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Original Research Article

Alteration of Coagulation Profile during Laparoscopic Cholecystectomy

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Abstract:

Objectives: The present study was to determine the coagulation profile alteration in laparoscopic cholecystectomy and to assessed the risk of thrombosis and prophylaxis for deep vein thrombosis in post operatively patients.

Methods: A detailed history, clinical examinations and relevant investigations were performed to all patients. Blood samples were taken preoperatively, 6 h after surgery and 24 h after surgery. Peripheral venous blood was collected in 3.8% sodium citrate at a ratio of nine parts blood to one part anticoagulant (1:10 ratio). Blood was centrifuged within 30 min and plasma kept at 80° C until analysis. Samples were processed for PT-INR, platelet count, D-Dimer. A total of 80 patients were enrolled. 40 patients (CASE) were undergone elective laparoscopic cholecystectomy. And 40 patients (CONTROL) were undergone open elective surgeries for benign lesions under general anesthesia with operative duration ≤ 2hrs. The values had recorded in case record proforma.

Results: In the Case group, 42.5% of the patients with a 24hr Post-op Platelet level between 150 and 250, while 57.5% fall within the range of 251 to 400. In the Control group, 47.5% of the patients had a platelet level between 150 and 250, and 52.5% fall within the range of 251 to 400. Similarly, in the Case group, 47.5% of the patients with a 24hr Post-op PT-INR level between 0.8 and 1.0, 35.0% fall within the range of 1.1 to 1.2, and 17.5% had levels greater than 1.2. In the Control group, 45.0% of the patients witha PT-INR level between 0.8 and 1.0, 27.5% fall within the range of 1.1 to 1.2, and 27.5% had levels greater than 1.2.

Conclusions: Coagulation parameters, particularly D-Dimer levels showed significant postoperative changes. The consistent distribution of PT- INR and Platelet levels within the normal range in both groups suggests that these parameters were less impacted by the surgical procedure than D-Dimer levels. And it emphasizes the critical need for tailored anticoagulation strategies and comprehensive postoperative monitoring to mitigate the risks of thromboembolic events and ensure optimal patient outcomes.

Key words: Coagulation profile, laparoscopic cholecystectomy, thromboembolic events

Introduction

Gallstones have been a significant medical concern for centuries, with evidence of their presence found in mummies dating back to ancient Egypt. Historically, gallstones have been recognized as a cause of biliary colic and cholecystitis, conditions that have afflicted humans across different cultures and eras [1].

When gallstones block the bile ducts of your biliary tract, the gallstones can cause sudden pain in your upper right abdomen. This pain is called a gallbladder attack, or biliary colic. If your symptoms continue and they're left untreated, gallstones can cause serious complications [2,3].

However, most gallstones don't cause blockages and are painless, also called "silent"gallstones. Silent gallstones usually don't need medical treatment [2,4]. Coagulopathy is a major cause of public health problems, which results in morbidity or mortality worldwide. About 26–45% of the world population who considered healthy had a history of nose and gum bleeding and about 5 -10% of reproductive age women seek treatment for prolonged bleeding during the menstruation period.

Laparoscopic Cholecystectomy has many advantages such as better cosmetic, shorter hospitalization time, minimal post-operative pain, early return to normal life and work [5].

In Laparoscopic Cholecystectomy a fundamental step is the insufflation of a gas inside the peritoneal cavity to allow the distention of the abdominal wall, to create a working cavity, to achieve better visibility of the surgical held. This cavity is commonly created by positive pressure pneumoperitoneum using carbon dioxide, as carbon dioxide is non combustible and electrocoagulation is possible during surgery [6].

Carbon dioxide pneumoperitoneum affects normal physiology. It may affect the coagulation system, cardiovascular system such as increase in systemic venous resistance and mean arterial pressure and decrease in venous return and cardiac output due to pressure on inferior vena cava. In respiratory system it may result in decrease in lung volume and compliance, increase in airway resistance and an increase in ventilation perfusion ratio [6].

