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A Comparative Study Between pH and PaCO2 Changes during Laparotomy VS Laparoscopic Abdominal Surgeries

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Abstract: ***The present study is a randomized observational comparative study, in which 60 adult patients, undergoing laparotomy and laparoscopic abdominal surgeries were included. The study population was randomly divided into two groups of 30 each into Group A and Group B. The pH and PaCO2 changes were observed at different intervals of time. An arterial blood sample was taken at different intervals of time, T1 (Before induction of anaesthesia), T2 (15 min after opening the peritoneum or creating pneumoperitoneum), T3 (40min after opening the peritoneum or creating pneumoperitoneum), T4 (60min after opening the peritoneum or creating pneumoperitoneum), T5 (30 min after surgery). The pH and PaCO2 analyzed by using the Radiometer Copenhagen ABL 800 BASIC results were statistically significant. . In the laparoscopy group, the pH was decreased, and PaCO2 was increased only during CO2 pneumoperitoneum. The pH increased in the laparoscopy group after the desufflation with the decrease in PaCO2, which suggests a respiratory factor as the cause of the decreased pH during laparoscopic abdominal surgery. The decrease in the pH was observed after laparotomy but not after laparoscopic surgery. The pH in the laparotomy group decreased after the surgery suggests a 46 metabolic factor - accumulation influenced by lactate or hyperchloraemia. The results were statistically significant.***

Keywords: PH $PaCO_2$ Laparoscopic Abdominal Surgeries Laparotomy Acid Base Balance

1. Introduction

Laparotomy was a surgical incision into the abdominal cavity performed to examine the organs and aid diagnosis. Possible complications include infection and formation of scar tissue within the abdominal cavity. In laparotomy, decreased pH after surgery suggests a metabolic factor.

Laparoscopy inspecting the abdomen and pelvis using an endoscope. Carbon dioxide is commonly used to insufflatethe core to facilitate the view.

Advantages include less postoperative pain, low incidence of pulmonary complications, rapid recovery of bowel function, less intraoperative bleeding, postoperative wound infection, fewer metabolic changes, lessens the hospital stay, small incisions heal well, resulting in improved cosmetic appearance.

The incidence of complications during laparoscopy depending on the type of procedure, and experience of the surgeon. Common complications related to the creation of a pneumoperitoneum, patient positioning, surgical instrumentation, and many others.

Aim:
To compare pH and Paco2 changes in patients undergoing laparotomy and laparoscopic abdominal surgeries.

2. Review of Literature:

Propofol and volatile anesthetic drugs have been associated with metabolic acidosis induced by increased lactate. In nitrous oxide anesthesia, such a high percentage of nitrous oxide may be necessary to obtain rapid induction that the patient may experience definite oxygen want and resulting hypercarbia may lower the CO2 tension and cause a temporary increase in pH, nitrous oxide anesthesia there may be a temporary decrease in CO2 tension during the few minutes of induction. Methoxyflurane and halothane cause a significant reduction in pH, and that this acidosis is entirely due to a raised PaCO2. Laparoscopy - inspecting the abdomen and pelvis using an endoscope. Carbon dioxide is commonly used to insufflate the core to facilitate the view. Laparoscopy was first performed by Georg Kelling in 1901, Dimitri Ott, and Christian Jacobeus in 1910 at the beginning of the 20th century. It has become an essential tool in patient management[5]. It became popular among gynecologists for its effectiveness and simplicity[4]. It was performed only for diagnosis of liver disorders and biopsy and visualization of abdominal trauma in general surgery until laparoscopic cholecystectomies were done in humans by Lukichev in 1983 and Muhe in 1985.

In the past two decades, the use of laparoscopy has increased due to the advances in video imaging, powerful light - sources, automatic pressure - driven insufflators, and high - flow suction irrigation technology, making it possible to perform complicated intra - abdominal maneuvers[4].

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to the creation of a pneumoperitoneum, patient positioning, surgical instrumentation[4].

3. Material and Methodology

Study Design: Observational and comparative study

Study Setting: GSL medical college and general hospital

Study Population: 6O patients undergoing elective laparoscopic surgeries and laparotomy surgeries will be randomly assigned to two group A and B [n=30 patients/group]

Study Duration: This study will be conducted between October 2020 to August 2022

Inclusion Criteria:
1) Patients above age of consent [18yrs] undergoing laparoscopic surgeries and laparotomy surgeries
2) ASA 1 and 2

Exclusion Criteria:
1) Patient refusal
2) Patients with coagulopathy
3) Patients with anaemia
4) Patients with chronic aneamia
5) Patients with respiratory insufficiency [COPD] and cardiac diseases
6) Patients with pre existing metabolic acidosis
7) ASA grading 3, 4

Statistical Analysis:
Patients undergoing laparoscopic surgeries and laparotomy surgeries atGSL MEDICAL COLLEGE AND HOSPITAL are randomly selected.

