

Study of changes in coagulation profile of patients undergoing laparoscopic cholecystectomy using carbon dioxide pneumoperitoneum

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ABSTRACT

BACKGROUND: Laparoscopic cholecystectomy is a common surgical procedure and carbon dioxide pneumoperitoneum created for this purpose may alter the coagulation profile of these patients. This study aims to find the effects of carbon dioxide pneumoperitoneum on coagulation profile and assess if there is an increased risk of thrombosis.

AIM AND OBJECTIVE:

1. To determine the changes in coagulation profile of patients undergoing laparoscopic cholecystectomy using carbon di oxide pneumoperitoneum.
2. Assess if there is an increased risk of thrombosis post-operatively.
3. To determine if patients undergoing laparoscopic cholecystectomy have to be started on prophylaxis for deep vein thrombosis to prevent complications

PATIENTS AND METHODS:

A clinical observational study was conducted with 50 patients who underwent laparoscopic cholecystectomy using carbon di oxide pneumoperitoneum. The prothrombin time and D-dimer values were calculated before and after surgery. using the paired t test data was analysed.

RESULTS:

The study showed a decrease in the prothrombin time and increase in the D-dimer value post operatively. The mean of prothrombin time after surgery was 0.13 seconds lower than the preoperative value and D-dimer was found to be elevated three times the pre operative values. The p value calculated for both were highly significant.

CONCLUSION:

Laparoscopic cholecystectomy using carbon dioxide pneumoperitoneum leads to hypercoagulable states. Hence stringent measures need to be taken to put the patient on prophylaxis for deep vein thrombosis to avoid dire consequences.

KEYWORDS: Laparoscopic cholecystectomy, Carbon dioxide Pneumoperitoneum, Coagulation Profile, Prothrombin time, D-Dimer, Hypercoagulation, DVT prophylaxis

INTRODUCTION:

Laparoscopy is one of the widely used tools for diagnostic and therapeutic purposes in recent times. Laparoscopy offers the advantage of better cosmesis, lesser post-operative pain, shorter hospital stays, early return to normal life and work. With advancements in technology and instrumentation, laparoscopy has entered into every array of surgical field.

A working cavity is one of the requisites for laparoscopy. This cavity is commonly created by positive pressure pneumoperitoneum using carbon di oxide. In 1924, Richard Zolliker of Switzerland first proposed the use of carbon di oxide for creation of pneumoperitoneum as it was non-combustible and hence electrocoagulation was possible during surgery.

Carbon di oxide pneumoperitoneum affects normal physiology. It is easily absorbed from the peritoneal cavity into circulation. It may affect the cardiovascular, respiratory and coagulation system, to name a few.

Laparoscopy has its complications due to increased intraabdominal pressure, carbon di oxide absorption from peritoneum during insufflation and reverse Trendelenburg position adopted during surgery.

The first laparoscopic cholecystectomy was performed in 1986 in Germany. Over the past 30 years there has been a gradual but drastic change in the methodology. The duration of surgery, complications have reduced over time. Laparoscopic cholecystectomy is now the gold standard procedure. And with over 5,00,000 procedures being done annually, laparoscopic cholecystectomy assumes a great significance in general surgical specialty.

Effects of carbon di oxide pneumoperitoneum need to be studied in detail with respect to individual systems. This study aims to study the effects of carbon di oxide pneumoperitoneum on the coagulation system of patients undergoing laparoscopic cholecystectomy, and make the surgeon aware of the detrimental effects, if any.

AIM AND OBJECTIVE OF THE STUDY:

1. To determine the changes in coagulation profile of patients undergoing laparoscopic cholecystectomy using carbon di oxide pneumoperitoneum.
2. Assess if there is an increased risk of thrombosis post-operatively.
3. To determine if patients undergoing laparoscopic cholecystectomy have to be started on prophylaxis for deep vein thrombosis to prevent complications

MATERIALS:

This study will be a CLINICAL OBSERVATIONAL of 50 patients done at General Surgical department of M K C G Medical College Hospital Berhampur between November 2022 to October 2023.

Inclusion criteria:

- All patients operated for cholecystectomy laparoscopically will be included in the study.
- Patient of both sexes.
- Age from 18 years to 60 years.
- Patients with gall stones or gallbladder polyps.
- Patients with chronic cholecystitis, relief stages of acute cholecystitis will be included.

