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Addition of lumbar intrathecal morphine along with standard thoracic epidural anesthesia for abdomino thoracic esophagectomy: A single centered observational study

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Abstract---Introduction: Thoracic epidural anaesthesia (TEA) has been the standard of care for postoperative pain management for patients undergoing abdomino-thoracic esophagectomy. The study aims to observe whether addition of lumbar intrathecal morphine along with TEA reduces the post operative pain scores, post operative opioid consumption and total epidural drug requirement. Materials and methods: 50 patients divided into two groups, one group was given standard TEA at level T5-T7, other group was receiving intrathecal morphine along with TEA. General anaesthesia will be provided as per standard protocol and one lung isolation will be achieved using Robertsons double lumen tube of proper size. Pain scores will be monitored using Numerical rating Scale. Total requirement of epidural drug in both the groups, requirement of rescue analgesia, complications in both the groups will be observed. Results and observations: In our study we found that VAS score were better in the

combined intrathecal morphine plus thoracic intrathecal morphine plus thoracic epidural approach group and there were less need of rescue analgesia and good recovery compared to conventional thoracic epidural approach. Haemodynamic parameters and complications were almost comparable in both the groups except for heart rate. Conclusion: It can be concluded that adding intrathecal morphine to conventional thoracic epidural may provide analgesia for surgery involving multiple dermatomes like abdomino thoracic esophagectomy.

Keywords---esophagectomy, intrathecal morphine, lumbar intrathecal.

Introduction

Abdomino thoracic esophagectomy is a curative approach for patients with carcinoma esophagus. Effective pain control is an essential requirement postoperatively for better pulmonary function, ambulation and overall recovery. Thoracic epidural anaesthesia (TEA) has been the standard of care for postoperative pain management for patients undergoing abdomino thoracic esophagectomy. TEA as a part of multimodal analgesia is often associated with hypotension, bradycardia and increase use of rescue analgesia. This study primarily aims to observe whether addition of lumbar intrathecal morphine along with TEA reduces the postoperative pain scores, postoperative opioid consumption and total epidural drug requirement.

Review of Literature

Adequate pain control is of utmost importance for patients undergoing abdomino thoracic esophagectomy for overall better outcome in terms of postoperative pain, pulmonary function and recovery. TEA for postoperative analgesia has been the gold standard for patients undergoing esophageal surgeries. TEA along with multimodal analgesia provides good pain coverage but may require higher epidural doses or additional IV analgesics/opioids. Higher doses of epidural often results in hypotension which hampers with early mobilization. (1) Intrathecal morphine has been proved to provide good postoperative analgesia in various abdominal and thoracic surgeries. (2,3). In this study we aim to observe whether additional intrathecal morphine along with TEA provides better post operative analgesia along with decreased postoperative opioid consumption and early ambulation.

Aim and Objective of the study

Aim

To determine whether addition of intrathecal morphine along with thoracic epidural anaesthesia for abdominothoracicesophagectomy is effective in adequate pain control and early recovery.

Primary objective

To compare the pain scores postoperatively in both rest and ambulation of both the groups.

Secondary objectives

- Total requirement of epidural drug in both the groups.
- Requirement of rescue analgesia.
- Complications in both the group.

The present study was conducted in the State Cancer Institute, Guwahati after getting approval from the Institutional Scientific Committee as well as Ethics Committee of State Cancer Institute.

Sample Size

50 cases

Study Design

Observational Study

Inclusion Criteria

Patients undergoing oesophagectomy aged 18 to 65years, with ASA status 1 & 2 were to be included in the study.

Exclusion Criteria

Any patients with known allergy to the study drugs, coagulation disorders, obesity (BMI<35kg/m²), the injection site infection or opioid abuse were excluded from the study.