If intraoperative carbon dioxide pneumoperitoneum lasts a long time renal artery flow decreases and results in decreased glomerular filtration rate [6]. The increase in intra-abdominal pressure during pneumoperitoneum causes mechanical compression on the inferior vena cava with a reduction in venous return. Moreover, the reverse Trendelenburg position adopted during surgery can induce blood stagnation in the lower limbs [7]. The effects of gas and the pathophysiological changes induced by CO_2 have led to use of low pressure to avoid the onset of some complications such as venous thromboembolism. The usual pressure range of the pneumoperitoneum is between 12 and 14 mmHg [8]. By exploring how the procedure affects coagulation, my research can contribute to improved strategies for preoperative, intraoperative, and postoperative management, thereby reducing risks associated with coagulation abnormalities.

Aim and Objectives

Primary:

- To determined coagulation profile alteration in laparoscopic cholecystectomy

Secondary:

- Assessed if there is an increased risk of thrombosis post-operatively.
- To determined if patients undergoing laparoscopic cholecystectomyhave to be started on prophylaxis for deep vein thrombosis

Materials and methods

Study design: A prospective observational study

Study population (materials):

The patients admitted consecutively in Dept. of General Surgery, PBM Hospital, KIMS, Bhubaneswer with provisional diagnosis of Cholelithiasis, planned for elective laparoscopic cholecystectomy shall be included into thestudy

Inclusion Criteria

- All patients undergoing elective laparoscopic cholecystectomy wereincluded in the study.
- Patients of both sexes.
- Age from 18 years to 60 years
- BMI< 25kg/m2
- Surgery ≤ 2hrs
- Patients who gave consent for the study were included.

Exclusion Criteria

- Procedures converted to open surgery.
- Diabetic and hypertensive patients
- Patients on anticoagulant therapy (past / present)
- Patients with known malignancies.
- Patients with known history of bleeding and clotting disorders.
- Blood transfusion (pre operative or post operative)
- Jaundice patients
- H/o Deep venous thrombosis.
- Pregnancy

Sampling Procedure:

The patients admitted consecutively in Dept. of General Surgery, PBM Hospital, KIMS, Bhubaneswar with provisional diagnosis of Cholelithiasis, planned for elective laparoscopic cholecystectomy shall be included into thestudy

Case Samples: 40

CASES: Elective laparoscopic cholecystectomy

Control Samples: 40

Control: Open elective surgeries for benign lesions under general anesthesia with operative duration ≤ 2hrs.

Total Samples: 80

Study Setting:

The study will be conducted in the Dept. of General Surgery in KIMSand PBM Hospital, Bhubaneswer from July 2022 to June 2024.

Method of Collection of Data:

- Eligible patients (both case and control) were chosen.
- Clinical assessment had done at time of inclusion in the study.
- Detailed history and examination had done
- Basic routine investigations had done for all patients
- Consent were obtained for inclusion under study and for surgery
- Blood samples were taken preoperatively, 6 h after surgery and 24 hafter surgery. Peripherous venous blood was collected in 3.8% sodium citrate at a ratio of nine parts blood to one part anticoagulant (1:10 ratio). Blood was centrifuged within 30 min and plasma will be kept at 80°C until analysis
- Samples were processed for PT-INR, platlet count, D-Dimer.
- The values had recorded in case record proforma.

Method of Follow Up:

Patients were assessed after a follow up period of 1 months fordevelopment of thromboembolic events based on history.

Statistical Analysis

Data was analyzed by using IBM® SPSS®. Mean and standard deviations were observed. P- value was taken less than or equal to 0.05 ($p \leq 0.05$) for significant differences.

Observation and Result

In the present study, age groups were categorized as follows: 18-29 years, 30-39 years, 40-49 years, and 50-60 years. The Case group comprises 25 males (62.5%) and 15 females (37.5%), while the Control group includes 27 males(67.5%) and 13 females (32.5%). The totals row confirms that each group consists of 40 patients, ensuring an equal distribution for both groups. This balanced gender distribution was crucial for ensuring that the study results were not biased by gender differences.

The BMI categories were defined a follows: Underweight (<18.5), Normal weight (18.5 24.9), Overweight (25-29.9), and Obese (≥30).

In the 'Case' group, 95.0% of the patients fall within the Normal weight category, with a small percentage (5.0%) categorized as Underweight. No patients in the 'Case' group were classified as Overweight or Obese.

