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Changes In Hematological Parameters And Liver Enzymes In Laproscoic Cholecystectomy Patients In A Tertiary Care Center.

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Abstract

Background: Laparoscopic cholecystectomy (LC) is a widely used minimally invasive procedure for treating symptomatic cholelithiasis. Although considered safe, LC may lead to transient changes in hematological and liver function parameters due to pneumoperitoneum and surgical stress.

Objectives: To compare and evaluate the changes in the preoperative and postoperative levels of hematological parameters and liver enzymes in patients undergoing laparoscopic cholecystectomy in a tertiary care center.

Materials and Method: A prospective observational study was conducted on 100 patients undergoing LC at a tertiary care center. Hematological parameters and liver enzymes were measured preoperatively, 24 hours postoperatively, and on postoperative day 7. Data were analyzed using ANOVA and Pearson correlation coefficient. Histopathological examination of gallbladder specimens was also performed.

Results: ALT and MPV levels significantly increased at 24 hours postoperatively ($p < 0.0001$), followed by a decline toward baseline by day 7. Hb, HCT, and platelet counts showed a significant decrease at 24 hours ($p < 0.0001$), with recovery by day 7. ALP levels remained relatively stable throughout the postoperative period. Histopathological analysis revealed chronic cholecystitis in most specimens, including features like mucosal thickening and Rokitansky-Aschoff sinuses.

Conclusion: LC induces transient, reversible changes in hematological and liver enzyme parameters which are self-limiting and clinically insignificant in patients with normal baseline liver function. Awareness of these expected alterations can help prevent misinterpretation of routine postoperative lab results.

Keywords: Laparoscopic Cholecystectomy, ALT, MPV, Hematological Parameters, Liver Enzymes, Cholelithiasis, Chronic Cholecystitis

Introduction

Cholelithiasis is hard, pebble-like pieces of material usually made of cholesterol or bilirubin that are formed in the gallbladder, and may range from a grain of sand to a golf ball in size. **(Tsai TJ et al., 2018)** They are also known as the gallstones and are one of the most prevalent gastro-intestinal dysfunctions and are considered as a disease of developed populations but are presently prevalent all around the world. **(Tsai TJ et al., 2018)**

The distribution of gallstones prevalence among different countries ranges from 1.93% in India to 25.8% in Mexico and at the continent level, South America has the highest prevalence (11.2%), followed by North America (8.1%), Africa (6.6%, and Europe (6.4%). Globally, 6% of the population has gallstones, with higher rates in females. **(Xin Wang et al., 2024)** In India, the prevalence is more in North compared to South India. **(Malhotra SL, 1968)**

Gallstones are formed due to bile imbalance, biliary stasis and supersaturation. When cholesterol, bile salts, or bilirubin is in excess, it causes substances in the bile to reach their limits of solubility. As bile becomes concentrated in the gallbladder, it becomes super-saturated with these substances, which in time precipitate into small crystals. These crystals, in turn, become stuck in the gallbladder mucus, resulting in gallbladder sludge. Over time, these crystals grow and form large stones. Complications caused by gallstones are a direct consequence of occlusion of the hepatic and biliary tree by sludge and stones. **(Shabanzadeh DM, 2018)**

However, most individuals diagnosed with gallstones are asymptomatic, but 10% will develop symptoms within five years, and 20% will develop symptoms within 20 years of diagnosing gallstones. **(Tsai TJ et al., 2018)** The prevalence increases as a person ages. Obesity increases the likelihood of gallstones, especially in women, due to an increase in the biliary secretion of cholesterol. On the other hand, patients with drastic weight-loss or fasting have a higher chance of gallstones secondary to biliary stasis. **(Shabanzadeh DM, 2018)** Symptomatic patients are managed by surgery to remove the gallbladder, called as cholecystectomy.