Materials and Methods

This observational study was conducted in the State Cancer Institute, Guwahati after getting approval from the Institutional Scientific Committee as well as Ethics Committee of State Cancer Institute. Informed and written consent were taken from all the patients before the procedure. Patients undergoing esophagectomy aged 18 to 65 yrs, belonging to American society of anesthesiologist (ASA) 1 & 2 were included in the study. Patients with any known allergy to study drug, coagulation disorder, obesity, infection in the injection site or opioid abuse were excluded from the study. Fifty patients undergoing abdomino thoracic esophagectomy were randomly allocated to receive either thoracic epidural (TE) alone or thoracic epidural plus intrathecal morphine (TEI) pre induction after proper counselling and consent. After attaching appropriate monitors and securing an IV line thoracic epidural catheter were placed at mid thoracic level (T5-T7) in both the groups.

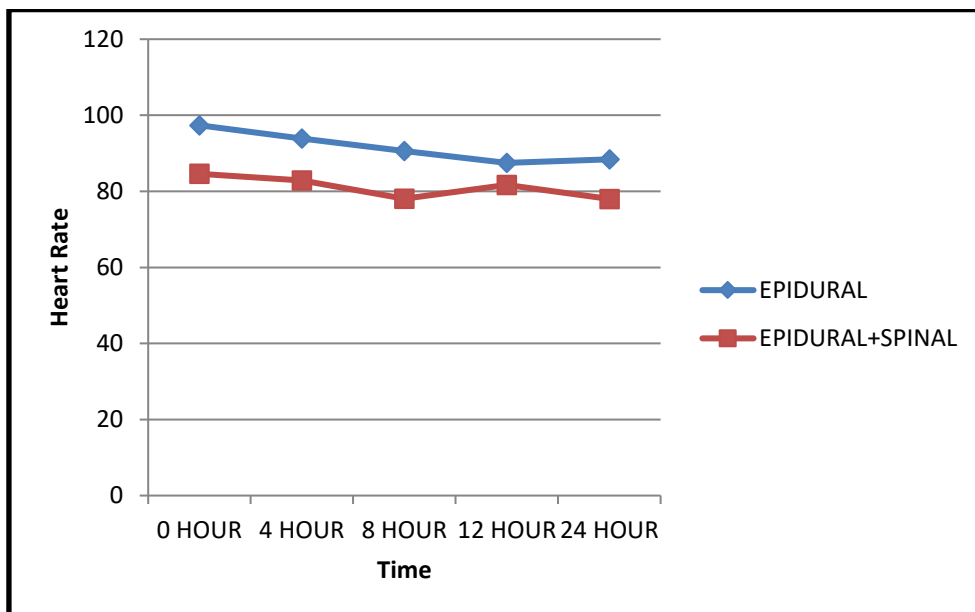
An epidural test dose bolus of 3ml 2% lignocaine adrenaline was given initially and post induction 5-8 ml of ropivacaine 0.25% was given every hourly. Patients belonging to TEI group were administered subarachnoid puncture at L3-L4 intervertebral space and intrathecal morphine (preservative free) of 200-300 mcg bolus was given after confirmation of free flow of cerebrospinal fluid (CSF) pre induction. General anaesthesia was provided as per standard protocol and one lung isolation was achieved using Robertsons double lumen tube of appropriate size. Patients neuromuscular blockade were reversed and trachea extubated at the end of surgery. In the postoperative period heart rate, systolic, diastolic, mean blood pressure and pain score (Numerical Rating scale) were monitored 0hrly, 4hrly, 8hrly, 12 hrly, 18 hrly and 24 hrly at both rest and during movement. Ropivacaine 0.125% plus fentanyl 2mcg/ml was infused epidurally at the rate of 5-8 ml/hr targeting NRS $\leq$ 3 and MAP $\geq$ 65 mm Hg. IV paracetamol 1 gm TDS was given to all the patients.