Similarly, the 'Control' group predominantly comprises patients within the Normal weight category (90.0%), with 7.5% of patients classified as Underweight, and a minor portion (2.5%) as Overweight. There were no Obese patients in the 'Control' group.

Table.1: Pre-op D-Dimer Distribution of case and control

Pre-op D-Dimer Category	Case	Control
High (>1.0)	23 (57.5%)	24 (60.0%)
Normal (0.5-1.0)	17 (42.5%)	16 (40.0%)
Low (<0.5)	0 (0.0%)	0 (0.0%)
Total	40 (100.0%)	40 (100.0%)

The present study shown the distribution of Pre-op D-Dimer levels among patients in the Case and Control groups of the current study. Each cell contains the number and percentage of patients within each D-Dimer category: High (>1.0), Normal (0.5-1.0), and Low (<0.5).

In the Case group, 57.5% of the patients had high Pre-op D-Dimer levels,while 42.5% with normal levels. The Control group shown a similar distribution, 60.0% of patients with high D-Dimer levels and 40.0% withnormal levels. There were no patients with low D-Dimer levels in either group.

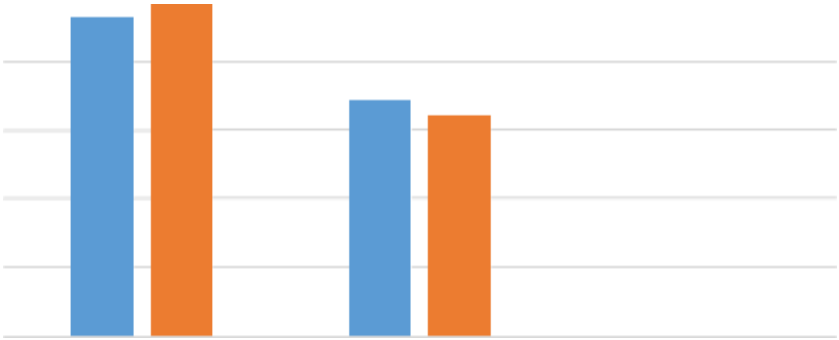

Figure 1: Pre-op Platelets Distribution of case and control

The distribution of preoperative platelet counts between the case and control groups shows a balanced allocation across different platelet count ranges. In the range of 150-250, both the case and control groups have 19 patients each,indicating an equal distribution in this moderately low platelet count category. Similarly, in the 251-400 range, both groups again have 21 patients each, representing a higher count within normal limits. This consistency across different platelet ranges ensures that the groups are well-matched, facilitating a robust comparative analysis.

Overall, the study encompasses 40 patients in both the case and control groups, totaling 80 patients. This equal distribution underscores the comparability of the two populations in terms of preoperative platelet counts. By maintaining an equal number of patients in each group, the study minimizes potential biases and ensures that any variations in outcomes can be attributed more reliably to the factors under investigation rather than discrepancies in patient numbers. This balanced distribution strengthens the validity of the study's findings and supports meaningful comparisons betweenthe case and control groups.

Table.2: Pre-op PT-INR Distribution of case and control

Pre-op PT-INRCategory	Case	Control
0.8-1.0	25 (62.5%)	17 (42.5%)
1.1-1.2	8 (20.0%)	10 (25.0%)
> 1.2	7 (17.5%)	13 (32.5%)
Total	40 (100.0%)	40 (100.0%)

In the Case group, 62.5% of the patients have a PT-INR between 0.8 and 1.0, 20.0% fall within the range of 1.1 to 1.2, and 17.5% had PT-INR levels greater than 1.2. In the Control group, 42.5% of the patients had a PT-INR between 0.8 and 1.0, 25.0% fall within the range of 1.1 to 1.2, and 32.5% with PT-INR levels greater than 1.2.

