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A Study of Post-Operative Outcome with Thoracic Epidural Analgesia in Major Abdominal Surgery

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Abstract

Background: *Ideal recovery and complication avoidance in extensive abdominal surgery need good perioperative analgesia. Thoracic epidural anaesthesia (TEA) added to general anaesthesia (GA) is proposed to optimize postoperative outcome. The aim of this study was to assess the post-operative outcome with thoracic epidural analgesia in major abdominal surgery.*

Methods & materials: *This prospective observational study was conducted in Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangladesh Medical University (BMU), Shahbag, Dhaka, Bangladesh from August 2024 to July 2025. Total 50 patients undergoing major abdominal surgery were included in this study. The patients were divided into two groups: Group A (n=25) received combined epidural with GA, and Group B (n=25) received GA alone.*

Results: *Demographic and preoperative clinical variables were comparable in groups but preoperative SpO_2 was significantly higher in Group B ($p<0.0001$). In intraoperative intervals, diastolic blood pressure was significantly higher in Group B ($p=0.025$), whereas pulse, systolic pressure, and SpO_2 were equal. Urine output and random blood sugar did not differ significantly. Hypotension was observed more frequently in the group A, while hypertension was more pronounced in the group B. Post operatively, Group B showed much higher diastolic BP and SpO_2. VAS score was significantly lower in Group A ($p<0.0001$) and no rescue analgesic required compared to 96% in Group B.*

Conclusion: *TEA with GA significantly improves postoperative analgesia and reduces the need for analgesics in major abdominal surgery, at the price of a higher risk of hypotension, which makes close haemodynamic monitoring of paramount importance.*

Keywords: *Post-operative Outcome, Thoracic Epidural Analgesia, and Major Abdominal Surgery.*

1. INTRODUCTION

Major abdominal surgery, like procedures including colorectal resection, hepatic surgery, and upper gastrointestinal surgery, is associated with extreme physiological stress and postoperative pain, both of which exert significant influence on recovery outcomes. Inadequately controlled pain following such procedures is not just a comfort problem for the patient but one with significant implications for morbidity and outcomes of recovery. Severe postoperative pain impedes mobilization, interferes with pulmonary function, delays gastrointestinal recovery, and prolongs the duration of hospitalization, thereby elevating the risk for thromboembolic complications, cardiopulmonary complications, and escalating healthcare costs.[1,2] Studies have consistently shown that ineffective pain control can limit activity in rehabilitation and early ambulation programs, worsening pulmonary complications and the duration of postoperative ileus.[3,4] This is a true burden to patients and healthcare systems alike, particularly in the context of enhanced recovery programmes where mobilization at an early stage and good analgesia are the prime determinants of successful outcomes.[5]

Thoracic epidural analgesia (TEA) has long been the gold standard of perioperative pain management for major abdominal and thoracic surgery. TEA is superior to systemic opioid-based analgesia for dynamic pain relief, and enables patients to breathe more deeply, mobilize sooner, and be less dependent on systemic opioids.[6] A growing body of evidence has established the correlation of TEA with improved postoperative outcomes. For instance, meta-analytic evidence demonstrates that epidural analgesia reduces pulmonary complications in abdominal and thoracic surgery by a noteworthy extent, demonstrating a protective effect on respiratory physiology.[7] Similarly, randomized controlled trials have shown TEA to improve gastrointestinal recovery, as manifested by the earlier return of bowel function compared with intravenous patient-controlled analgesia.[8,9] Observational analyses also suggest that TEA reduces hospital stay and assists in improved functional recovery, which further contributes to its perioperative advantage.[10]

Despite these benefits, evidence of the impact of TEA on more general clinical outcomes such as morbidity and mortality is heterogeneous. While many studies have demonstrated benefits in the quality of analgesia extent, bowel function, and postoperative ambulation, others have suggested that, in the context of multimodal analgesic strategies and enhanced recovery pathways, the incremental benefits of TEA are possibly less apparent. For instance, systematic reviews of enhanced recovery surgery protocols have reported contradictory findings for the impact of TEA on hospital stay and gastrointestinal recovery, implying that its role may be context-dependent.[5] More specifically, an investigation in patients undergoing colorectal surgery under ERAS pathways has found no overall effect of TEA on length of stay or in-hospital opioid consumption, challenging its routine application as a first-line analgesic modality for all patients.[11] In addition, randomized controlled data in thoracic surgical patients demonstrate heterogeneity in gastrointestinal motility outcomes, emphasizing the controversy for TEA's clinical relevance in contemporary perioperative practice.[12]

