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The Benefit and Risk of Combined Epidural and General Anesthesia for Laparoscopic Surgery

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Abstract **Original Research Article**

***Introduction*:** Laparoscopic surgery, also known as minimally invasive surgery, is a modern surgical technique that allows surgeons to perform operations using small incisions instead of the larger incisions required for open surgery. Combined epidural and general anesthesia for laparoscopic surgery is an anesthesia technique that merges the benefits of both general and epidural anesthesia to achieve improved patient outcomes. ***Aim of the Study*:** The aim of this study was to assess the benefit and risk of combined epidural and general anesthesia for laparoscopic surgery. ***Methods*:** This cross-sectional study was conducted in Department of Anesthesiology, Holy Family Red Crescent Medical College and Hospital, Dhaka, Bangladesh, during the period from January 2021 to January 2023. Total 300 patients undergoing laparoscopic surgery were in this study. All the patients were divided into two groups: Group A consist of 150 patients operated with only general anesthesia and Group B consist of 150 patients operated with combined epidural and general anesthesia. ***Result*:** In this study, no demographic characteristics were statistically significant (P>0.05). The operation time was significantly ($p \leq 0.05$) higher in group B compared to group A. The duration of anesthesia was also significantly ($p \leq 0.05$) higher in group B compared to group A. For systolic arterial pressure, no significant differences were found between the two groups at any time point. Similarly, for heart rate, only the difference after anesthesia was significant, with a p-value of 0.0457. For diastolic arterial pressure, the only significant difference was found after anesthesia, with a p-value of <0.0001. Group A had a mean VAS score of 2.8 (SD±1.5), while Group B had a mean VAS score of 1.5 (SD±1.4). The pain score was statistically ($p<0.0001$) lower in group B. Group A had a mean recovery time of 21.5 minutes with a SD of 8.2, and Group B had a mean recovery time of 15.5 minutes with a SD of 6.8. The recovery time was statistically lower ($p<0.0001$) in group B. For complications and adverse effects, there were statistically significant ($p \leq 0.05$) differences between the groups in incisional pain, abdominal pain and back pain. On the contrary, there was no statistically significant (P>0.05) differences between the groups in nausea and vomiting. ***Conclusion*:** From the findings of our study, it can be concluded that combined epidural and general anesthesia for laparoscopic surgery provided better postoperative pain control, hemodynamic stability, and shorter recovery times compared to general anesthesia alone. However, it also showed increased operative and anesthesia duration, as well as a higher incidence of back pain in the combined group.

Keywords: The Benefit, Risk, Combined Epidural and General Anesthesia, and Laparoscopic Surgery.

I. INTRODUCTION

Laparoscopic surgery often requires different anesthesia techniques, including general anesthesia, regional anesthesia (such as epidural or spinal), and local anesthesia [1]. The choice of anesthesia depends on various factors, including the type of surgery, patient characteristics, and surgeon preferences. Anesthesia is essential for the effective management of surgical pain and stress, as well as for facilitating optimal surgical conditions. There are various anesthesia techniques used in laparoscopic surgery, including general anesthesia, regional anesthesia (e.g., epidural or spinal), and local anesthesia. The choice of anesthesia is influenced by factors such as the type of surgery, patient characteristics, and surgeon preferences [1]. General anesthesia is frequently employed in laparoscopic procedures due to its ability to provide complete muscle relaxation and unconsciousness,

ensuring patient comfort and immobility during surgery [2]. Epidural anesthesia involves injecting an anesthetic agent into the epidural space of the spinal column, blocking pain signals from the lower part of the body. It can be utilized as a standalone technique or in combination with general anesthesia [3]. General anesthesia is commonly used for laparoscopic surgery, as it provides complete muscle relaxation and unconsciousness, ensuring the patient's comfort and immobility during the procedure [2]. Epidural anesthesia, on the other hand, involves the injection of an anesthetic agent into the epidural space of the spinal column, blocking pain signals from the lower part of the body. It can be used as a standalone technique or in combination with general anesthesia [3]. The combination of epidural and general anesthesia has been suggested to provide synergistic benefits during laparoscopic surgery [4]. Epidural anesthesia can provide better postoperative analgesia than general anesthesia alone, reducing the need for opioid analgesics and their associated side effects [4, 5]. Combined anesthesia can decrease the surgical stress response, reducing the release of stress hormones and lowering the risk of postoperative complications [6]. Improved pain control and reduced stress response may contribute to faster recovery and shorter hospital stays [7]. Epidural anesthesia can help maintain stable blood pressure and heart rate during surgery, reducing the risk of cardiovascular complications [3]. Despite these benefits, the use of combined epidural and general anesthesia is not without risks. Some potential risks and complications include- technical difficulties, infection, nerve injury, hypotension and etc. The placement of an epidural catheter can be challenging, particularly in patients with spinal abnormalities or obesity [3]. The risk of nerve injury during epidural catheter placement is low but should be considered, especially in patients with pre-existing neurological conditions [3]. In addition, epidural anesthesia can cause a decrease in blood pressure, which may require medical intervention [8]. The current study was conducted to assess the benefit and risk of combined epidural and general anesthesia for laparoscopic surgery.