Cholecystectomy is performed either laparoscopically, or via an open surgical technique. **(Hirajima S et al., 2017)** Laparoscopic cholecystectomy (LC) is a minimally invasive surgical procedure for removal of a diseased gallbladder. **(Beal JM, 1984; Kapoor T et al., 2018)** This technique has replaced the open technique for routine cholecystectomies since the early 1990s. **(Kapoor T et al., 2018)** The LC approach is preferred due to its benefits/ advantages over open cholecystectomies like less post-operative pain, earlier return of bowel function, shorter length of hospital stay, earlier return to full activity, improved cosmesis, and decreased overall cost. **(Kaushik R et al., 2002; Teitelbaum EN et al., 2019)** LC has become the standard surgical treatment of gallstone disease in India. **(Udwadia TE, 2005; Kapoor T et al., 2018; Sargn Virk et al., 2024; Kaushik R et al., 2002)**

Despite the short hospital stay and quick recovery period, LC has a risk of developing cardiovascular complications in susceptible populations due to its hemodynamic and ventilatory consequences. The increased pressure of pneumoperitoneum and hypercarbia are associated with changes in hemodynamic parameters during laparoscopic surgeries. **(Umar A et al., 2013; Atkinson TM et al., 2017; Keus F et al., 2006)** Decreased hepatic artery and portal venous blood flow result in transient hepatocellular ischemia triggering cellular injury, as a consequence, the Alanine transaminase (ALT) level elevates. Higher intra-abdominal pressure is linked with higher fluctuations in hemodynamics and more abnormalities in Liver function tests (LFT). Changes in LFTs postoperatively during LC are related to pneumoperitoneum and duration of exposure. **(Umar A et al., 2013; Rizvi ZA et al., 2018)** Various studies have reported changes in hematological parameters during Laparoscopic procedures. **(Celep RB et al., 2014; Bitkin A et al., 2018)**

The effects of these surgeries, under different circumstances, on the hematological parameters need to be clearly defined so that adequate measures are taken Pre, Peri and Post-operatively to minimize morbidity, mortality, hospitalization as well as the overall cost for the patient and the hospital.

Currently, very little research is available. Therefore, the present study was conducted to compare and evaluate the changes in the preoperative and postoperative levels hematological parameters and Liver enzymes in patients undergoing LC.

Material & Method

A prospective observational study was conducted from May 2024, for approximately a year in the Pathology department in coordination with the Surgery department in a tertiary care center in Jammu region of J&K, India.

Ethical clearance: An informed consent was obtained after explaining the study to the willing participants. The ethical clearance was obtained from the institutional ethical committee (IEC/GMCJ/2025/2084).

Selection criteria: Patients who are undergoing LC for Cholelithiasis and patients having symptomatic gallstone disease were included in the study. Patients not willing to participate in the study/ not willing to sign the informed consent or, patients having systemic conditions or diseases or, patients where LC was converted to open cholecystectomy or, patients suffering from post-operative infections or coagulation disorders and/ or, pregnant or Lactating women were not included in the study.

Methodology: A total of 100 patients, both male and female, with an age range of 18-75 years were selected from the IPD of the Surgery Department, who had to undergo cholecystectomy for cholelithiasis.

Complete case history including clinical details, personal history, family history of the patients was recorded followed by collection of blood samples for laboratory investigations pre-operatively. LC was successfully performed in the patients by the surgeon and the cholecystectomy specimens were sent to the pathology department for evaluation. Post-operative blood samples were collected within 24 hours and at day 7 for laboratory investigation.

Blood sample preparation and evaluation: All the blood samples collected from the patients pre-operatively and post-operatively (within 24 hours and at 7^{th} day) were analyzed for hematological parameters and liver function tests. The hematological parameters included; Hemoglobin (Hb), Mean Corpuscular

Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), Hematocrit (Hct), Platelets (Plt), and Mean Platelet Volume (MPV); and the Liver Function Tests included; Alanine transaminase (ALT), and Alkaline phosphatase (ALP).

The blood sample were processed using auto analyzers Yumizen G1500 (HORIBA, Ltd., Japan) and BC 5800 (MINDRAY, Ltd., China), to obtain the hematological parameters and; Siemens Dimension RXL Max (Siemens Healthineers, Germany) and Abbott Architect ci4100 integrated system (Abbott Diagnostics, USA) to analyze the liver function tests.

Sample preparation and evaluation for Light microscopy: All the cholecystectomy specimens received in the Pathology department were fixed in 10% Neutral Buffered Formalin (NBF) after which grossing was done followed by processing of the tissue in Auto Tissue Processor i.e., Excelsior AS (Epredia, Japan). Then tissues were embedded using embedding station HistoStar™ Embedding Center (Epredia, Japan) followed by cutting with Microtome and Hematoxylin and Eosin (H&E) staining of the slides.