Rescue analgesia of epidural bolus 5ml was given if NRS $\geq$ 4 and MAP $\geq$ 65 mm Hg. If pain was persistent even after epidural bolus or MAP $\leq$ 65 mm Hg IV tramadol 50 mg was given. In case of hypotension (MAP $\leq$ 65 mm Hg) epidural infusion was stopped and fluid bolus of 20 ml/kg was given. In case of persistent hypotension vasoconstrictor (noradrenaline) was given. Epidural catheter was placed till Post Operative Day 3 and at the end of removal total epidural drug consumption in both the groups were noted. Day of ambulation and discharge from ICU/ PACU were noted in all the patients. Complications like hypotension, anastomotic leaks, nausea, vomiting were also noted.

Results and Observations

Table 1

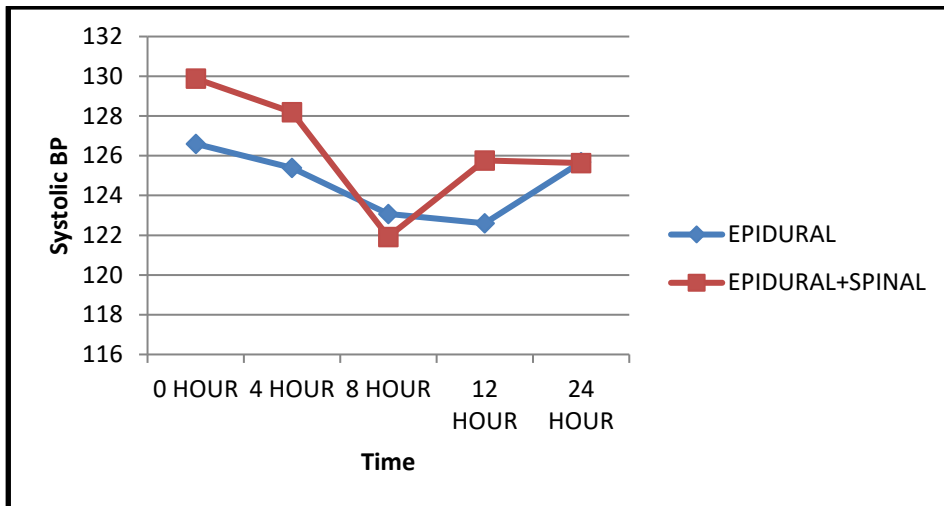
HR	EPIDURAL		EPIDURAL+SPINAL		P-VALUE
	MEAN	SD	MEAN	SD	
0 HOUR	97.36	9.53	84.60	7.75	0.000
4 HOUR	93.84	5.91	82.84	6.05	0.000
8 HOUR	90.60	5.17	78.08	7.30	0.000
12 HOUR	87.48	4.82	81.64	7.27	0.002
24 HOUR	88.44	4.20	78.00	8.20	0.000



In our study there were significant difference between the patients of group E and group ES as far as heart rate was concerned and the “p” value was significant ($P < 0.05$) at any time in 24 hour post operative period

Table 2

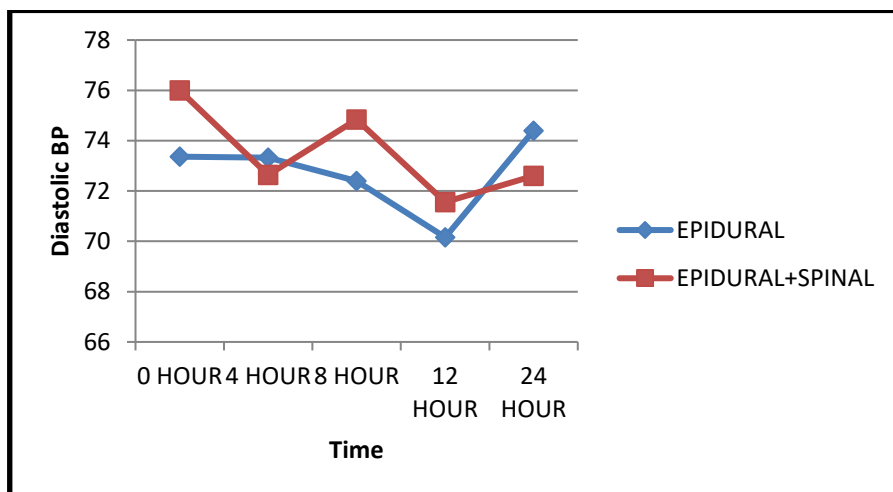
SBP	EPIDURAL		EPIDURAL+SPINAL		P-VALUE
	MEAN	SD	MEAN	SD	
0 HOUR	126.60	8.10	129.88	7.81	0.151
4 HOUR	125.40	7.94	128.20	7.53	0.207
8 HOUR	123.08	6.03	121.92	6.26	0.508
12 HOUR	122.60	8.67	125.76	8.10	0.189
24 HOUR	125.68	6.59	125.64	7.98	0.985