II. OBJECTIVES

To assess the benefit and risk of combined epidural and general anesthesia for laparoscopic surgery.

III. METHODOLOGY & MATERIALS

This cross-sectional study was conducted in Department of Anesthesiology, Holy Family Red Crescent Medical College and Hospital, Dhaka, Bangladesh, during the period from January 2021 to January 2023. Total 300 patients undergoing laparoscopic surgery were in this study. All the patients were divided into two groups: Group A consist of 150 patients operated with only general anesthesia and Group B consist of 150 patients operated with combined epidural and general anesthesia. Visual analog scale (VAS) pain score was measured in both groups where 0=no pain, 10=worst pain. Consent of the patients and guardians were taken before collecting data. After collection of data, all data were entered into computer and statistical analysis of the results being obtained by using windows-based computer software devised with Statistical Packages for Social Sciences version 22. After compilation, data were presented in the form of tables, figures and charts, as necessary. P value of less than 0.05 was considered statistically significant.

IV. RESULT

Table-I shows the demographic characteristics of the study people. Group A has a mean age of 42.3 (SD± 9.8) years, and Group B has a mean age of 41.8 (SD±9.5) years. In both groups, there was male predominance. Group A has a mean BMI of 25.2 (SD±2.9), while Group B has a mean BMI of 25.1 (SD±3.1). Both groups have identical ASA physical status: 112 participants (74.7%) are classified as ASA I, and 38 participants (25.3%) are classified as ASA II. All the demographic characteristics were not statistically significant (P>0.05. Table-II demonstrates the operative outcome of the study people. Mean operation duration in group A was 77.2 (SD±11.3) minutes, and mean operation duration in group B was 81.1 (SD±12.4) minutes. The p-value for the duration of operation was 0.0047, which is statistically significant. Mean duration of anesthesia in group A was 94.4 (SD±8.5) minutes, while mean duration of anesthesia in group B was 100.3 (SD±9.7) minutes. The p-value for duration of anesthesia was <0.0001, which is statistically significant. For systolic arterial pressure, no significant differences were found between the two groups at any time point, with p-values of 0.6213, 0.1001, and 0.4814, respectively. Similarly, for heart rate, only the difference after anesthesia was significant, with a p-value of 0.0457. The other time points showed non-significant differences, with p-values of 0.4711 and 0.2996. For diastolic arterial pressure, the only significant difference was found after anesthesia, with a p-value of <0.0001, while the other time points had non-significant p-values of 0.0846 and 0.0707. Group A had a mean VAS score of 2.8 with a SD of 1.5, while Group B had a mean VAS score of 1.5 with a SD of 1.4. The pain score was statistically (p<0.0001) lower in group B. Group A had a mean recovery time of 21.5 minutes with a SD of 8.2, and Group B had a mean recovery time of 15.5 minutes with a SD of 6.8. The recovery time was statistically lower (p<0.0001) in group B. Table-III shows the complications and adverse effects after surgery between the groups. For incisional pain, Group A had 50 participants (33.3%) experiencing it, while Group B had 34 participants (22.7%) experiencing it. The p-value for incisional pain was 0.0412, which is statistically significant. In Group A 46 participants (30.7%) experienced abdominal pain, while Group B had 21 participants (14.0%) experiencing it.

The p-value for abdominal pain was 0.0005, which is statistically significant. In Group A 21 participants (14.0%) experienced nausea, while Group B had 13 participants (8.7%) experiencing it. The p-value for nausea was 0.1486, which is not significant. In Group A had 13 participants (8.7%) experienced vomiting, while Group B has 15 participants (10.0%) experiencing it. The p-value for vomiting was 0.6994, which is not significant. In Group A has 4 participants (2.7%) experienced back pain, while Group B had 12 participants (8.0%) experiencing it. The p-value for back pain was 0.0417, which is statistically significant.

Table I: Demographic characteristics of the study people (N=300).

Characteristics		Group A (n=150)	Group B (n=150)	P-value
Age (Years)	Mean ± SD	42.3 ±9.8	41.8 ±9.5	0.6540^{ns}
	Range	18-55	18-55	
Sex (n, %)	Male	79 (52.7%)	78 (52%)	0.9036^{ns}
	Female	71 (47.3%)	72 (48%)	
BMI (kg/m^2)	Mean ± SD	25.2 ±2.9	25.1 ±3.1	0.7732^{ns}
ASA physical status (n, %)	ASA I	112 (74.7%)	112 (74.7%)	1.000^{ns}
	ASA II	38 (25.3)	38 (25.3)	

Statistical analysis was done by unpaired Student t-test.

