicating a true difference among intervention groups and the difference is significant.The VAS score postoperatively was meaningfully less in continuous infusion intervention group compared to intermittent bolus intervention group by 0.29 mean score

points.

We conclude that Preoperative paravertebral block with continuous infusion of Bupivacaine significantly decreases visual analogue scale score postoperatively compared to preoperative paravertebral block with intermittent bolus of Bupivacaine when used in patients undergoing elective thoracotomy surgeries.

SUMMARY

This prospective randomized study has been conducted to compare the analgesic efficacy of Thoracic Paravertebral block using continuous infusion versus intermittent bolus of Bupivacaine in groups containing 32 patients in each.

Group A patients receieved continous infusion of bupicavaine and Group B receieved intermittent bolus of bupivacaine .

Heart rate, systolic blood pressure ,diastolic pressure , mean arterial pressure were monitored.

On the course of the study it was observed that both the technique provided comparable analgesia as evident from VAS score.

Systolic pressure, diastolic pressure, mean arterial blood pressure and VAS score were less in continuous group than the intermittent bolus group.

CONCLUSION

From this study we can conclude that the continuous infusion of local anaesthetic is really superior to intermittent bolus administration of local anaesthetic in the paravertebral block as shown by continuous pain relief with absence of break through pain and better patient compliance in post operative physiotherapy and ability to cough out sputum.

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