Microscopic examination using light microscope of the H&E-stained slides was done under a magnification of 10x and 40x to study histopathological spectrum.

Statistical Analysis: All the data collected was tabulated in an excel sheet (Microsoft office, version 2019) and was statistically analyzed using SPSS version 22.0 statistical analysis software (IBM, Chicago, IL, USA). Data obtained was statistically analyzed by ANOVA test and pearson correlation coefficient. The level of statistical significance was set at $p < 0.05$.

Results

Out of the total patients, 30% were males and 70% were females, with a male to female ratio of 1:2.3 and an average age of 46.57 years. The mean age for females is 44 years whereas mean age for males is 52 years.

Table 1 shows a higher number of patients belonged to the middle-age group of 40-59 years in females, whereas least number of patients belonged to young-age group of 18-39 years in males.

Table 2 presents hematological and liver enzymes at three different time points: pre-operation, 24 hours post-operation, and 7 days post-operation. Hb levels show a slight decrease at 24 hours post-operation compared to the pre-operative values, but by 7 days, the Hb levels appear to have returned to near pre-operative values. It is seen that the coefficient of variation remains relatively stable across all three time points, suggesting consistent Hb measurements within the sample. MCV values remains relatively stable across all three time points, indicating no significant changes in the average size of red blood cells but the CV is low, suggesting homogeneity in red blood cell size. Similar to Hb, MCH shows a slight increase at 24 hours post-operation compared to pre-operative values, but returns close to baseline by 7 days. The CV is also relatively stable. MCHC levels also remains quite stable across the three time points, indicating consistent average concentration of hemoglobin in red blood cells. The CV is the lowest among the red blood cell indices, suggesting high consistency. The platelets count shows a decrease at 24 hours post-operation compared to the pre-operative value. It is also seen that by 7 days, the platelet count appears to be recovering but is still slightly lower than the pre-operative level. The CV for platelet count is notably higher compared to other parameters, indicating more variability in platelet counts within the sample (Table 2).

ALT and ALP levels are also seen in Table 2. The ALT levels show a marked increase at 24 hours post-operation compared to the pre-operative values. By 7 days, ALT levels have decreased but are still elevated compared to the baseline. This suggests some degree of liver injury that is resolving over time. The CV for ALT is also relatively high, especially at 24 hours. ALP levels remain relatively stable across all three time points and its CV is moderate and consistent.

Graph 1 shows a strong positive correlation between Hb and HCT, MCV and MCH; a moderate correlation between MCV and HCT, MCH and HCT, MPV and ALT; a strong negative correlation between PLT and MPV, respectively.

Table 3 shows the interpretation of difference of the hematological parameters and liver enzymes in different time slots i.e., pre-op, post-op 24 hrs and 7 days. The data suggests a general trend towards a slight decrease in haemoglobin, MCV, MCH, MCHC, and platelets post-operatively, although the high coefficients of variation indicate that individual responses vary greatly. There's an indication of an average increase in ALP and an average decrease in ALT post-operatively. The lower coefficient of variation for ALT suggests a more consistent response in this liver enzyme compared to ALP and the hematological parameters (Table 3).

All the samples of the were evaluated under light microscope at 10x & 40x magnification and photographs were taken. All these photographs demonstrated a thickened mucosal layer; lymphoid cells which are the prominent, darkly stained cells, characteristic of lymphoid follicles and; muscularis layer which can be fibrosed (scarred) within and around the layer [Figure 1 (a & b)]. The outermost layer called as serosa Figure 1 (c) was also visible in some samples.

Under high power magnifications (40x) of samples showed ulcerated gallbladder mucosa with mild congestion as shown in Figure 2. Figure 3 (a & b) shows low power magnification (10x) and high power (40x) of the gallbladder samples with outpouchings of the mucosal epithelium that extend into or through the muscle layer, called as Rockitansky Aschoff sinuses, respectively.