There were no statistical difference between the two groups in relation to systolic blood pressure

Table 3

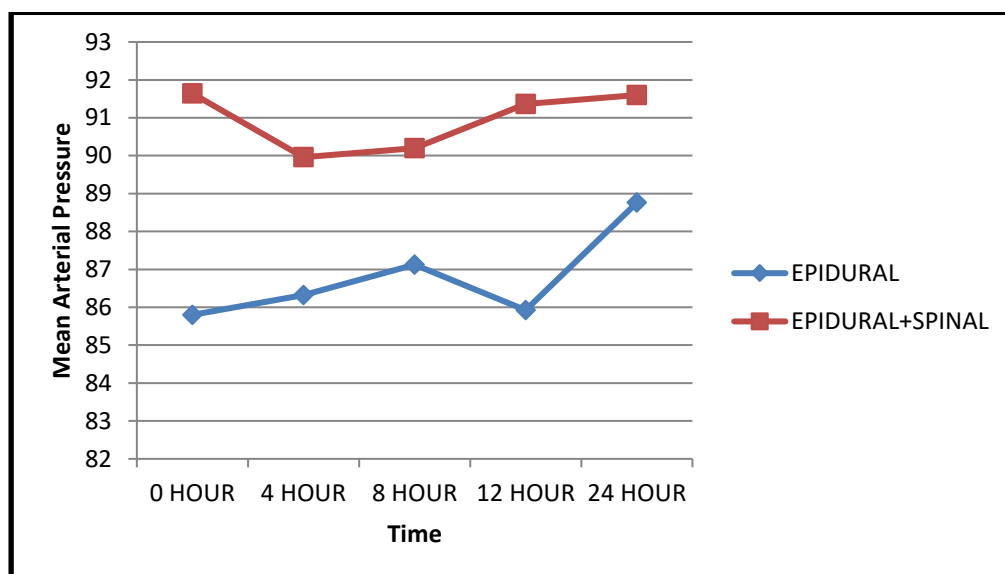
DBP	EPIDURAL		EPIDURAL+SPINAL		P-VALUE
	MEAN	SD	MEAN	SD	
0 HOUR	73.36	6.65	76.00	6.31	0.156
4 HOUR	73.32	6.61	72.64	4.67	0.676
8 HOUR	72.40	5.44	74.84	7.20	0.183
12 HOUR	70.16	5.51	71.56	6.01	0.395
24 HOUR	74.40	5.28	72.60	7.27	0.321



In our study we did not find any statistical difference in relation to diastolic blood pressure.

Table 4

MAP	EPIDURAL		EPIDURAL+SPINAL		P-VALUE
	MEAN	SD	MEAN	SD	
0 HOUR	85.80	6.45	91.64	7.67	0.0054
4 HOUR	86.32	6.28	89.96	4.40	0.0217
8 HOUR	87.12	5.04	90.20	5.85	0.0519
12 HOUR	85.92	5.82	91.36	6.57	0.0032
24 HOUR	88.76	4.75	91.60	5.63	0.0597