Aside from the heterogeneity in clinical outcomes, TEA is also associated with established complications such as hypotension, urinary retention, motor blockade, and the potential for rare but devastating neurological adverse effects. Recent reviews, particularly in high-risk or specialized populations such as esophageal surgery, promote both perioperative advantages and the lack of consensus in an absolute sense, reflecting the complexity in reconciling efficacy, safety, and feasibility in modern surgical practice.[13]

Cumulatively, the evidence suggests that while TEA remains an effective and widely applied technique with demonstrable benefits in pain control and painstakingly selected outcome measures, its impact on global postoperative outcomes is variably established in diverse surgical populations and institutional settings. These studies are required to clarify TEA's current role in perioperative care and guide clinicians toward evidence-based practice. Therefore, the present study aims to evaluate postoperative outcomes of thoracic epidural analgesia for major abdominal surgery.

2. OBJECTIVES

To assess the post-operative outcome with thoracic epidural analgesia in major abdominal surgery.

3. METHODS & MATERIALS

This prospective observational study was conducted in Department of Anaesthesia, Analgesia and Intensive Care Medicine,

Bangladesh Medical University (BMU), Shahbag, Dhaka, Bangladesh from August 2024 to July 2025. Total 50 adult patients scheduled to undergo elective major abdominal surgery were include for this study. Patients were divided into two equal groups of 25 each. Group A received thoracic epidural anaesthesia in combination with standard general anaesthesia (GA), while Group B underwent surgery under general anaesthesia alone. All adult patients aged between 18 and 70 years with American Society of Anesthesiologists (ASA) physical status I–III who were scheduled for major abdominal surgery were considered eligible. Patients with contraindications to epidural anaesthesia (such as coagulopathy, local infection at the insertion site, or patient refusal), severe cardiopulmonary disease, chronic opioid dependence, neurological disorders, or who required postoperative mechanical ventilation were excluded from the study. A detailed clinical examination was performed and preoperative vital signs were documented. Intraoperatively, all patients were monitored according to American Society of Anesthesiologists (ASA) standards. Continuous electrocardiographic monitoring was employed to detect any ST-T changes, along with invasive arterial blood pressure, heart rate, SpO_2, and central venous pressure.

Renal function was evaluated perioperatively using urine output and random blood sugar (RBS) measurements. The surgical protocols followed institutional standards and were similar across both groups. Postoperatively, patients were monitored in the intensive care unit (ICU). Analgesic efficacy was assessed using a visual analogue scale (VAS), and rescue analgesic requirements were noted. Analgesia VAS score ranged from 0-100 which can be interpreted as follows:

0–4 mm: No pain

5–44 mm: Mild pain

45–74 mm: Moderate pain

75–100 mm: Severe pain

Postoperative support requirements were carefully documented, including the need for inotropes, pacemaker, defibrillator intervention, and volume support. Duration of mechanical ventilation and any perioperative complications were also recorded. The primary outcomes of interest were differences in perioperative haemodynamic stability, postoperative analgesic requirement, and supportive interventions between the two groups. Ethical clearance was obtained from the Institutional Review Board (IRB). Written informed consent was secured from each participant. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 22.0 and p-values more than 0.05 were considered statistically significant.

4. Results

Table I presents the demographic characteristics of the study population. The mean age of patients in Group A (epidural with GA) was 47.84 ± 12.64 years, compared to 41.48 ± 13.96 years in Group B (GA only), and this difference was not statistically significant ($p = 0.0977$). The gender distribution was also comparable, with males comprising 64% of Group A and 52% of Group B ($p = 0.3948$). The mean body mass index (BMI) was slightly lower in Group A (22.4 ± 2.1 kg/m²) compared to Group B (23.5 ± 2.4 kg/m²), though this difference did not reach statistical significance ($p = 0.091$). Overall, both groups were similar in terms of baseline demographic profiles.