The test of significance was calculated and p values ≤ 0.05 was accepted as level of significance.

ns = Not significant, n = Number of subjects in each group, N = Total number of patients, ASA= American Society of Anesthesiology

Table II: Operative outcome of the study people (N=300)

Characteristics		Group A (n=150)	Group B (n=150)	P-value
Duration of operation (Minutes)		77.2±11.3	81.1±12.4	0.0047^{s}
Duration of anesthesia (Minutes)		94.4±8.5	100.3±9.7	<0.0001^{s}
Systolic arterial pressure (mm Hg)	Baseline	126.2±8.4	125.7±9.1	0.6213^{ns}
	After anesthesia	116.6±9.3	114.8±9.6	0.1001^{ns}
	After surgery	127.5±8.7	126.8±8.5	0.4814^{ns}
Diastolic arterial pressure (mm Hg)	Baseline	78.1±6.2	79.4±6.8	0.0846^{ns}
	After anesthesia	71.9±6.1	67.8±7.2	<0.0001^{s}
	After surgery	77.6±5.9	78.9±6.5	0.0707^{ns}
Heart rate	Baseline	84.4±7.1	83.8±7.3	0.4711^{ns}
	After anesthesia	81.6±8.3	79.7±8.1	0.0457^{s}
	After surgery	85.3±7.4	86.2±7.6	0.2996^{ns}
VAS pain score		2.8±1.5	1.5±1.4	<0.0001^{s}
Recovery time		21.5±8.2	15.5±6.8	<0.0001^{s}

Statistical analysis was done by unpaired Student t-test.

The test of significance was calculated and p values ≤ 0.05 was accepted as level of significance.

s = Significant, ns = Not significant, n = Number of subjects in each group, N = Total number of patients

Table III: Complications and adverse effects after surgery between the groups (N=300)

Complications and adverse effects	Group A (n=150)		Group B (n=150)		P-value
	n	%	n	%	
Incisional pain	50	33.3	34	22.7	0.0412^{s}
Abdominal pain	46	30.7	21	14.0	0.0005^{s}
Nausea	21	14.0	13	8.7	0.1486^{ns}
Vomiting	13	8.7	15	10.0	0.6994^{ns}
Back pain	4	2.7	12	8.0	0.0417^{s}

Statistical analysis was done by unpaired Student t-test.

The test of significance was calculated and p values ≤ 0.05 was accepted as level of significance.

s = Significant, ns = Not significant, n = Number of subjects in each group, N = Total number of patients

V. DISCUSSION

In this study, the benefits and risks of combined epidural and general anesthesia (CEGA) for laparoscopic surgery were evaluated. Group A has a mean age of 42.3 (SD± 9.8) years, and Group B has a mean age of 41.8 (SD±9.5) years. In both groups, there was male predominance. Group A has a mean BMI of 25.2 (SD±2.9), while Group B has a mean BMI of 25.1 (SD±3.1). Both groups have identical ASA physical status: 112 participants (74.7%) are classified as ASA I, and 38 participants (25.3%) are classified as ASA II. The demographic characteristics of the study

participants were not statistically significant between the two groups. These findings were similar to the study of Luchetti M *et al.,* [9] and Calvo-Soto P *et al.,* [10]. Our study found that Group B had significantly lower mean VAS pain scores ($p<0.0001$) and a shorter recovery time ($p<0.0001$) than Group A. In the study of Luchetti M *et al.,* [9], CEGA group also had better score after operation. The duration of operation and anesthesia were found to be significantly longer in Group B ($p=0.0047$ and $p<0.0001$, respectively). This could be attributed to the additional time required for epidural anesthesia administration and its monitoring. Despite the increased duration, the combined approach demonstrated improved recovery times and reduced pain scores, indicating its potential benefits outweigh this disadvantage. Comparing hemodynamic parameters, our study found no significant differences in systolic arterial pressure between the two groups at any time point. However, diastolic arterial pressure and heart rate showed significant differences after anesthesia ($p<0.0001$ and $p=0.0457$, respectively). These findings are in line with the study of Calvo-Soto P *et al.,* [10] where CSGAB patients had lower figures for systolic and diastolic pressures after change of posture and pneumoperitoneum. Similar results were found in the study of Nizamoglu A *et al*., [11]. In terms of complications and adverse effects, our study found that Group B had significantly lower incidences of incisional pain ($p=0.0412$) and abdominal pain ($p=0.0005$) compared to Group A. These results align with a meta-analysis by Pöpping *et al.,* [12], which concluded that combined epidural and general anesthesia reduced postoperative pain and opioid consumption. However, our study found no significant differences in the incidence of nausea and vomiting between the two groups. Our study also found that Group B had a significantly higher incidence of back pain ($p=0.0417$) compared to Group A. This is likely due to the epidural anesthesia, as back pain is a known potential complication of this technique [13]. The increased incidence of back pain should be considered when evaluating the overall benefits and risks of combined anesthesia.

VI. *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 in Dhaka city, so may not represent wider population. The study was conducted at a short period of time.

VII. CONCLUSION AND RECOMMENDATIONS

From the findings of our study, it can be concluded that combined epidural and general anesthesia for laparoscopic surgery provided better postoperative pain control, hemodynamic stability, and shorter recovery times compared to general anesthesia alone. However, it also showed increased operative and anesthesia duration, as well as a higher incidence of back pain in the combined group. Future studies with larger sample sizes and diverse surgical procedures are needed to further validate these findings and establish the optimal anesthesia technique for laparoscopic surgery.

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