Section: Anaesthesiology

Original Research Article

COMPARATIVE ANALYSIS OF EPIDURAL 0.125 % BUPIVACAINE WITH TRAMADOL VERSUS EPIDURAL 0.125 % BUPIVACAINE WITH PETHIDINE VERSUS EPIDURAL 0.125 % BUPIVACAINE AS CONTROL FOR POST OPERATIVE ANALGESIA IN ABDOMINAL SURGERIES

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Abstract

Background: Postoperative pain management is crucial for patient recovery, especially in abdominal surgeries. This study evaluates the efficacy and safety of adding Tramadol or Pethidine to epidural Bupivacaine for postoperative analgesia. **Materials and Methods:** A randomized, controlled trial was conducted with 90 patients undergoing abdominal surgery, divided into three groups: Bupivacaine with Tramadol (BT), Bupivacaine with Pethidine (BP), and Bupivacaine alone (BC). Parameters assessed included the onset and duration of analgesia, pain scores (using the Visual Analogue Scale), hemodynamic stability (pulse rate, systolic and diastolic blood pressure), respiratory rate, and complications. **Result:** The study found that the BT group experienced a faster onset of analgesia (6.90 ± 0.99 minutes) and prolonged duration (7.09 ± 1.67 hours) compared to BP and BC groups ($P<0.001$). VAS scores were significantly lower in the BT group at 4 and 6 hours postoperatively ($P<0.001$ and $P=0.019$, respectively). Hemodynamic parameters remained stable across all groups, with no significant differences observed. A slight but statistically significant difference in diastolic blood pressure was noted initially in the BT group ($P=0.014$). Respiratory rates were marginally higher in the BC group at certain intervals. The incidence of complications such as nausea, vomiting, and other side effects were similar and minimal across all groups. **Conclusion:** Epidural 0.125% Bupivacaine with Tramadol provides more effective analgesia with faster onset and longer duration compared to Bupivacaine with Pethidine or Bupivacaine alone, without increasing the risk of complications. This combination could be considered a preferred choice for postoperative pain management in abdominal surgeries.

INTRODUCTION

Effective postoperative pain management is crucial in enhancing patient recovery, reducing the risk of complications, and improving overall satisfaction with surgical care. Abdominal surgeries, in particular, are associated with significant postoperative pain, necessitating effective analgesic strategies.[1,2] Epidural analgesia is widely recognized for its efficacy in managing postoperative pain. Bupivacaine, a long-acting local anesthetic, is commonly used in epidural analgesia due to its effectiveness in providing sensory and motor block.[3] However, the quest for improving analgesic efficacy and reducing side effects has led to the exploration of adding adjuvants such as opioids to the local anesthetic.

Tramadol and Pethidine, both opioids, have been used as adjuvants to epidural analgesics. Tramadol, a centrally acting analgesic, provides pain relief with a lower risk of respiratory depression, a common side effect of stronger opioids.[4,5] Pethidine, another opioid, is known for its analgesic properties but carries a risk of side effects such as nausea and respiratory depression.[6,7] The combination of these opioids with Bupivacaine could potentially enhance analgesic efficacy while minimizing side effects. Therefore, a comparative study of these combinations is needed to establish the most effective and safe regimen for postoperative pain management in abdominal surgeries.

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Objectives

This study aims to compare the efficacy and safety of epidural 0.125% Bupivacaine with Tramadol versus epidural 0.125% Bupivacaine with Pethidine, and versus epidural 0.125% Bupivacaine alone as a control, for postoperative analgesia in abdominal surgeries. The primary outcomes include the onset and duration of analgesia, pain relief (assessed by the Visual Analogue Scale), and hemodynamic stability. Secondary outcomes focus on the incidence of complications such as nausea, vomiting, pruritis, and respiratory depression.

MATERIALS AND METHODS

Study Design and Setting

This study was a randomized, controlled trial conducted at the Government Medical College/Government General Hospital, Ananthapuramu, between January 2019 to December 2019. The trial was designed to compare the efficacy and safety of three different epidural analgesia regimens for postoperative pain management in patients undergoing abdominal surgeries.