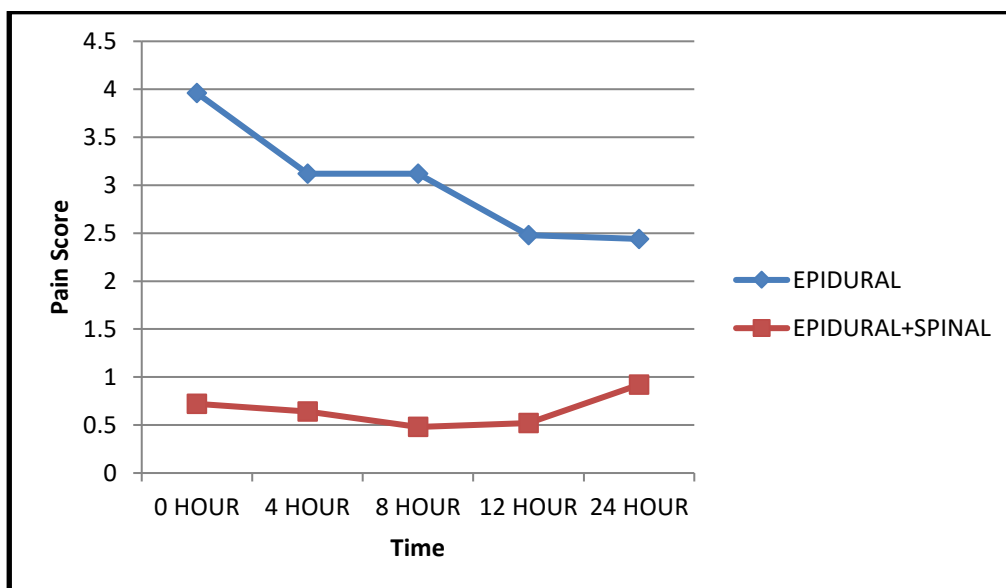


For 24 hrs postoperative period monitoring other than 0thhr, we could not find statistical difference between the groups.

A total of 50 consented patients scheduled for abdominoesophagectomy were randomized to two groups of 25 each. Both groups were comparable for their demographic data of age, weight, height, ASA status and duration of surgery. In our present study we found a significant difference in heart in both the groups with TEI group with lower rate than TE group, while no significant difference was found in blood pressure (SBP, DBP AND MAP) in both the groups. When we compared the total epidural drug consumed over 72 hrs in both the groups, the TE group consumed 350 ± 10.16 compared to 272.08 ± 6.69 in TEI group with a significant difference in both the groups. The NRS pain score in the TE group was significantly higher than the TEI group at all time points over 24 hrs with higher scores in the initial hours. In the TE group the mean pain score was 2.44 ± 1.26 to 3.96 ± 1.65 while in TEI group it was 0.48 ± 0.65 to 0.92 ± 1.22 . Similarly the requirement of rescue analgesia was also higher in the TE group than the TEI group with significant difference between both the groups. In the 0 hrs the TE group required 13 doses while the TEI group required only 1 dose of rescue analgesia. There was no requirement of rescue analgesia at all in the TEI group from 4 to 12 hrs with only 2 doses given in 24 hr.

Table 5

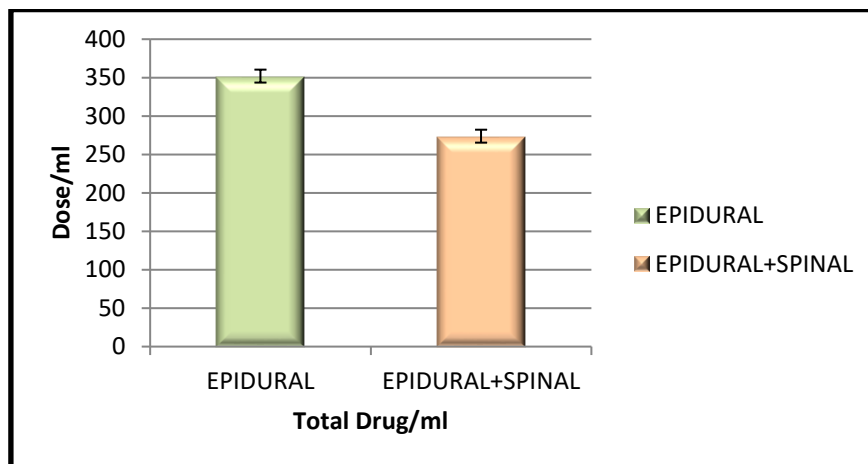
PAIN SCORE	EPIDURAL		EPIDURAL+SPINAL		P-VALUE
	MEAN	SD	MEAN	SD	
0 HOUR	3.96	1.65	0.72	1.02	0.0000
4 HOUR	3.12	1.09	0.64	0.81	0.0000
8 HOUR	3.12	1.13	0.48	0.65	0.0000
12 HOUR	2.48	1.08	0.52	0.59	0.0000
24 HOUR	2.44	1.26	0.92	1.22	0.0001