Discussion

Cholecystectomy, the surgical removal of the gallbladder, stands as the definitive treatment for symptomatic gallstone disease and its complications, including cholecystitis. Traditionally performed as an open procedure involving a larger abdominal incision, the advent of laparoscopic cholecystectomy (LC) in the late 20th century revolutionized the surgical management of this condition. This minimally invasive technique utilizes small abdominal incisions through which a camera and specialized instruments are inserted to visualize and remove the gallbladder. Laparoscopic cholecystectomy offers several advantages over open surgery, including reduced postoperative pain, shorter hospital stays, faster recovery times, and improved cosmetic outcomes **(Hassler R. et al., 2024; Feng JW et al., 2019)**

Open cholecystectomy remains a relevant approach in specific situations, such as complex cases with severe inflammation, adhesions from previous surgeries, suspected gallbladder cancer, or when laparoscopic surgery is not feasible or safe. Understanding the indications, techniques, and outcomes of both laparoscopic and open cholecystectomy is crucial in the comprehensive management of gallstone-related inflammation. **(Chinnery GE et al., 2013; Kenneth R. et al., 2024; Buia A et al., 2015)**

Laparoscopy has become one of the staples of modern surgery practice. Hence, its benefits and adverse effects need to be carefully monitored to continue to benefit the society. **(Ashraf Butt AU et al., 2021; Buia A et al., 2015)**. We have, in our study, obtained some interesting results that will help provide a clearer picture about the effects of this surgery. There were significant differences in the levels of some of the parameters under study. This suggests that despite its apparent innocuousness, laparoscopy still requires appropriate care and precautionary measures in order to assure the well-being of the patient

This prospective observational study assessed the hematological and hepatic biochemical changes in patients undergoing LC, a widely accepted minimally invasive technique for the treatment of symptomatic cholelithiasis. The primary focus was to evaluate perioperative alterations in parameters such as Hb, MCV, MCH, MCHC, HCT, platelets, MPV,ALT, and ALP. The findings demonstrated that most hematological parameters showed transient changes, particularly at 24 hours post-operation, followed by normalization or partial recovery by day 7. This pattern was mirrored in ALT levels, which significantly rose at 24 hours and declined towards baseline by the seventh postoperative day, while ALP remained relatively stable.

Liver enzyme changes and comparison with literature: The observed postoperative rise in ALT is consistent with findings from **Saber et al. (2000)** and **Sakorafas et al. (2005)**, both of whom reported a statistically significant increase in liver enzymes—primarily ALT and AST—within 24–72 hours following LC, attributing this to transient hepatocellular injury caused by CO_2 pneumoperitoneum and reduced hepatic perfusion. Our study corroborates this, showing a notable increase in ALT with a peak at 24 hours and near normalization by day 7, suggesting a reversible and clinically silent hepatic stress in otherwise healthy individuals.

Similarly, **Tan et al. (2003)** and **Guven et al. (2007)** observed that the extent of enzyme elevation is significantly more in laparoscopic procedures compared to open cholecystectomy (OC), reinforcing the role of intra-abdominal pressure and CO_2 insufflation as key contributors. **Rajan Gupta et al. (2013)** further validated this by demonstrating a direct correlation between higher pneumoperitoneum pressure (14 mmHg) and greater LFT derangement, compared to lower pressure settings. Although pneumoperitoneum pressures were not varied in our study, the pattern of enzyme elevation aligns with the hypothesis of pressure-induced hepatic stress.

Hematological changes and their implications: Our study showed a statistically significant decrease in Hb, HCT, and platelet count 24 hours post-surgery, which then approached preoperative levels by day 7. These findings are in line with **Butt et al. (2021)** and **Thabet et al. (2024)**, who noted similar trends in hematological values following LC, attributing the changes to intraoperative hemodilution, minor blood loss, and surgical stress-induced inflammatory responses.

The increase in MPV observed at 24 hours post-op, which partially normalized by day 7, is of particular interest. Elevated MPV is often a marker of platelet activation and has been associated with inflammatory and thrombotic activity. **Celep et al. (2014)** reported that MPV correlates with intra-abdominal pressure and could serve as an indirect marker of intra-abdominal hypertension. Our study supports this, suggesting MPV as a sensitive indicator for transient inflammatory changes following LC.

Furthermore, **Ashraf Butt et al. (2021)** and **Amar Varshney et al. (2024)** emphasized that leukocyte counts and MPV were significantly elevated postoperatively, and that neutrophil-lymphocyte ratios (NLR) and platelet-lymphocyte ratios (PLR) might serve as additional prognostic tools in surgical monitoring. Though we did not evaluate NLR or PLR specifically, the observed MPV increase is consistent with these inflammatory trends.

