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A PROSPECTIVE, COMPARATIVE STUDY ON THE ROLE OF INTRA-OPERATIVE END TIDAL CARBON DIOXIDE (ETCO2) MONITORING IN ABDOMINAL SURGERIES AND ITS EFFECT ON POSTOPERATIVE OUTCOMES.

Anaesthesiology

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ABSTRACT

Background: Capnometry is measuring the concentration of carbon dioxide (CO2) in the atmosphere. In early 1980s, capnometry was used in the field of anesthesia.(2, 3). It is used for confirming the ET tube position and also for assessing the resuscitation response. In our study, we have analyzed the effect of intra operative ETCO2 monitoring in predicting postoperative morbidity and mortality in abdomino-pelvic oncological surgeries. We have compared the difference in intraoperative ETCO2 levels between open and laparoscopic surgeries.

Materials And Methods: We included all abdomino-pelvic surgeries operated in Department of Surgical oncology, Government Royapettah Hospital, Chennai, either laparoscopy or open were included in this study during January 2019 to march 2020. For all patients, intraoperative ETCO2 monitoring was done every 30 minutes and mean ETCO2 was calculated. These values were correlated with post operative mortality and morbidity (Surgical site infections, respiratory tract infections, deep vein thrombosis).

Results: Totally 80 patients were included in our study. Laparoscopic surgeries were 41 and 39 cases were open abdominal surgeries. Mean ETCO2 recorded was 41 and 35.9 respectively in laparoscopic and open abdominal surgeries. Recorded ETCO2 was higher in laparoscopic surgeries than open abdominal surgeries. There is no correlation between ETCO2 and morbidity among abdominal oncological surgeries (p=0.08). Mean ETCO2 was not associated with morbidity in open abdominal oncological surgeries (p=0.5). Mean ETCO2 was not associated with morbidity in laparoscopic abdominal oncological surgeries (p=0.9).

Conclusion: Mean ETCO2 was high in laparoscopic surgeries. Also, the morbidity was marginally reduced in patients with intraoperative ETCO2 more than 40. This may be the one of the reason why the patients underwent laparoscopic surgery had early recovery, less number of hospital stay.

KEYWORDS

Capnometry, End Tidal carbon dioxide, Abdominal surgeries.

INTRODUCTION

Capnometry is measuring the concentration of carbon dioxide (CO2) in the atmosphere. It was used for the first time during World War II as a tool for monitoring safety of the internal environment (1). In early 1980s, capnometry was used in the field of anesthesia.(2, 3). It is used for confirming the ET tube position and also for assessing the resuscitation response. In our study, we have analysed the effect of intra operative ETCO2 monitoring in predicting postoperative morbidity and mortality in abdomino-pelvic oncological surgeries. We have compared the difference in intraoperative ETCO2 levels between open and laparoscopic surgeries.

MATERIALS AND METHODS

Inclusion Criteria

1. All abdomino-pelvic surgeries operated in Department of Surgical oncology, Government Royapettah Hospital, Chennai, either laparoscopy or open were included in this study.
2. Age >18 yrs <70 yrs

Exclusion Criteria

1. Age <18yrs and >70 yrs

Study Period

Jan 2019 to march 2020

For all patients, intraoperative ETCO2 monitoring was done every 30 minutes and mean ETCO2 was calculated. Any variations were recorded. These values were correlated with post operative mortality and morbidity(Surgical site infections, respiratory tract infections, deep vein thrombosis) Microsoft excel was used for data collection and analysis was done using standard statistical methods.

RESULTS

Totally 80 patients were included in our study. Laparoscopic surgeries were 41 and 39 cases were open abdominal surgeries.

Table -1 Patient Characteristics (n=80)

	Laparoscopic	Open
Preoperative Mean Age (in years)	48.5	51.5
Sex	Female=30 Male =11	Female=20 Male =19
Neo adjuvant therapy	Yes=28 No=13	Yes=23 No=16
Intraoperative ETCO2 (Mean+/- SD)	41+/-4.2	35.9+/-2.8
Blood loss (mean in ml)	190	300.4
Duration of surgery(min)	140.5	180.5

Table-2 Correlation Between Mean ETCO2 & Morbidity In Abdominal Surgeries

Mean ETCO2	Morbidity	No morbidity	P value
<40	15	25	
>40	8	32	
	23	57	(P=0.08)

Table-3 Correlation Between Mean ETCO2 & Morbidity In Open Surgeries

Mean ETCO2	Morbidity	No morbidity	P value
<40	7	17	
>40	3	12	
	10	29	(P=0.5)

Table-4 Correlation Between Mean ETCO2 & Morbidity In Laparoscopic Surgeries

Mean ETCO2	Morbidity	No morbidity	P value
<40	8	8	
>40	5	20	
	13	28	(P=0.9)

Table-1 showed that there was difference in mean ETCO2 between laparoscopic and open abdominal surgeries. Mean ETCO2 recorded was 41 and 35.9 respectively in laparoscopic and open abdominal surgeries. Recorded ETCO2 was higher in laparoscopic surgeries than open abdominal surgeries.