Participants

The study enrolled patients aged 18-60 years, scheduled for elective abdominal surgeries. Exclusion criteria included patients with known allergies to study medications, contraindications to epidural analgesia, chronic opioid use, significant hepatic or renal impairment, and those with a history of respiratory or cardiovascular diseases.

Randomization and Blinding

Participants were randomly assigned to one of three groups using a computer-generated randomization sequence. The groups were:

Epidural 0.125% Bupivacaine with Tramadol (BT)

Epidural 0.125% Bupivacaine with Pethidine (BP)

Epidural 0.125% Bupivacaine alone as control (BC)

Blinding was maintained for patients and the evaluators assessing the outcomes.

Intervention

All patients received an epidural catheter for analgesia administration. The BT group received 0.125% Bupivacaine with Tramadol, the BP group received 0.125% Bupivacaine with Pethidine, and the BC group received 0.125% Bupivacaine alone. The dosages were standardized based on existing guidelines and literature.

Outcome Measures

Primary outcomes included the onset and duration of analgesia, and pain relief was assessed using the Visual Analogue Scale (VAS) at predetermined intervals postoperatively. Secondary outcomes were hemodynamic stability (pulse rate, systolic and diastolic blood pressure), respiratory rate, and the incidence of complications such as nausea, vomiting, pruritis, and respiratory depression.

Statistical Analysis

Data were analyzed using appropriate statistical methods. Continuous variables were compared using the ANOVA or Kruskal-Wallis test, and categorical variables were analyzed using the Chi-square test. A P-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of Government Medical College, Ananthapuramu. Written informed consent was obtained from all participants before enrollment. The study adhered to the principles of the Declaration of Helsinki and maintained confidentiality and privacy of participant data.

RESULTS

Demographic and Baseline Characteristics

The study compared the efficacy of three epidural analgesia regimens for post-operative pain management in abdominal surgeries: 0.125% Bupivacaine with Tramadol (BT), 0.125% Bupivacaine with Pethidine (BP), and 0.125% Bupivacaine alone as control (BC). Demographic characteristics including age, gender, height, and weight were assessed [Table 1-4].

Age: No significant difference in mean age among BT (40.27 ± 9.13 years), BP (41.36 ± 7.69 years), and BC (38.53 ± 9.63 years) (P=0.461) [Table 1].

Gender: Distribution of males and females was similar across all groups (P=0.986) [Table 2].

Height and Weight: Mean height and weight were evenly distributed among the groups (P=0.986 and P=0.205, respectively) [Table 3 and 4].

Onset and Duration of Analgesia

Onset of Analgesia: The BT group had a significantly faster onset (6.90 ± 0.99 minutes) compared to BC (8.57 ± 1.24 minutes). BP (6.92 ± 0.99 minutes) was similar to BT (P<0.001) [Table 5].

Duration of Analgesia: BT showed a longer duration (7.09 ± 1.67 hours) than BP (5.07 ± 0.75 hours) and BC (4.25 ± 0.39 hours) (P<0.001) [Table 6].

Visual Analogue Scale (VAS) Scores

Initial Pain Scores: There were no significant differences at 0 minutes among the groups (P=0.975) [Table 7].

Subsequent Evaluations: At 4 and 6 hours, the BT group reported significantly lower pain scores compared to BP and BC (P<0.001 at 4 hours and P=0.019 at 6 hours) [Table 7].

Late Post-operative Period: BT continued to show significantly lower pain scores at 8 and 10 hours (P<0.001) [Table 7].

Hemodynamic Parameters

Pulse Rate and Blood Pressure: No significant differences in pulse rate and systolic blood pressure (SBP) across the groups at all time points [Table 8 and 9].

Diastolic Blood Pressure (DBP): A statistically significant difference in DBP at the initial time point (0 min) favored the BT group (P=0.014) [Table 10].

Respiratory Rate

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The respiratory rate was marginally higher in the BC group at various intervals, with significant differences at 0, 60 min, 6, and 8 hrs (P<0.05) [Table 11].