ALP stability and clinical relevance: Unlike ALT, ALP levels remained relatively stable throughout the postoperative period, showing only minor variations. This observation is consistent with studies by **Sakorafas et al. (2005)** and **Naikoo et al. (2018)**, who found no statistically significant increase in ALP after LC in patients with normal preoperative biliary function. ALP elevation is more often associated with biliary obstruction, which was absent in our study population, supporting the notion that LC does not significantly affect biliary enzyme profiles in uncomplicated cases.

Histopathological findings: The histopathological evaluation of gallbladder specimens revealed classic features of chronic cholecystitis, including mucosal thickening, lymphoid follicle formation, and the presence of Rokitansky-Aschoff sinuses, consistent with longstanding gallstone disease. These findings were similar to those described in previous pathological studies and confirm the chronic inflammatory nature of gallstone disease in symptomatic patients.

Strengths and clinical implications: This study adds to the existing body of evidence by demonstrating that while transient alterations in hematological and liver enzyme parameters occur following laparoscopic cholecystectomy, they are self-limiting and clinically insignificant in patients with normal preoperative liver function. Routine postoperative monitoring of these markers can aid in differentiating normal physiological response from pathological complications, such as bile duct injury or infection.

Limitations & Future Recommendations

Despite the valuable insights, the study has some limitations:

- Lack of a control group (e.g., open cholecystectomy patients) limits comparative evaluation.
- Pneumoperitoneum pressure and duration were not stratified, although they are known to influence hepatic and hematological responses.
- Postoperative follow-up was limited to 7 days, whereas longer-term monitoring might detect delayed or persistent abnormalities.
- Subgroup analysis based on comorbidities (e.g., obesity, fatty liver) could offer more nuanced insights.

Conclusion

This prospective observational study concludes that laparoscopic cholecystectomy, while being a minimally invasive and routinely performed surgical procedure, is associated with transient and statistically significant alterations in hematological parameters and liver enzymes. Notably, parameters such as ALT, MPV, MCV, and leukocyte counts showed a rise postoperatively, particularly within the first 24 hours, whereas haemoglobin, haematocrit, and platelet count exhibited a transient decline. Importantly, these changes were observed to normalize or trend toward baseline levels by postoperative day 7, indicating their reversible and non-pathological nature in patients with otherwise normal hepatic function. The stability of ALP levels further reinforces the absence of biliary complications in the studied cohort.

Understanding these trends can help clinicians implement appropriate perioperative care protocols, monitor high-risk individuals more closely, and contribute to reducing patient anxiety, hospital stay, and healthcare burden.

Future studies with larger sample sizes, controlled surgical variables, and longer follow-up periods are warranted to better understand the full spectrum of hematological and biochemical alterations in laparoscopic surgery.

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Legend Tables and Figure

Table 1: Gender-wise distribution in various age groups.

Age groups	Male		Female	
	n	%	N	%
18 – 39 years	6	20	28	40
40 – 59 years	12	40	32	45.7
60+ years	12	40	10	14.3

n – number of patients; % – percentage

Table 2: Comparison of changes in hematological factors and liver enzyme between different time intervals.

	Mean	S.E	95% of CI		CV (%)
			LB	UB	
	PRE-OP				
Hb (g/dL)	12.24	0.159	11.9	12.56	13.0
MCV (fL)	87.49	0.620	86.2	88.71	7.07
MCH (pg)	28.20	0.260	27.6	28.72	9.24
MCHC (g/dL)	33.24	0.201	32.8	33.64	6.07
MPV (fL)	8.59	0.118	8.36	8.833	13.8
HCT	42.54	0.358	41.8	43.25	8.42
PLT (10^3/IU))	192.5	5.591	181	203.6	29.0
ALP (U/L)	89.90	1.826	86.2	93.52	20.3
ALT (U/L)	34.16	0.271	33.6	34.70	7.94
	24 HRS				
Hb (g/dL)	11.51	0.141	11.2	11.79	12.3
MCV (fL)	89.65	0.554	88.5	90.75	6.18
MCH (pg)	29.68	0.252	29.1	30.18	8.49
MCHC (g/dL)	34.49	0.203	34.0	34.89	5.89
MPV (fL)	9.097	0.120	8.85	9.337	13.2
HCT	39.82	0.281	39.2	40.37	7.05
PLT (10^3/IU))	174.6	5.181	164	184.8	29.6
ALP (U/L)	91.12	1.834	87.4	94.76	20.1
ALT (U/L)	49.19	0.487	48.2	50.16	9.90
	7 DAYS				
Hb (g/dL)	12.29	0.158	11.9	12.60	12.8
MCV (fL)	87.66	0.615	86.4	88.89	7.03