Table II compares pre-operative clinical parameters between the two groups. Mean haemoglobin levels were comparable between Group A (11.58 ± 2.00 g/dL) and Group B (11.87 ± 1.96 g/dL) ($p = 0.6083$). Likewise, blood sugar, serum creatinine, and ejection fraction showed no statistically significant differences ($p > 0.05$ for all). Thyroid-stimulating hormone (TSH) levels were higher in Group B (5.40 ± 1.75 µU/mL) compared to Group A (1.66 ± 0.66 µU/mL), although this difference was not statistically significant ($p = 0.1946$). Cardiovascular parameters including pre-operative pulse rate and blood pressures (systolic and diastolic) were also comparable. However, pre-operative oxygen saturation (SpO_2) was significantly higher in Group B (98.88 ± 1.08%) than in Group A (97.13 ± 1.14%) ($p < 0.0001$), indicating a statistically significant baseline difference.

Table III illustrates per-operative haemodynamic comparisons. Although pulse rate and systolic blood pressure were marginally higher in Group B, these differences did not reach statistical significance. However, diastolic blood pressure was significantly higher in Group B (91.20 ± 11.30 mmHg) compared to Group A (83.48 ± 12.27 mmHg) ($p = 0.025$). Oxygen saturation was maintained intraoperatively in both groups, with no significant difference ($p = 0.1792$).

Renal parameters, shown in Table IV, did not differ significantly between the two groups.

Mean urine output per hour was slightly higher in Group B (104.21 ± 32.20 mL) compared to Group A (87.92 ± 41.70 mL), but the difference was not significant (p = 0.1559). Similarly, random blood sugar levels were comparable (p = 0.5833).

Per-operative complications are depicted in Figure 1. Hypotension occurred in 28% of patients in Group A (epidural with GA) compared to 12% in Group B (GA only). Conversely, hypertension was more frequent in the GA group (88%) compared to 72% in the epidural group. This indicates that while epidural use was associated with more hypotensive episodes, GA-only patients experienced more hypertensive surges intraoperatively. Table V compares post-operative clinical parameters. Post-operative pulse rate and systolic blood pressure were similar across groups. However, diastolic blood pressure was significantly higher in Group B (84.00 ± 10.00 mmHg) compared to Group A (72.88 ± 9.78 mmHg) (p = 0.0002). Furthermore, post-operative SpO_2 was significantly higher in Group B (99.75 ± 0.85%) than in Group A (98.08 ± 1.04%) (p < 0.0001).

Pain assessment results are presented in Table VI. The mean VAS score was significantly lower in Group A (2.39 ± 1.73) compared to Group B (47.40 ± 9.37) (p < 0.0001), highlighting superior analgesia in the epidural group. Importantly, none of the patients in Group A required rescue analgesics, whereas 96% of patients in Group B required additional pain relief (p < 0.0001). This underscores a statistically and clinically significant benefit of adding epidural anaesthesia to GA in reducing post-operative pain and analgesic requirements.

Table I. *Demographic characteristics of the study groups (N=50)*

Parameter	Group A (n=25)	Group B (n=25)	P value
Age (in years)			
Mean ± SD	47.84± 12.64	41.48± 13.96	0.0978
Range	23-70	17-68	
Sex			
Male	16 (64%)	13 (52%)	0.3948
Female	9 (36%)	12 (48%)	
BMI (kg/m^2)			
Mean ± SD	22.4± 2.1	23.5 ± 2.4	0.091

p value reached from Chi-square test

Table II. *Comparison of pre-operative clinical parameters between the study groups (N=50)*