Table.3: 6hr Post-op D-Dimer Distribution of case and control

6hr Post-op D-Dimer Category	Case	Control
0.5-1.0	19 (47.5%)	18 (45.0%)
1.1-1.5	15 (37.5%)	17 (42.5%)
> 1.5	6 (15.0%)	5 (12.5%)
Total	40 (100.0%)	40 (100.0%)

P value – 0.8856 is non-significant

In the Case group, 47.5% of the patients had a 6hr Post-op D-Dimer level between 0.5 and 1.0, 37.5% fall within the range of 1.1 to 1.5, and 15.0% with levels greater than 1.5. In the Control group, 45.0% of the patients hada D-Dimer level between 0.5 and 1.0, 42.5% fall within the range of 1.1 to 1.5, and 12.5% with levels greater than 1.5.

In the Case group, 35.0% of the patients had a 6hr Post-op Platelet level between 150 and 250, while 65.0% fall within the range of 251 to 400. In the Control group, 27.5% of the patients had a platelet level between 150 and 250, and 72.5% fall within therange of 251 to 400.

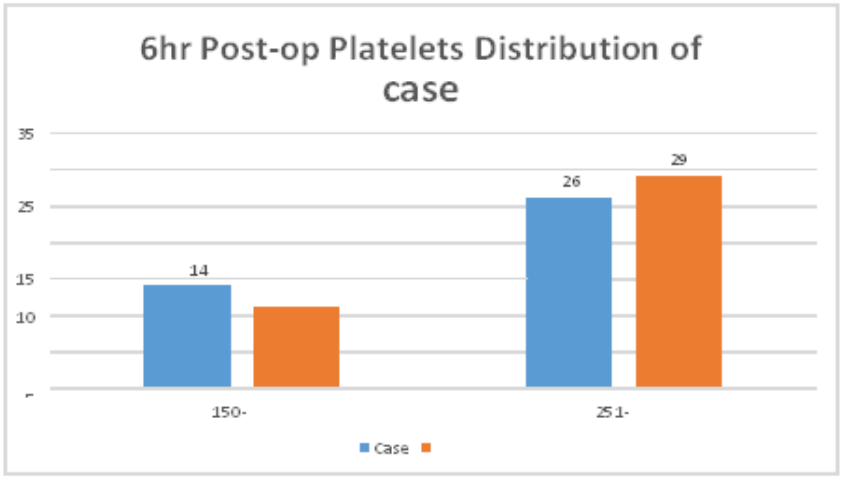

Figure 2: 6hr Post-op Platelets Distribution of case and control

In the Case group, 55.0% of the patients had a 6hr Post-op PT-INR level between 0.8 and 1.0, 27.5% fall within the range of 1.1 to 1.2, and 17.5% had levels greater than 1.2. In the Control group, 37.5% of the patients had a PT-INR level between 0.8 and 1.0, 30.0% fall within the range of 1.1 to 1.2,and 32.5% with levels greater than 1.2.