MCH (pg)	28.23	0.255	27.7	28.74	9.05
MCHC (g/dL)	33.28	0.201	32.8	33.68	6.03
MPV (fL)	8.635	0.116	8.40	8.866	13.4
HCT	42.53	0.352	41.8	43.23	8.29
PLT (10^3/IU))	193.2	5.600	182	204.3	28.9
ALP (U/L)	88.80	1.762	85.3	92.30	19.8
ALT (U/L)	35.10	0.270	34.5	35.64	7.71

Hb – Haemoglobin, MCV – Mean Corpuscular Volume, MCH – Mean Corpuscular Haemoglobin, MCHC – Mean Corpuscular Haemoglobin Concentration, MPV – Mean Platelet Volume, HCT – Hematocrit, PLT – Platelets, ALT – Alanine Transaminase, ALP – Alkaline Phosphatase, S.E – Standard Error of mean, CI – Confidence Interval, LB – Lower Bound, UB – Upper Bound, CV – Coefficient of Variation.

Table 3: Descriptive Analysis of Hematological Parameters and Liver Enzymes

	HB	MCV	MCH	MCHC	HCT	PLAT	MPV	ALP	ALT
25% Pertil.	-0.10	-0.10	-0.10	-0.10	-0.10	-2.00	-0.10	0.300	-1.30
Median	-0.10	-0.10	0.000	0.000	0.000	-1.00	0.000	0.700	-0.90
75% Pertil.	0.000	0.000	0.100	0.000	0.075	1.000	0.000	1.575	-0.40
Ran	0.600	7.600	2.200	50.40	1.300	11.00	0.800	7.400	5.200
95% CI	96.48	96.48	96.48	96.48	96.48	96.48	96.48	96.48	96.48
LB	-0.10	-0.10	-0.10	-0.10	0.000	-1.00	-0.10	0.500	-1.10
UB	0.000	-0.10	0.000	0.000	0.000	0.000	0.000	0.800	-0.70
Mean	-0.04	-0.10	-0.02	-1.03	0.014	-0.71	-0.03	1.066	-0.93
S.D	0.111	0.643	0.219	7.031	0.188	2.143	0.104	1.237	0.835
S.E	0.011	0.064	0.021	0.703	0.018	0.214	0.010	0.123	0.083
CV (%)	258.7%	630.8%	756.6%	678.0%	1347%	301.8%	291.5%	116.1%	89.77%
Sum	-4.30	-10.2	-2.90	-103.	1.400	-71.0	-3.60	106.6	-93.1

Hb – Haemoglobin, MCV – Mean Corpuscular Volume, MCH – Mean Corpuscular Haemoglobin, MCHC – Mean Corpuscular Haemoglobin Concentration, MPV – Mean Platelet Volume, HCT – Hematocrit, PLT – Platelets, ALT – Alanine Transaminase, ALP – Alkaline Phosphatase, Pertil. – Percentile, Ran – Range, CI – Confidence Interval, LB – Lower Bound, UB – Upper Bound, S.D – Standard Deviation, S.E – Standard Error of mean, CV – Coefficient of Variation.