In relation to VAS score, there were definite statistical difference between the groups ($P < 0.05$) in favour of Epidural plus spinal group.

Table 6

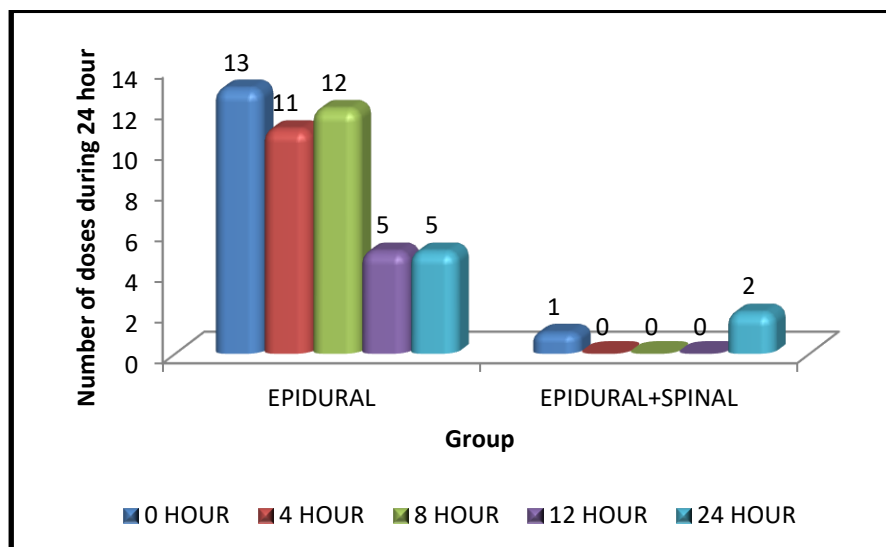
Total Drug	EPIDURAL		EPIDURAL+SPINAL		P-VALUE
	MEAN	SD	MEAN	SD	
Total Drug/ml	350.24	10.16	272.08	6.69	0.000



Total epidural drug used in only thoracic epidural was more than the group epidural and spinal which is statistically significant ($p < 0.05$)

Table 7

RESCUE ANALGESIC	EPIDURAL	EPIDURAL+SPINAL
0 HOUR	13	1
4 HOUR	11	0
8 HOUR	12	0
12 HOUR	5	0
24 HOUR	5	2



Use of rescue analgesia was more in standard thoracic epidural which is statistically significant ($p < 0.05$)

Discussion

Abdomino thoracic esophagectomy is a curative approach for patients with carcinoma esophagus. Effective pain control is an essential requirement postoperatively for better pulmonary function, ambulation and overall recovery. Thoracic epidural analgesia (TEA) is commonly used in the care of patients undergoing esophagectomy, as it provides superior pain relief when compared with parenteral opioids alone. In addition, the use of TEA is associated with reduced rates of pulmonary complications and anastomotic leaks after esophagectomy^(4,5) as well as improved quality of life following major thoracoabdominal surgery⁶. As it involves 3 approaches from thorax, neck and abdomen simultaneously involving large number of dermatomes, adequate pain control becomes challenging in the postoperative period. The number of dermatomes involved in the abdomino-thoracic approach presents unique analgesic challenges. The aim of this investigation was to analyze the impact of adding intrathecal morphine to standard TEA on postoperative analgesic outcomes associated with abdomino thoracic esophagectomy and to take note if any complications.