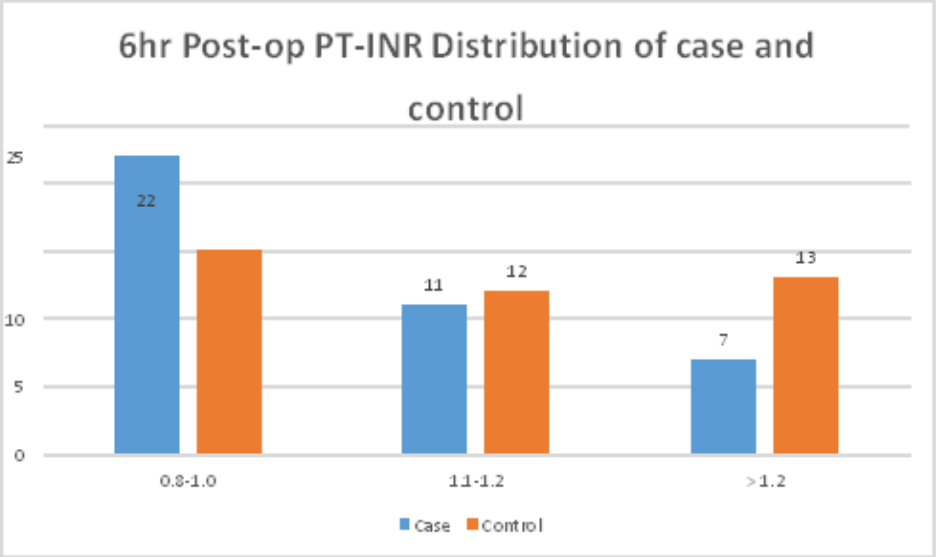

Figure 3: 6hr Post-op PT-INR Distribution of case and control

In the Case group, 47.5% of the patients with a 24hr Post-op D-Dimer level between 0.5 and 1.0, 35.0% fall within the range of 1.1 to 1.5, and 17.5% had levels greater than 1.5. In the Control group, 55.0% of the patients had a D-Dimer level between 0.5 and 1.0, 30.0% fall within the range of 1.1 to 1.5,and 15.0% with levels greater than 1.5.

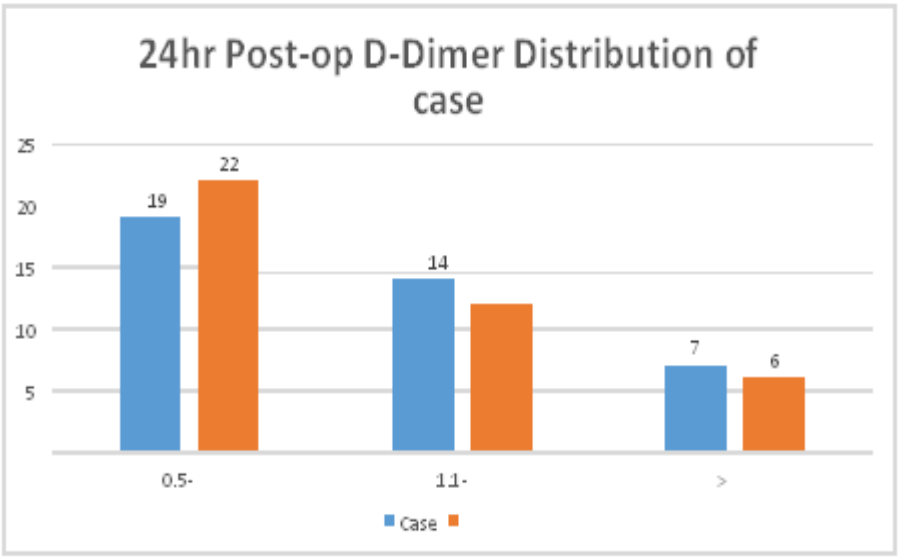

Figure 4: 24hr Post-op D-Dimer Distribution of case and control

Table 4: 24hr Post-op Platelets Distribution of case and control

24hr Post-op PlateletsCategory	Case	Control
150-250	17 (42.5%)	19 (47.5%)
251-400	23 (57.5%)	21 (52.5%)
Total	40 (100.0%)	40 (100.0%)

P value – 0.6531 is non-significant

In the Case group, 42.5% of the patients with a 24hr Post-op Platelet level between 150 and 250, while 57.5% fall within the range of 251 to 400. In theControl group, 47.5% of the patients had a platelet level between 150 and 250, and 52.5% fall within the range of 251 to 400.

Table 5: 24hr Post-op PT-INR Distribution of Patients

24hr Post-op PT-INR Category	Case	Control
0.8-1.0	19 (47.5%)	18 (45.0%)
1.1-1.2	14 (35.0%)	11 (27.5%)
> 1.2	7 (17.5%)	11 (27.5%)
Total	40 (100.0%)	40 (100.0%)

P value – 0.5284 is non-significant

In the Case group, 47.5% of the patients with a 24hr Post-op PT-INR level between 0.8 and 1.0, 35.0% fall within the range of 1.1 to 1.2, and 17.5% had levels greater than 1.2. In the Control group, 45.0% of the patients witha PT-INR level between 0.8 and 1.0, 27.5% fall within the range of 1.1 to 1.2, and 27.5% had levels greater than 1.2.