Table-2 showed the correlation between mean ETCO2 and morbidity and mortality in abdominal oncological surgeries including both open and laparoscopy. Morbidity was 28.75% among 80 patients. If Mean ETCO2 is <40, 10% of patients had post operative morbidity and in patients with mean ETCO2 more than 40, incidence of morbidity was 6%. Hence there is no correlation between ETCO2 and morbidity

among abdominal oncological surgeries(p=0.08).

Table-3 showed the correlation between mean ETCO2 and morbidity and mortality in open abdominal oncological surgeries. Total 25.6% of patients had morbidity and morbidity was 17.9% and 7.6% respectively when ETCO2 less than and more than 40. Mean ETCO2 was not associated with morbidity in open abdominal oncological surgeries(p=0.5).

Table-4 showed the correlation between mean ETCO2 and morbidity and mortality in laparoscopic abdominal oncological surgeries. Total 31.7% of patients had morbidity and morbidity was 19.5% and 12.1% respectively when ETCO2 less than and more than 40. Mean ETCO2 was not associated with morbidity in laparoscopic abdominal oncological surgeries(p=0.9).

DISCUSSION

Carbon dioxide (CO2) is one of the final products of metabolism and is transferred to lungs through blood circulation and transmitted through respiratory system. So exhaled CO2 reflects the body's metabolic status (4,5). ETCO2 is a fast, inexpensive and non-invasive indicator to estimate the amount of HCO3- bicarbonate and PaCO2 in emergency and critical situations (6). Due to the direct connection between ETCO2 and HCO3, ETCO2 is a predictor of metabolic acidosis and mortality, so capnograph as a screening tool for metabolic acidosis is very useful in the intra-operative monitoring department (7). ETCO2 can be recommended as a noninvasive method for determination of early metabolic acidosis in patients with spontaneous breathing. ABG should be used as the gold standard for diagnosis and management of treatment of metabolic acidosis (8).

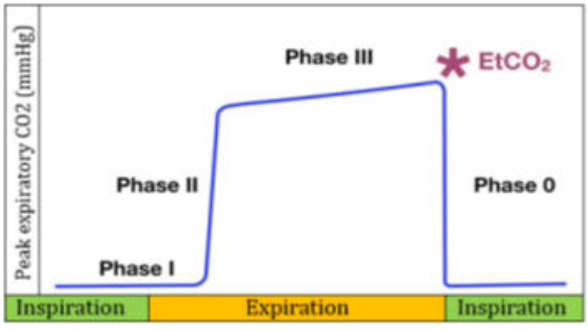

Fig-1. Diagram of a normal capnogram that includes the inspiratory and expiratory phase.

Recently, capnography was used as the gold standard for confirming the position of the endotracheal tube (10, 11). For more than 2 decades, experimental and clinical studies have shown that hypocapnia during anesthesia presents with various deleterious effects (12,13,14).

Even a minor decrease in ETCO2 levels during anesthesia was associated with an increase in postoperative mortality rate (15). In our study we monitored ETCO2 intra-operatively In both laparascopic and open abdominopelvic oncological surgeries. We found that mean intraoperative ETCO2 greater than 40 is predictive of reduced post operative morbidity (but not of statistical significance).

Study conducted by Philippe Dony et.al, Low ETCO2 level during anesthesia is associated with an increase in postoperative mortality rate. These results emphasize the importance of preventing hypocapnia during anesthesia to improve surgical outcomes. But in our study there were no 30 day mortality.

Way and Hill(16) in a review paper concluded that mild hypercapnia (ETCO2 values around 40 mm Hg or higher) is beneficial and should be accepted as a standard of care.

Wax et al (17) studied the relationship between intraoperative ETCO2 and of hospital length of stay (LOS) after colon resection and open hysterectomy in 3421 patients. They found a statistically and clinically significant association between higher intraoperative ETCO2 and shorter lenth of stay. In our study we took both laparoscopic and open abdominal surgeries, and we not took lenth of stay for analysis. Because laparoscopic surgeries had eventually shorter hospital stay compared to open abdominal surgeries. To avoid confounding bias we not analysed the lenth of hospital stay as a parameter.

CONCLUSION

Mean ETCO2 was high in laparoscopic surgeries. Also, the morbidity was marginally reduced in patients with intraoperative ETCO2 more than 40. This may be the one of the reason why the patients underwent laparoscopic surgery had early recovery, less number of hospital of stay.

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