Effective action of morphine or other opiates can be achieved by their specific action at the dorsal horn⁷. Intrathecal opioids act both pre and post synaptically by reducing the neurotransmitter release and hyperpolarize the membranes of neurons in the dorsal horn^{7,8}. The concentration of the drug needed for such effects cannot be achieved by the standard parenteral and non parenteral doses used in clinical practice⁴. Secondary to its hydrophilic property, morphine binds to high affinity receptors in the dorsal horn but has a lower propensity for binding to the non-receptor sites in the myelin and white matter⁹. This hydrophilic property of morphine minimizes the spinal cord capillary loss, which results in a higher concentration of available morphine in the CSF, leading to a wider band of analgesia. Also due to high hydrophilicity, morphine stays in the CSF for a long time leading to a long duration of action, upto 24 hr. Cephalad spread may occur as early as 30 min when drug is detectable in cisternal CSF⁹.

In our study, the demographic profiles (age, sex weight, height), ASA status, type of surgery and duration of surgery were comparable and statistically insignificant. In our study there were significant difference between the two groups as far as heart rate was concerned and the "p" value was significant ($P < 0.05$) at any time in 24 hour post operative period in favour of epidural and spinal. The results are significant with heart rate nearer to the baseline in the epidural and spinal group may be because of lesser pain experienced by patient in this group. There were no statistical difference between the two groups in relation to systolic blood pressure. In our study we did not find any statistical difference in relation to diastolic blood pressure. For 24 hrs postoperative period monitoring other than 0thhr, we could not find statistical difference between the groups in relation to mean arterial pressure. Jefferson Tang² et al study in intrathecal morphine for liver resection did not find much of haemodynamic alterations in post operative patients. Michael J. Brown¹⁰ et al also in double epidural technique have not found much haemodynamic alterations in patients undergoing Ivor-Lewis Esophagectomy using their technique in post operative period.

In relation to VAS score, there were definite statistical difference between the groups ($P < 0.05$) in favour of Epidural plus spinal group. Our results were in accordance with Jefferson Tang² who used intrathecal morphine for liver resection. Michael J Brown also with double epidural technique found better pain control. Whereas E. Visser¹ in their systemic review and meta analysis could not find any differences in pain score with different modalities of pain management for post operative esophagectomy patients. Total epidural drug used in only thoracic epidural was more than the group epidural and spinal which is statistically significant ($p < 0.05$) which is something very encouraging. Jeffersong Tang² also found less use systemic opioid drugs in patients where intrathecal morphine was used.

Use of rescue analgesia was more in standard thoracic epidural which is statistically significant ($p < 0.05$). Whereas Michael J. Brown¹⁰ did not find much of differences in both the groups where double epidural was compared to single epidural for post esophagectomy pain management. Adverse effects associated with epidural catheter infusions (hypotension, respiratory depression, sedation, nausea and vomiting, and pruritus), as assessed and documented. There are a number of limitations with this investigation that deserve mention as well. Intraoperative monitoring was not mentioned in the study as altered hemodynamics, hypoxia or hypercapnea may be due various reasons like due to one lung ventilation, bleeding or may due to other reasons, so we took into considerations post operative findings only. Post operative monitoring could have been done for 48 hrs but we monitored only for 24 hrs. There were 3 cases of anastomotic leakage, which were dropped from the study. We could not comment on number of days of hospital stay as apart from pain there were other factors due to various surgical reasons which may prolong the hospital stay.

Conclusion

We conclude that addition of intrathecal morphine along with thoracic epidural for patients undergoing abdomino thoracic esophagectomy reduces pain, requirement of epidural drug and rescue analgesia without any significant haemodynamic variation or any adverse effects. Thus it can be a better alternative from the conventional thoracic epidural approach.

Declarations

Funding: None

Conflict of interest: None

Ethical approval: taken from Institutional Ethics Committee of State Cancer Institute, GMC, Guwahati

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