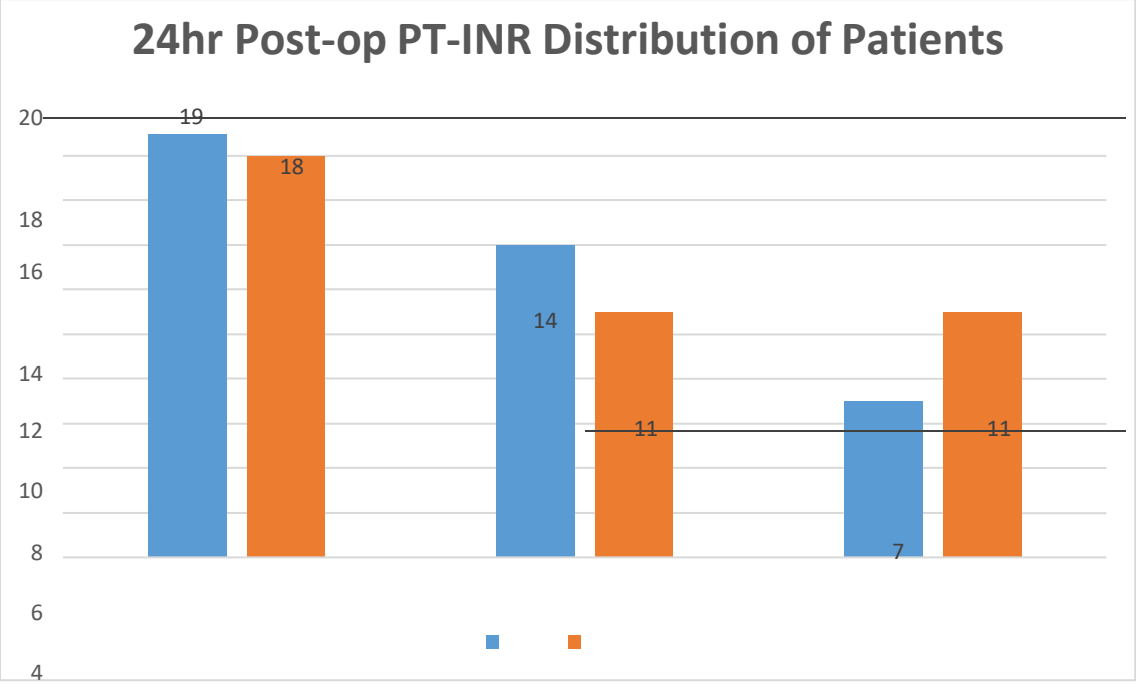

Figure 5: 24hr Post-op PT -INR Distribution of case and control

Discussions

In the Case group, the majority of patients in the current study fall within the Normal weight category (95.0%), similar to the findings of the other studies, which range from 80.0% to 87.7%. The Control group shown a similar trendwith 90.0% of patients in the Normal weight category, consistent with other studies [6, 9].

In the Case group, 57.5% of the patients in the current study with high Pre-op D-Dimer levels, similar to other studies which report 41.1% to 50.0%. The Control group in the current study shows 60.0% of patients with high D-Dimer levels, consistent with other studies reporting 44.0% to 54.0% [6,9]

This comparison highlights demographic similarities and differences, helping to assess the representativeness of the current study's groups relative to other research efforts. This analysis is crucial for understanding how the Pre-op D-Dimer distribution in the current study aligns with existing literature, ensuringthe validity and reliability of the study outcomes [6,9].

In the Case group, 100% of the patients in the current study with normal Pre-op Platelet levels, while other studies show a higher variability with some patients having low or high platelet counts. In the Control group, the current study also shown all patients within the normal range, whereas other studies reported a mix of low, normal, and high platelet levels [6,9].

In the Case group, 62.5% of the patients in the current study had a PT-INR between 0.8 and 1.0, while other studies show a range from 40.0% to 44.0%.

The Control group in the current study shows 42.5% of patients within the same range, consistent with other studies reporting 36.0% to 40.0%. This analysis is crucial for understanding how the Pre-op PT-INR distribution in the current study aligns with

existing literature, ensuring the validity and reliability of the study outcomes [6,9].

In the Case group, 47.5% of the patients in the current study had a D-Dimer level between 0.5 and 1.0, while other studies shown a range from 42.0% to 44.0%. The Control group in the current study shows 45.0% of patients within the same range, consistent with other studies reporting 38.0% to 40.0% [6,9].