Graph

	HB	MCV	MCH	MCHC	HCT	PLAT	MPV	ALP	ALT
HB	1.00	0.06	0.05	0.01	-0.15	-0.06	0.01	-0.12	-0.02
MCV	0.06	1.00	0.03	-0.02	-0.03		0.04	0.02	-0.09
MCH	0.05	0.03	1.00	0.02	0.21	-0.14	-0.09	0.12	-0.02
MCHC	0.01	-0.02	0.02	1.00	0.08	0.05	0.08	-0.03	-0.02
HCT	-0.15	-0.03	0.21	0.08	1.00	-0.06	-0.14	-0.03	-0.02
PLAT	-0.06		-0.14	0.05	-0.06	1.00	-0.25	-0.08	0.05
MPV	0.01	0.04	-0.09	0.08	-0.14	-0.25	1.00	-0.03	0.10
ALP	-0.12	0.02	0.12	-0.03	-0.03	-0.08	-0.03	1.00	-0.19
ALT	-0.02	-0.09	-0.02	-0.02	-0.02	0.05	0.10	-0.19	1.00

+ve/ -ve R value	Correlation
1.00 – 0.80	Very Strong
0.79 – 0.60	Strong
0.59 – 0.40	Moderate
0.39 – 0.20	Weak
0.19 – 0.01	Very Weak

Graph 1: Pearson Correlation Coefficients of Hematological and Biochemical Markers.

Hb – Haemoglobin, MCV – Mean Corpuscular Volume, MCH – Mean Corpuscular Haemoglobin, MCHC – Mean Corpuscular Haemoglobin Concentration, MPV – Mean Platelet Volume, HCT – Hematocrit, PLT – Platelets, ALT – Alanine Transaminase, ALP – Alkaline Phosphatase, R value – Correlation Coefficients.

Figure

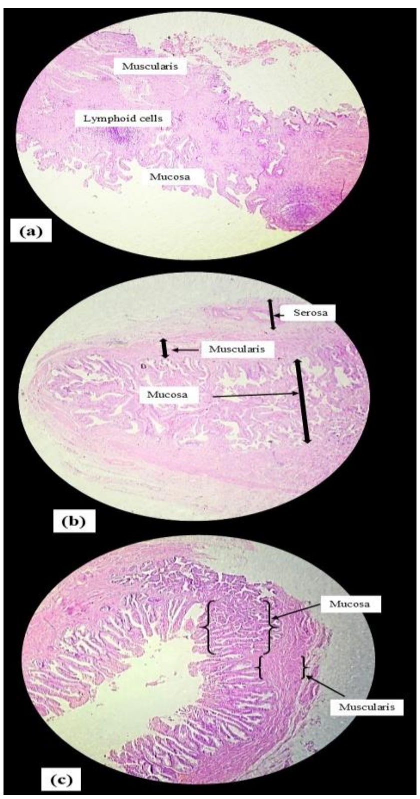

Figure 1: Histopathological of Chronic cholecystitis showing, (a, b & c) serosa (outer-layer), thickened mucosa with lymphoid cells and muscularis layer.

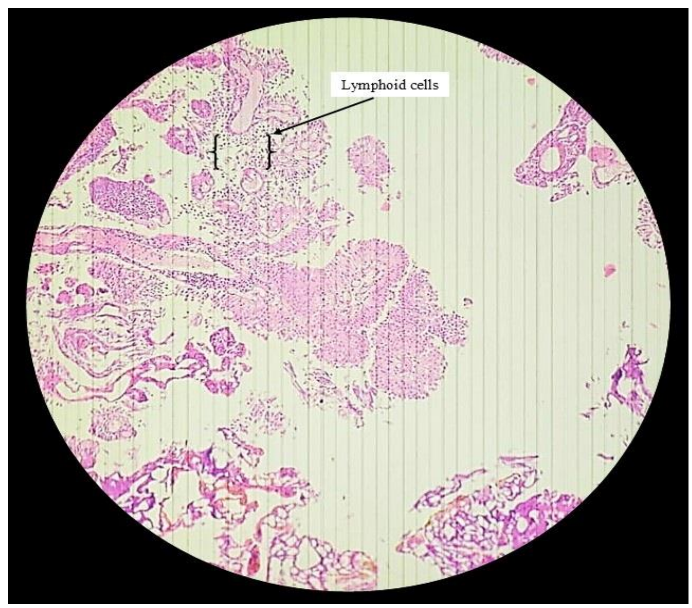

Figure 2: Histopathological of Chronic cholecystitis showing, ulcerated gallbladder mucosa with mild congestion.

Figure 3: Histopathological of Chronic cholecystitis showing, Rokitansky-Aschoff sinuses viewed at 10x (a) and 40x, respectively.