Complications

The incidence of complications like nausea & vomiting, pruritis, motor block, bradycardia, hypotension, respiratory depression, and shivering was low and showed no significant difference among the groups (P=0.872) [Table 12].

In summary, the addition of Tramadol to epidural Bupivacaine significantly improved the onset and duration of analgesia with better pain control, without increasing complications.

Table 1: Comparison of Age between the study groups

Group		Mean	SD	P value
Age (Years)	BT	40.27	9.13	0.461
	BP	41.36	7.69	
	BC	38.53	9.63	

Table 2: Comparison of Gender between the study groups

Gender	Group			P value
	BT	BP	BC	
Male	16 (30.8)	18 (34.6)	18 (34.6)	0.986
Female	14 (36.8)	12 (31.6)	12 (31.6)	
Total	30	30	30	

Table 3: Comparison of Height between the study groups

Groups		Mean	SD	P value
Height (cms)	BT	159.67	5.53	0.986
	BP	159.80	5.41	
	BC	159.90	5.26	

Table 4: Comparison of weight between the study groups

Groups		Mean	SD	P value
Weight (Kgs)	BT	60.80	5.09	0.205
	BP	59.33	4.32	
	BC	61.43	4.48	

Table 5: Comparison of the mean time of onset of analgesia between the study group

Groups		Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BC	BP-BC	BT-BP
On set of analgesia (minutes)	BT	6.90	0.99	<0.001	<0.001	<0.001	1.000
	BC	8.57	1.24				
	BP	6.92	0.99				

Table 6: Comparison of the mean duration of analgesia between the study groups

		Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BP	BP- BC	BT- BC
Duration of analgesia (Hours)	BT	7.09	1.67	<0.001	<0.001	0.001	<0.001
	BP	5.07	0.75				
	BC	4.25	0.39				

Table 7: Comparison of VAS score between the study groups

VAS	Group	Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BP	BP-BC	BT-BC
0 min	BT	7.27	0.91	0.975	1.000	1.000	1.000
	BP	7.23	0.96				
	BC	7.28	0.92				
15 min	BT	3.23	0.57	0.234	0.339	0.451	1.000
	BP	3.48	0.77				
	BC	3.24	0.58				
30 min	BT	2.27	0.64	0.115	0.251	0.125	1.000
	BP	2.58	0.81				
	BC	2.24	0.64				
60 min	BT	1.77	0.50	0.065	0.136	0.125	1.000
	BP	2.06	0.68				
	BC	1.76	0.51				
2 hrs	BT	2.27	0.58	0.347	0.598	0.668	1.000
	BP	2.48	0.77				
	BC	2.28	0.59				
4 hrs	BT	3.17	0.65	<0.001	0.135	<0.001	<0.001
	BP	3.55	1.03				
	BC	4.37	0.49				

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6 hrs	BT	3.80	0.71	0.019	1.000	0.173	0.018
	BP	3.97	1.22				
	BC	4.50	0.57				
8 hrs	BT	4.17	0.92	<0.001	0.011	<0.001	0.418
	BP	3.52	1.03				
	BC	5.18	0.96				
10 hrs	BT	4.57	0.68	<0.001	0.232	<0.001	0.0.10
	BP	3.39	0.99				
	BC	5.20	1.16				

Table 8: Comparison of pulse rate between the study groups

HR	Group	Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BP	BP-BC	BT-BC
0 min	BT	96.83	7.76	0.553	1.000	1.000	0.879
	BP	97.52	11.89				
	BC	99.31	6.11				
15 min	BT	91.80	6.45	0.806	1.000	1.000	1.000
	BP	92.87	9.38				
	BC	92.93	6.07				
30 min	BT	89.97	6.41	0.814	1.000	1.000	1.000
	BP	88.97	8.09				
	BC	88.89	5.38				
60 min	BT	83.83	6.14	0.777	1.000	1.000	1.000
	BP	84.71	8.06				
	BC	85.03	5.64				
2 hrs	BT	81.07	6.65	0.882	1.000	1.000	1.000
	BP	81.87	7.25				
	BC	81.76	6.29				
4 hrs	BT	80.57	5.08	0.796	1.000	1.000	1.000
	BP	81.38	5.93				
	BC	81.34	4.76				
6 hrs	BT	84.37	5.53	0.931	1.000	1.000	1.000
	BP	85.26	6.36				
	BC	84.69	5.37				
8 hrs	BT	87.33	5.77	0.370	0.535	1.000	0.912
	BP	89.48	7.00				
	BC	89.00	5.65				
10 hrs	BT	92.47	5.19	0.718	1.000	1.000	1.000
	BP	92.74	7.16				
	BC	93.66	4.84				