- Surgery time between 90- 180 minutes.
- Patients who give consent for study will be included

Exclusion criteria:

- Patients below age of 18 and above the age of 60.
- Surgery time exceeding three hours.
- Procedures converted to open surgery.
- Associated hypertension.
- Patients on anticoagulant therapy.
- Patients with known malignancies.
- Patients with known history of bleeding and clotting disorders.
- Deep venous thrombosis.
- Pregnancy

METHODS:

Patients who get admitted to Department of General Surgery, M K C G medical college hospital and who were diagnosed to have a gall bladder pathology and underwent laparoscopic cholecystectomy were included in the study. All who satisfied the inclusion criteria were retained in the study group and those who did not were excluded from the study. Consent was obtained from the patient regarding inclusion in study. History and clinical examination were done. Patient`s age sex, symptoms and their duration of surgery were recorded.

METHOD OF COLLECTION OF DATA:

- 50 eligible patients are chosen.
- Clinical assessment done at time of inclusion in the study.
- Detailed history and examination done.
- Basic routine investigations will be done for all patients
- 3 cc of blood will be drawn under strict aseptic precautions
- One sample prior to surgery
- One sample 6 hours after onset of pneumoperitoneum
- Samples will be processed for prothrombin time and D-dimer
- Duplex scan will be done to look for deep vein thrombosis
- Consent will be obtained for inclusion under study and for surgery

RESULTS AND DATA ANALYSIS:

Data collection was done. The prothrombin time and D-dimer values before and after the surgery were collected for all the 50 patients and were entered into the Microsoft excel sheet. The values were used for analysis. The Paired student T –test was used to analyse the values collected before and after the surgery. The software tools used for the purpose were downloaded from the internet. The values obtained were confirmed using another similar software to check the validity. The mean of the two groups, the standard deviation, standard error of mean and the Pvalue was calculated.

Of the 50 patients operated, 31 were female and 19 were male patients. The most common age group was 41-50 years among both female and male groups. Followed by the age group of 51-60.

The duration of the surgery ranged from 1hour 25 minutes to 2 hours 50 minutes. The reasons for prolonged surgical time were dense adhesions in the Calot’s triangle and gall bladder adherent to the liver bed.

There were no major perioperative complications. There was wound infection at the umbilical site in 3 patients which settled with conservative treatment with a course of antibiotics. There were no major postoperative complications in the operated patients during hospital stay and during the follow up period. The mean hospital stay was 4 days.

PROTHROMBIN TIME		
	BEFORE SURGERY	AFTER SURGERY
MEAN	11.83	11.7
STANDARD DEVIATION	1.008	0.898
STANDARD ERROR OF MEAN	0.143	0.127

The prothrombin time of the patients before surgery ranged from 10 to 13.5 seconds, with the mean at 11.83 seconds. The standard deviation was 1.008 and standard error of mean was 0.143. The prothrombin time of patients 6 hours after surgery ranged from 10.5 seconds to 14 seconds. The mean of prothrombin time after surgery was 11.7 seconds. The standard deviation was 0.898 and the standard error of mean being 0.127. Not all patients had a change in prothrombin time before and after surgery. While some had elevated prothrombin time, some had decreased prothrombin time and few showed no change at all. The difference in the mean between the two groups was 0.130. The confidence interval at 95% was between 0.031 to 0.229. The p- value was 0.0109 (<0.05). Hence the value was statistically extremely significant.

D DIMER		
	BEFORE SURGERY	AFTER SURGERY
MEAN	129.78	350.22
STANDARD DEVIATION	21.01	73.21
STANDARD ERROR OF MEAN	2.97	10.35

The values for D-dimer were analysed. The D-dimer value before surgery for the 50 patients ranged from 99 to 178, with the mean at 129.78. The standard deviation was 21.01 and standard error of mean was at 2.97. The D-dimer values after surgery varied between 199 and 506. The mean was calculated to be 350.22 with the standard deviation at 73.21 and standard error of mean at 10.35. The D-dimer of all the patients showed a drastic increase post-surgery. The difference in mean of the two groups was 220.44 and the confidence interval of 95 % lay between 240 to 200.83. The p-value of the D-dimer analysis was at 0.001 was meant it was extremely significant statistically.

On follow up none of the patient’s developed signs of deep vein thrombosis clinically when they turned up for follow up to 2 weeks post-surgery.

DISCUSSION:

The values of prothrombin time and D-dimer of the 50 patients were analysed. The inferences derived from them were compared with other similar studies.