Sampling Technique
Arterial blood for measurement of pH and PaCO2.

First sample was taken pre operatively [T1], second sample was taken at 15min after opening the peritoneum [or] pneumoperitoneum [T2], Third sample after 40min [T3]and the fourth sample was collected at 60 min [T4], fifth sample collected 30min after surgery. The ABG sample was analysed.

4. Methodology

All the patients will be assessed prior to surgery and detailed history will be elicited. Detailed systemic and local examination will be carried out. All routine and relevant investigations will be done and whenever required specific investigations were asked for and ASA grading of the patients will be determined. patients will be informed about the anaesthesia procedure. patients are randomly divided in to two groups A and B of thirty patients each. All patients will be kept nil per mouth for 6 - 8 hours prior to surgery. Intravenous acess will be secured with 18gauge cannula on hand and intravenous ringer lactate Standard monitors like ECG, Pulse oximeter, non –invasive blood pressure was attached and baseline parameters were recorded. Pre - oxygenation was done for three minutes with 100% oxygen. Induction was done by administering thio pentone sodium [5mg/kg bodyweight], muscle relaxation was provided by injection vecuronium [0.1mg/kg body weight loading dose and maintenance dose of 1/4 th per the requirement] and then patient was intubated via endotracheal tube ofthe appropriate size. Anaesthesia was maintained with 50% nitrous oxide, 50% oxygen and sevoflurane.

Injection paracetamol 1gm/100ml was used for analgesia. pneumoperitoneum was maintained with a constant flow of 400ml/min for all patients throughout the procedure. surgical technique was uniform in all patients. Patients were ventilated with tidal volume of 10ml/kg and respiratory rate of 14 breaths/minute and PO2, end tidalCO2, Paco2, PH measurement were done before during and after C02 pneumoperitoneum ventilatory adjustments were done for end tidal CO2 levels above 55mmhg or haemodynamic changes attributable to elevated CO2. Arterial blood samples were taken puncturing the left radial artery for arterial blood gas measurements. first sample was taken pre operatively [T1], second sample at 15min after opening the peritoneum in the laparotomy group or pneumoperitoneum in the laparoscopy group [T2], third sample after 40min [T3], and fourth sample was collected 60 min [T4], fifth sample collected 30min after the patient was extubated [T5] and ascertained to be breathing spontaneously and adequately.

5. Results

PH Changes

TWO GROUPS AT T_1 –T_5 INTERVALS

Time interval	Group 1 Mean ±SD	Group 2 Mean ±SD	P value
T_1	7.43±0.012	*7.41±0.023*	0.0001
T_2	7.41±0.013	7.37±0.018	0.0001
T_3	7.40±0.013	7.34±0.016	0.0439
T_4	7.38±0.015	7.31±0.013	0.0076
T_5	7.36±0.103	7.42±0.016	0.0026

Statistically significant differences from baseline (P-Value <0.05)

PACO2 Changes

TWO GROUPS AT T_1 –T_5 INTERVALS

Time interval	Group 1 Mean± SD	Group 2 Mean ± SD	P- value
T_1	41.4 ±1.832	39.4 ±2.192	0.0003
T_2	39.7±1.664	43.8 ±1.34	0.0001
T_3	38.4 ±1.546	46.06 ±1.20	0.0001
T_4	36.7 ±1.387	48.3±1.154	0.0001
T_5	43.2 ±1.494	36.2 ±1.229	0.0001

Statistically significant difference from preoperative to postoperative period (P-Value <0.05)

6. Summary

The present study is a randomized observational comparative study, in which 60 adult patients, aged above 18 years of either sex belonging to ASA status 1 and 2, with Mallampati class 1 and 2 undergoing laparotomy and laparoscopic abdominal surgeries were included after getting approval from Institutional Ethics committee, and written informed consent from patients. The study population was randomly divided into two groups of 30 each into Group A and Group B. The pH and PaCO2 changes were observed at different intervals of time. An arterial blood sample was taken at different intervals of time, T1 (Before induction of anaesthesia), T2 (15min after opening the peritoneum or creating pneumoperitoneum), T3 (40min after opening the peritoneum or creating pneumoperitoneum), T4 (60min after opening the peritoneum or creating pneumoperitoneum), T5 (30 min after surgery). The pH and PaCO2 analyzed by using the Radiometer Copenhagen ABL 800 BASIC results were statistically significant. Demographics, patient characteristics parameters were comparable in both groups.

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7. Conclusion

The present study concluded that decrease in the pH during the pneumoperitoneum was affected by the increase in Paco2, which promptly returned to an normal value after the desufflation. The decrease in the pH after laparotomy was affected by metabolic factors, which persisted an hour after the surgery.

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