

## Prospective Comparative Analysis of Intra-operative Factors Influencing Outcome in Abdominal Surgeries

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### Abstract

*Introduction:* All abdominal (either laparoscopic or open) surgeries need intra operative monitoring of Oxygen saturation(SpO<sub>2</sub>), mean blood pressure, End tidal carbon dioxide (ETCO<sub>2</sub>) and blood loss. This monitoring is vital to prevent intra operative adverse events. Blood loss must be monitored and has to be replaced whenever essential.

The objectives of the study is

1. To find the difference in intra operative factors like SpO<sub>2</sub>, mean blood pressure, ETCO<sub>2</sub>, and blood loss between open and laparoscopic surgeries

*Materials and methods:* This was a prospective observational study was performed over a period of 12 months from October' 2018 to October 2019. All abdominal surgeries (either laparoscopic or open surgeries) performed at department of surgical oncology, Government Royapettah Hospital, Tamilnadu, Chennai were included in the study. All patients were given anesthesia by ETGA and monitored values recorded intra operatively. ETCO<sub>2</sub>, Blood Pressure, SPO<sub>2</sub> and blood loss were recorded. These factors were compared between open and laparoscopic surgeries. Results were analyzed using standard statistical methods.

*Results:* There were no statistically significant differences noted in SPO<sub>2</sub>, Mean BP and ETCO<sub>2</sub>, between all abdominal surgeries. Mean blood loss noted was 160.5ml, 192.7ml; 300.5ml in laparoscopic, lap assisted and open abdominal surgeries respectively. Hypotension was found more among open surgeries (51%) compared to laparoscopic (18%) or lap assisted (18%) abdominal surgeries (p=0.004). ETCO<sub>2</sub> values >35 were recorded in 68%, 41%, 38% in laparoscopic, lap assisted and open abdominal surgeries respectively.

*Conclusions:* We concluded that there was no statistical difference noted in intra-operative factors SPO<sub>2</sub>, Mean BP, ETCO<sub>2</sub>, between all abdominal surgeries. Mean blood loss, hypotension and blood transfusions were noted more among open than laparoscopic abdominal surgeries. Hypotension was significantly associated with open surgeries compared with laparoscopic abdominal surgeries.

**Key words:** Intra operative factors; ETCO<sub>2</sub>; laparoscopy Vs open surgeries.

### Introduction

All abdominal (either laparoscopic or open) surgeries need intra operative monitoring of Oxygen saturation(SpO<sub>2</sub>), mean blood pressure, End tidal carbon dioxide (ETCO<sub>2</sub>) and blood loss. This monitoring is vital to prevent intra operative adverse events. Blood loss must be monitored and has to be replaced whenever essential. Capnometry, measuring the concentration of carbon dioxide (CO<sub>2</sub>) in the atmosphere, was used for the first time during World War II as a tool for monitoring the

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internal environment.<sup>1</sup> This technology entered in medicine field in 1980 as a monitoring tool in emergency medicine and anesthesia.<sup>2,3</sup> It is measured by gas analyzer using photo acoustic spectra. Usage of ET<sub>CO</sub><sub>2</sub> during anesthesia has been extensively documented.<sup>10,11,12</sup>

Role of Laparoscopic surgeries are well established in gastro intestinal and gynecological surgeries. Benefits of laparoscopic surgeries are early recovery, less hospital stay and less analgesic requirements.<sup>9</sup> These benefits are well established in many studies.

The objectives of the study is

- To find the difference in intra operative factors like SpO<sub>2</sub>, mean blood pressure, ET<sub>CO</sub><sub>2</sub>, and blood loss between open and laparoscopic surgeries.

## Materials and Methods

This was a prospective observational study was performed over a period of 12 months from October 2018 to October 2019. All abdominal surgeries(either laparoscopic or open surgeries)performed at department of surgical oncology, Government Royapettah Hospital, Tamilnadu, Chennai were included in the study. All patients were given anesthesia by ETGA and monitored values recorded intra operatively. ET<sub>CO</sub><sub>2</sub>, Blood Pressure, SPO<sub>2</sub> and blood loss were recorded. Those patients who were converted to open from laparoscopy were excluded from the study. Hypotension defined as systolic BP <90 (8)or reduction of Mean BP more than 20% of baseline value.<sup>19</sup> ET<sub>CO</sub><sub>2</sub> measured every 15 min intra operatively. These factors were compared between open and laparoscopic surgeries. Results were analyzed using standard statistical methods.

## Results

Total 85 cases included in our study. In this study, the total numbers of open surgeries were 39 and laparoscopic surgeries were 46. Among laparoscopic surgeries 22 were total laparoscopic and 24 lap assisted.

Results were depicted in tables 1 to 3. Mean age was 48.9, 51.3, 51.5 respectively in laparoscopic, lap assisted and open abdominal surgeries. Majority of surgeries were performed for gynecological malignancies. Amongst the common ones were Carcinoma cervix<sup>15</sup>, carcinoma endometrium<sup>4</sup> and carcinoma ovary<sup>3</sup>. The operative primary specimens were retrieved through vaginal vault. No separate abdominal opening was made for organ retrieval except two patients in whom the specimens were

retrieved by small pfannenstiel incision.