There was a higher incidence of female patients undergoing cholecystectomy 62%, compared to male 32%. This matches the global rates and rates in India which also shows a higher female predisposition towards gall bladder pathologies. The majority of the patients who underwent surgery were in the age group of 41-50 years in both the sexes. The second highest was seen in the age group of 51-60 years. These two groups constituted 76% of the cases. Showing that the disease incidence increased after the age of 40 years.

The duration of surgery varied between 1 hour 25 minutes to 2 hours 50 minutes. This shows the unpredictability of the duration of the surgery the longest taking twice the time for the shortest procedure.

The prothrombin times of patients when analysed showed that the results were not uniform for all patients. While some showed an elevation in prothrombin time indicating hypocoagulability, there were a few who had decreased prothrombin time after surgery showing hypercoagulability. The prothrombin time was not altered in most of the patients 62% (31 out of 50). This gave the appearance that there was not much difference in the coagulation profile with respect to prothrombin time. The mean of the prothrombin time before surgery was 11.83 and the one after surgery was 11.7. The standard error of mean was 0.143 and 0.127. This small value showed the accuracy of the mean and that a similar mean would have been obtained with a study with a larger sample. These values when charted showed that the decrease in the mean was statistically significant. Hence the prothrombin time can be considered to decrease, and there is hypercoagulability of blood.

The study goes in line with other studies by Hans et al¹, Garg et al² and Schietroma et al³ who also support the fact that there is a state of hypercoagulability.

When the D-dimer values are analysed, all the patients are seen to have an increase in the d-dimer values. With many showing a twofold increase in the d-dimer values before and after surgery. The mean of the D-dimer before and after surgery were calculated to be 129.78 and 350.22 and the standard error of mean was 2.97 and 10.35. The difference in the mean was 220.44. This increase clearly indicates the undergoing fibrinolytic process. Statistically too the values were found to be extremely significant with a p value of 0.001. Thus, this increase in d-dimer suggests the high risk of thrombosis leading to activation of fibrinolytic systems.

The high values of D-dimer post-surgery was also seen in many studies like the study by Amin buhe⁴ et al where post operative d-dimer values have been shown to get elevated by close to 5 times the pre operative values. The findings of the study though contradict the studies by Rahr et al⁵, Yan MJ⁶ et al, Martinez et al⁷. who report hypocoagulability of blood post operatively or no change in coagulation profile. The change in the coagulation profile can be attributed to be due to surgery and is not specific to laparoscopy with carbon dioxide pneumoperitoneum as other studies by Jens Fromholt⁸ and Schietroma et al³ have shown similar rise in values after open surgery and gasless laparoscopic surgeries too.

While Custendil et al⁹ and Lord RV^{10,11} in their studies found increased incidence of thrombosis on the first- and third-days following surgery, no such observations were made during the study. None of the patients in the study were put on prophylaxis of any form because there were no added risk factors that indicated their need. On the contrary to many studies that reported the incidence of thrombosis postoperatively, there were no cases who developed signs of thrombosis though the patients showed increased coagulation profile. This was probably due to the small size of the population under study.

CONCLUSION:

The study was done with the objective to find if there was a change in the coagulation profile in laparoscopic cholecystectomy using carbon dioxide pneumoperitoneum and if there is an increased risk of

thrombosis. The study shows a marked increase in the d-dimer values and a significant decrease in the prothrombin time. This goes to prove that there is activation of both coagulation and fibrinolytic systems post laparoscopic cholecystectomy. This activation of coagulation system could spell a disaster if the patients were to face a thromboembolic phenomenon post cholecystectomy. But none of the 50 patients operated by us had any thromboembolic problems postoperatively. This could mean that the body has effective counter mechanisms to deal with this change in coagulation profile. When assessed if there is a need for prophylaxis against thrombosis, the study shows change in the coagulation profile resulting in a hypercoagulable state. Hence it is better that for patients undergoing laparoscopic cholecystectomy stringent measures are taken and patients are put on some form of stringent deep vein thrombosis prophylaxis, preferably Low molecular weight Heparin. The surgeon is hence left with a daunting task of looking into the cost- riskbenefit ratio for individual patients with respect to deep vein thrombosis prophylaxis. The presence of even a single risk factor should necessitate the surgeon to start the patient on prophylaxis to avoid dire consequences. Finally larger and detailed studies are required to throw more light on these changes in the coagulation system and quantitatively determine the risk associated for laparoscopic cholecystectomy using carbon di oxide pneumoperitoneum.

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