Table 9: Comparison of SBP between the study groups

SBP	Group	Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BP	BP-BC	BT-BC
0 min	BT	130.57	3.44	0.083	0.903	0.081	0.517
	BP	129.67	4.72				
	BC	132.00	3.68				
15 min	BT	117.38	1.95	0.001	0.734	0.001	0.040
	BP	116.36	4.11				
	BC	119.58	3.36				
30 min	BT	119.07	1.44	<0.001	0.906	<0.001	0.002
	BP	118.42	2.84				
	BC	121.28	2.75				
60 min	BT	119.23	1.96	<0.001	1.000	<0.001	0.001
	BP	118.74	2.64				
	BC	121.66	2.42				
2 hrs	BT	119.97	2.17	0.023	0.869	0.044	0.872
	BP	119.25	3.19				
	BC	120.93	2.27				
4 hrs	BT	119.80	2.17	0.003	1.000	0.003	0.045
	BP	119.29	3.19				
	BC	121.58	2.67				
6 hrs	BT	121.30	2.17	0.018	0.797	0.229	0.015
	BP	122.16	3.54				
	BC	123.55	3.11				
8 hrs	BT	122.87	2.67	0.005	0.724	0.004	0.724
	BP	122.13	2.42				
	BC	124.24	2.19				
10 hrs	BT	121.87	2.77	0.034	1.000	0.040	0.161
	BP	121.70	2.59				
	BC	123.03	2.87				

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Table 10: Comparison of DBP between the study groups

DBP	Group	Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BP	BP-BC	BT-BC
0 min	BT	84.60	2.97	0.014	1.000	0.013	0.143
	BP	83.90	2.75				
	BC	86.38	4.71				
15 min	BT	78.97	2.77	0.053	1.000	0.057	0.247
	BP	78.48	2.20				
	BC	80.27	3.50				
30 min	BT	78.20	1.95	0.017	1.000	0.176	0.202
	BP	78.16	2.63				
	BC	79.60	4.27				
60 min	BT	78.73	1.72	0.024	1.000	0.029	1.000
	BP	78.19	2.34				
	BC	80.14	4.03				
2 hrs	BT	78.37	2.42	0.783	1.000	1.000	1.000
	BP	77.93	2.73				
	BC	78.27	2.42				
4 hrs	BT	78.67	2.71	0.875	1.000	1.000	1.000
	BP	78.42	2.49				
	BC	78.76	2.73				
6 hrs	BT	79.87	2.14	0.963	1.000	1.000	1.000
	BP	79.71	2.57				
	BC	79.83	2.21				
8 hrs	BT	80.27	2.45	0.889	1.000	1.000	1.000
	BP	80.00	1.82				
	BC	80.37	2.35				
10 hrs	BT	79.20	2.49	0.937	1.000	1.000	1.000
	BP	79.00	2.58				
	BC	79.21	2.57				