Pre-operative clinical parameters	Group A (Mean ± SD)	Group B (Mean ± SD)	P value
Hb% (mg/dL)	11.58 ± 2.00	11.87 ± 1.96	0.6083
Blood sugar (mg/dL)	10.08 ± 14.87	6.23 ± 1.28	0.2084
Creatinine (mg/dL)	0.80 ± 0.20	1.19 ± 1.55	0.2136
Ejection Fraction (%)	63.5 ± 4.11	63.3 ± 4.75	0.8742
TSH (µU/mL)	1.66 ± 0.66	5.40 ± 1.75	0.1946
Pulse (per minute)	80.29 ± 9.27	78.62 ± 6.90	0.4836
BP (Systolic) (mmHg)	121.46 ± 16.18	116.67 ± 14.35	0.2835
BP (Diastolic) (mmHg)	78.42 ± 8.68	79.33 ± 9.66	0.7276
SpO_2 (%)	97.13 ± 1.14	98.88 ± 1.08	<0.0001*

*=significant

p value reached from Chi-square test

Table III. *Comparison of per-operative clinical parameters between the study groups (N=50)*

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	P value
Pulse (per minute)	85.36 ± 12.66	90.08 ± 9.16	0.138
BP (Systolic) (mmHg)	125.32 ± 17.78	130.40 ± 14.28	0.2712
BP (Diastolic) (mmHg)	83.48 ± 12.27	91.20 ± 11.30	0.025*
SpO_2 (%)	94.20 ± 19.65	99.56 ± 0.71	0.1792

*=significant

p value reached from Chi-square test

Table IV. *Comparison of renal parameters between the study groups (N=50)*

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	P value
Urine output/hour	87.92 ± 41.70	104.21 ± 32.20	0.1559
RBS (mg/dL)	6.92 ± 1.48	6.68 ± 1.33	0.5833

p value reached from Chi-square test

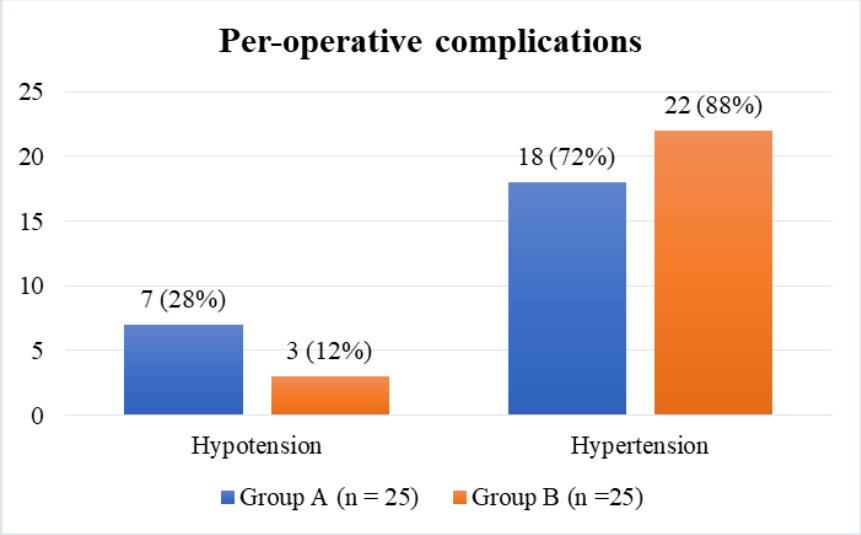

Figure 1. *Per-operative complications (N=50*

Table V. *Comparison of post-operative clinical parameters between the study groups (N=50)*

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	P value
Pulse (per minute)	82.40 ± 10.60	83.28 ± 7.41	0.7354
BP (Systolic) (mmHg)	115.40 ± 18.37	120.40 ± 13.38	0.2772
BP (Diastolic) (mmHg)	72.88 ± 9.78	84.00 ± 10.00	0.0002*
SpO_2 (%)	98.08 ± 1.04	99.75 ± 0.85	<0.0001*

*=significant

p value reached from Chi-square test

Table VI. *Comparison of post-operative pain score between the study groups (N=50)*

Parameter	Group A (n=25)	Group B (n=25)	P value
VAS Score (Mean ± SD)	2.39 ± 1.73	47.40 ± 9.37	<0.0001*
Requirement of rescue analgesics	0	24 (96%)	<0.0001*