**Table 1:** Characteristics of intra-operative factors (n=85).

	Laparoscopic	Lap assisted	Open
Age (Mean)	48.9	51.3	51.5
Sex	Female=21 Male =1	Female=10 Male =14	Female=10 Male =29
Neo adjuvant therapy	Yes=18 No=4	Yes=15 No=9	Yes=21 No=18
SPO <sub>2</sub> (Mean+/- SD)	97.5 +/-1.5	98 +/- 1.2	97.2+/-1.7
MBP (Mean+/- SD)	75 +/-8.3	73+/- 9.1	72+/-10.2
ETCO <sub>2</sub> (Mean+/- SD)	38.6+/-4.2	34.8+/-3.9	32.9+/-2.8
Blood loss (mean in ml)	160.5	192.7	300.4
Blood transfusion (no of patients)	2	4	8
Duration of surgery(min)	158.2	169.6	164.6

**Table 2:**

Hypotension	Laparoscopic	Lap assisted	Open	P value
Yes	4	4	20	
No	18	20	19	
	22	24	39	0.004

**Table 3:**

ETCO <sub>2</sub>	Laparoscopic	Lap assisted	Open	P value
<35	7	14	24	
>35	15	10	15	
	22	24	39	0.07

Lap assisted open abdominal surgeries were usually gastrointestinal surgeries (gastrectomy-7, pelvic exenterations-6, radical cystectomy-2, hemicolectomy-4,colostomy/ileostomy-3, feeding jejunostomy-1, lap assisted gastro-esophageal mobilization-1). Lap assisted surgeries most of the dissection was done laparoscopically. Open part was done for either anastomosis or creating ostomies.

Open surgeries were done for ovarian malignancy<sup>15</sup>, endometrium<sup>5</sup>, feeding jejunostomy<sup>4</sup>, nephrectomy<sup>2</sup>, pancreatico-duodenectomy<sup>2</sup> surgery for soft tissue sarcoma of abdomen<sup>3</sup>, feeding jejunostomy for esophageal cancer<sup>4</sup>, surgery for cancer stomach<sup>2</sup>, and retro peritoneal lymph nodal dissection/iliac nodal dissection<sup>2</sup>.

There were no statistically significant differences

noted in  $SPO_2$ , Mean BP and  $ETCO_2$ , between all abdominal surgeries. Mean blood loss noted was 160.5ml, 192.7ml; 300.5ml in laparoscopic, lap assisted and open abdominal surgeries respectively. Mean blood loss was more among open surgeries compared to laparoscopic and lap assisted abdominal surgeries. This leading to more blood transfusion requirements in open surgeries compared to laparoscopy or lap assisted surgeries.

Hypotension was found more among open surgeries (51%) compared to laparoscopic (18%) or lap assisted (18%) abdominal surgeries ( $p=0.004$ ).  $ETCO_2$  continuous monitoring was useful intra operatively.  $ETCO_2$  values  $>35$  were recorded in 68%, 41%, 38% in laparoscopic, lap assisted and open abdominal surgeries respectively.

### Discussions

Intra-operative monitoring of parameters like  $SPO_2$ ,  $ETCO_2$ , mean arterial blood pressure is mandatory during anesthesia. Maintaining  $SPO_2$  and blood pressure are the most important goals during surgery and anesthesia.  $ETCO_2$  monitoring is one of the important parameters during anesthesia.

*ETCO<sub>2</sub> and capnography:* Capnography is an effective method to diagnose early respiratory depression and airway disorders, especially during sedation, leading to a reduction in serious complications.<sup>13,14</sup> Capnography provided more safety in monitoring patients during sedation. Oxygen prescription does not have an effect on respiratory function parameters evaluated by capnography.<sup>15</sup> It shows impaired airway function sooner than any other device, 5 to 240 seconds earlier than pulse oximetry.<sup>16,17</sup> Moderate to severe hypercarbia can result in premature ventricular contractions, ventricular tachycardia and even ventricular.

Fibrillation.<sup>18</sup> Vagal stimulation may also cause bradyarrhythmias.<sup>18</sup> These effects can be prevented by minimizing the intra-abdominal pressure (not above 12 mm of Hg) and proper preoperative hydration and monitoring the  $ETCO_2$ .<sup>18</sup>

Results of a retrospective survey show that general anesthesia with  $ETCO_2$  values below 35mmHg as associated with increased mortality rate in the 30-day postoperative period when compared with general anesthesia with normocapnia.<sup>7</sup> But it was not statistically significant in our study.

*Hypotension:* Intraoperative hypotension is one of the most encountered factors associated with death related to anesthesia. During the intraoperative period, anesthesia leads to hypotension.

Hypotension episodes should be promptly treated by intravenous vasopressors, and according to their etiology.<sup>20</sup> Many measurements could be analyzed, such as a decrease in SAP or mean arterial pressure (MAP) under a threshold, variation from baseline, combination of parameters, duration of hypotension, and administration of fluids or vasopressors.<sup>20</sup> Bijker et al found that intraoperative hypotension occurs with anesthesia administration in 5%–99% of patients, in accordance with the definition used.<sup>20</sup> A decrease of MAP higher than 20% is often chosen to define perioperative hypotension.<sup>19</sup> Elevated risks of end-organ injury were reported for exposures to mean arterial pressures  $<80$  mm Hg for  $>10$  min, and for shorter durations  $<70$  mm Hg. Elevated risks were reported for increased durations for mean arterial pressures  $<65$ – $60$  mm Hg or for any exposure  $<55$ – $50$  mm Hg.<sup>22</sup> Occurrence of hypotension in our study was more among open surgeries than laparoscopic or lap assisted surgeries ( $p=0.004$ ).

Limitations of our study were that the total laparoscopic surgeries were mostly gynecological surgeries for carcinoma of cervix and endometrium. Majority of Lap assisted abdominal surgeries were gastrectomy and pelvic exenterations. Most of the open surgeries were done for ovarian malignancy.

### Conclusions

We concluded that there was no statistical difference noted in intra-operative factors  $SPO_2$ , Mean BP,  $ETCO_2$ , between all abdominal surgeries. Mean blood loss, hypotension and blood transfusions were noted more among open than laparoscopic abdominal surgeries. Hypotension was significantly associated with open surgeries compared with laparoscopic abdominal surgeries.

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