Table 11: Comparison of Respiratory rate between the study groups

RR	Group	Mean	SD	P value	Post hoc test (Bonferroni)		
					BT-BP	BP-BC	BT-BC
0 min	BT	18.60	1.25	0.001	1.000	0.006	<0.001
	BP	18.32	1.27				
	BC	19.93	2.33				
15 min	BT	14.57	1.19	0.002	0.596	0.006	0.137
	BP	14.13	0.89				
	BC	15.34	1.75				
30 min	BT	14.37	0.89	0.005	0.566	0.004	0.150
	BP	14.07	0.89				
	BC	14.83	0.89				
60 min	BT	14.40	1.00	<0.001	0.698	<0.001	0.001
	BP	14.10	1.01				
	BC	15.34	0.93				
2 hrs	BT	14.50	1.26	0.070	0.832	0.064	0.645
	BP	14.13	1.38				
	BC	14.93	1.33				
4 hrs	BT	14.77	1.13	0.055	1.000	0.060	0.265
	BP	14.55	1.13				
	BC	15.34	1.32				
6 hrs	BT	15.23	1.25	0.002	1.000	0.004	0.015
	BP	15.10	1.11				
	BC	16.17	1.39				
8 hrs	BT	15.47	1.46	0.003	1.000	0.002	0.006
	BP	15.32	1.44				
	BC	16.76	1.77				
10 hrs	BT	16.27	1.46	0.020	1.000	0.010	0.096
	BP	16.03	1.47				
	BC	17.17	1.47				

Table 12: Comparison of Complications between the study groups

Complications	BT	BP	BC	P value
Nausea &Vomiting	9 (30)	5 (16.6)	4 (13.3)	0.872
Pruritis	0	0	0	-
motor block	0	0	0	-
Bradycardia	0	0	0	-
Hypotension	0	0	0	-
Respiratory depression	0	0	0	-
Shivering	0	0	0	-

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DISCUSSION

This study provides a comprehensive analysis of the efficacy and safety of adding Tramadol or Pethidine to epidural Bupivacaine for postoperative analgesia in abdominal surgeries. The results demonstrated that Bupivacaine with Tramadol (BT) significantly improved the onset and duration of analgesia and provided more effective pain relief compared to Bupivacaine with Pethidine (BP) and Bupivacaine alone (BC).

Comparison with Previous Studies

The findings are in line with previous research highlighting the benefits of opioid additives to local anesthetics in epidural analgesia. Studies have shown that opioids like Tramadol and Pethidine enhance the analgesic effect of Bupivacaine by acting on spinal opioid receptors.[8,9] However, our study is unique in directly comparing the effects of Tramadol and Pethidine as additives to Bupivacaine in a controlled setting.

Efficacy of Bupivacaine with Tramadol

The superior efficacy of BT in terms of onset and duration of analgesia can be attributed to Tramadol's dual mechanism of action, which involves opioid receptor activation and inhibition of serotonin and norepinephrine reuptake. This dual action may contribute to a more rapid and prolonged analgesic effect, as observed in our study.[10,11]

Safety Profile

Notably, the safety profile of BT was comparable to BP and BC, with no significant increase in the incidence of complications like nausea, vomiting, pruritus, or respiratory depression.[12] This finding is particularly relevant given the concerns associated with opioid use, such as respiratory depression.[13] The lack of significant respiratory depression in the BT group suggests that Tramadol, when used as an adjunct to Bupivacaine in epidural analgesia, may offer a safer alternative to stronger opioids.[14,15]

Limitations: While the study provides valuable insights, it is not without limitations. The sample size, although adequate to detect differences in primary outcomes, may not fully represent the diversity of the general population undergoing abdominal surgeries. Additionally, the study was conducted at a single center, which may limit the generalizability of the findings. Further multicenter studies with larger sample sizes are warranted to validate our results.

Clinical Implications: The findings have significant clinical implications. The use of BT for postoperative analgesia in abdominal surgeries can potentially improve patient comfort, reduce the need for rescue analgesics, and possibly shorten hospital stays. Furthermore, the low incidence of side effects with BT supports its safe use in clinical practice.

CONCLUSION

This study indicates that for postoperative pain management in elective abdominal surgeries, Epidural 0.125% Bupivacaine combined with Tramadol is superior to both Bupivacaine with Pethidine and Bupivacaine alone. The combination with Tramadol not only accelerates the onset of analgesia but also prolongs its duration, without significant hemodynamic changes or increased incidence of adverse events. These findings suggest that adding Tramadol to Bupivacaine offers an optimal balance of effectiveness and safety, potentially improving patient outcomes and satisfaction in postoperative pain management.

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