In the Case group, 35.0% of the patients in the current study had a platelet level between 150 and 250, while other studies shown a range from 30.0% to 36.0%. The Control group in the current study shown 27.5% of patients within the same range, consistent with other studies reporting 28.0% to 30.0%.

The distribution of 6hr Post-op PT-INR levels in the current study's Case group shows that a majority of patients (55.0%) have PT-INR levels between 0.8 and 1.0. This was consistent with findings from Pankaj Kumar Garg et al.,who reported 42.0% of patients in the same range and Chabungbam Gyan Singh et al. found 43.8% of patients with PT-INR levels between 0.8 and 1.0, indicating a similar trend. This suggests that the current study's Case group was comparable to these studies in terms of PT-INR levels shortly after surgery [6,9].

In the Control group, 37.5% of the patients in the current study had PT-INR levels between 0.8 and 1.0. This was in line with the findings of Pankaj Kumar Garg et al., who reported 36.0%, and Chabungbam Gyan Singh et al. also reported 35.6% in this range, demonstrating a consistent pattern across studies. The slightly higher percentage of patients with PT-INR levels greater than 1.2 in the Control group of the current study (32.5%) compared to other studies may indicate a variability in postoperative coagulation response [6,9].

In the Case group, 47.5% of patients in the current study have D-Dimer levelsbetween 0.5 and 1.0 at 24 hours post-op. This aligns with the findings of Pankaj Kumar Garg et al and Chabungbam Gyan Singhet al., who reported similar percentages in the same range. For the Control group, 55.0% of patients in the current study fall within the 0.5-1.0 range, which was consistent with the other studies. The distribution in higher ranges(1.1-1.5 and >1.5) also shown a similar trend across studies, highlighting the comparable coagulation profiles observed in these patient populations post- surgery. This analysis confirms that the 24hr Post-op D-Dimer levels in the current study were in line with existing literature, supporting the validity of the findings and contributing to a broader understanding of coagulation changes following laparoscopic cholecystectomy [6,9].

In the Case group, 42.5% of patients in the current study have platelet levels between 150 and 250 at 24 hours post-op, which aligns with the finding of Pankaj Kumar Garg et al who reported similar percentage in the same range. The majority of patients (57.5%) fall within the 251-400 range, consistent with other studies [6,9].

For the Control group, 47.5% of patients in the current study fall within the 150-250 range, and 52.5% are in the 251-400 range. This was comparable to the results reported by other studies, highlighting a similar distribution of platelet levels post-surgery [6,9].

The distribution of 24hr Post-op Platelets levels in the current study was consistent with existing literature, supporting the validity of the findings and contributing to a broader understanding of postoperative platelet changes following laparoscopic cholecystectomy [6,9].

In the Case group, 47.5% of patients in the current study have PT-INR levelsbetween 0.8 and 1.0 at 24 hours post-op. This aligns with the finding of Pankaj Kumar Garg et al who reported similar percentage in the same range. The proportion of patients with PT-INR levelsbetween 1.1 and 1.2, and those with levels greater than 1.2, also aligns closely with other studies, indicating comparable coagulation profiles [6,9].

For the Control group, 45.0% of patients in the current study fall within the 0.8-1.0 range, which was consistent with other studies. The distribution in higher ranges (1.1-1.2 and >1.2) also shown a similar trend across studies, highlighting the comparable coagulation profiles observed in these patient populations post-surgery [6,9].

The distribution of 24hr Post-op PT-INR levels in the current study was consistent with existing literature, supporting the validity of the findings and contributing to a broader understanding of postoperative coagulation changes following laparoscopic cholecystectomy. No thromboembolic events noted in both case and control group for a followup period of 1 month.

Conclusions

The present study concluded the underscore the importance of monitoring coagulation parameters, particularly D-Dimer levels, which showed significant postoperative changes. The consistent distribution of PT- INR and Platelet levels within the normal range in both groups suggests that these parameters were less impacted by the surgical procedure than D-Dimerlevels. And it emphasizes the critical need for tailored anticoagulation strategies and comprehensive postoperative monitoring to mitigate the risks of thromboembolic events and ensure optimal patient outcomes.

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