*=significant

p value reached from Chi-square test

VAS=Visual Analogue Score

5. Discussion

The present study compared postoperative and perioperative results of thoracic epidural anaesthesia (TEA) with general anaesthesia and general anaesthesia (GA) alone in patients undergoing major abdominal surgery. The demographic characteristics in the form of age, gender distribution, and body mass index (BMI) were comparable between the two groups without any statistically significant disparity. These are consistent with earlier studies that have demonstrated baseline demographics in studies determining TEA and GA were largely well matched, thereby reducing confounding in comparisons of outcomes.[14-16] Similar comparability was also noted in preoperative clinical parameters such as haemoglobin, blood sugar, serum creatinine, and ejection fraction. While thyroid-stimulating hormone and oxygen saturation (SpO_2) were slightly varied, the latter in isolation was statistically significant. Previous studies have also observed that preoperative physiological as well as biochemical observations are comparable in epidural and GA groups, ensuring comparisons post-surgery are just.[17,18]

Intraoperative haemodynamic stability remains a required element when evaluating TEA. In the present study, pulse rate and systolic blood pressure were not group-wise different, while diastolic blood pressure was lower in the TEA group with greater numbers of hypotensive episodes. Hypertension, on the contrary, was more frequent in GA-only patients. These results are in agreement with earlier reports of sympathetic blockade induced by TEA leading to predisposition to hypotension, while GA is most commonly associated with hypertensive surges due to inadequate autonomic regulation.[17,19] Intraoperative haemodynamic instability was also reported by Li et al.[14] for TEA patients, while El-Tahan[20] highlighted the risk of hypotension as a daily but manageable side effect of TEA. Despite these differences, intraoperative

SpO_2 was maintained in both groups, consistent with research establishing that TEA preserves oxygenation and doesn't compromise arterial saturation.[21] Renal function, as expressed by intraoperative urine output, was comparable, supporting previous research showing that while TEA may reduce systemic vascular resistance, renal perfusion is usually preserved.[20]

Postoperative haemodynamic parameters were likewise balanced in terms of pulse and systolic blood pressures between groups but with the TEA group having much lower diastolic pressures. These results parallel those of Sudheshna et al.[22], who noted lower diastolic blood pressure readings among TEA subjects compared to controls. Postoperative oxygen saturation was ever so slightly yet significantly higher for GA-only patients, although both groups had clinically acceptable SpO_2. Earlier studies, like El-Tahan[17], have shown that TEA has an impact on sympathetic tone rather than oxygenation, supporting the clinical insignificance of the effect.

The strongest contrast observed was in postoperative pain. TEA patients had a very low visual analogue scale (VAS) score and did not require rescue analgesia, whereas the majority of GA-only patients required rescue analgesia. These findings concur with a vast pool of literature that attests to the superiority of TEA for managing postoperative pain during major abdominal and thoracic surgery.[12,17] Pintaric et al.[23] also demonstrated that TEA is superior in pain relief and reduces opioid requirement compared to other techniques. Similarly, Zoumprouli et al.[12] also emphasized the contribution of TEA in reducing pain scores and enhancing postoperative gastrointestinal recovery, while Sudheshna et al.[22] also confirmed superior analgesia in TEA patients compared to systemic analgesia. The results confirm the central role of TEA in multimodal pain management regimens and enhanced recovery pathways.

Overall, this study reaffirms TEA to be distinctly better for postoperative pain relief with reduced pain scores and analgesic requirements but at the price of an increased frequency of intraoperative hypotension and reduced postoperative diastolic blood pressures.

6. Limitations of the Study

In our study, there was small sample size and absence of control for comparison. Study population was selected from one center of Dhaka city, so may not represent wider population. The study was conducted at a short period of time.

7. Conclusion

This study confirms that thoracic epidural anaesthesia with general anaesthesia in major abdominal surgery provides more effective postoperative analgesia, significantly reducing pain scores and rescue analgesics usage. Although more frequent intraoperative hypotension and decreased diastolic blood pressures were noted, oxygen saturation and renal parameters were the same in both groups. These findings highlight the clinical value of epidural anaesthesia in maximizing postoperative recovery, with strict observation needed to exchange analgesic benefits against haemodynamic stability.

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