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ORIGINAL RESEARCH

To determine the impact of laparoscopic surgery on liver function

Rajendrakumar Natvarlal Nayak

Assistant Professor, Department of Surgery, Swaminarayan Institute of Medical Sciences and Research, Kalol, Gandhinagar, Gujarat, India

Corresponding Author
Rajendrakumar Natvarlal Nayak
Assistant Professor, Department of Surgery, Swaminarayan Institute of Medical Sciences and Research, Kalol, Gandhinagar, Gujarat, India

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ABSTRACT

Aim: To determine the impact of laparoscopic surgery on liver function. **Material and methods:** The study included 50 patients who were scheduled to undergo elective laparoscopic procedures for various indications. Fifty patients were enrolled in the study. Patients aged 18 years and older, scheduled for elective laparoscopic surgery, including cholecystectomy, hernia repair, or other abdominal procedures and who provided written informed consent were included in the study. The occurrence of any postoperative complications, including infections, bile leaks, or hemorrhage, Length of hospital stay was measured. The impact on liver function was assessed based on changes in the LFTs from baseline to the postoperative period. An elevation of more than 2 times the upper limit of normal for ALT or AST was considered significant. Changes in ALP, total bilirubin, and albumin levels were also monitored and analyzed. Patients were closely monitored during their hospital stay and followed up for 30 days post-surgery. **Results:** The mean ± SD values were: ALT 25 ± 8 U/L (normal range 7-56 U/L), AST 22 ± 7 U/L (normal range 10-40 U/L), ALP 75 ± 20 U/L (normal range 44-147 U/L), total bilirubin 0.8 ± 0.2 mg/dL (normal range 0.1-1.2 mg/dL), and albumin 4.0 ± 0.5 g/dL (normal range 3.5-5.0 g/dL). These results confirm the hepatic stability of the patients before undergoing surgery. The intraoperative data reveal that the majority of surgeries were cholecystectomies (60%), followed by hernia repairs (30%), and other abdominal procedures (10%). Most surgeries (70%) were completed in less than 2 hours, while 30% took 2 hours or more. Regarding CO2 insufflation pressure, 60% of the surgeries used pressures ≥12 mmHg, and 40% used pressures <12 mmHg. The postoperative LFTs indicate a transient elevation in liver enzyme levels following laparoscopic surgery. On postoperative day 1, mean ALT levels increased to 40 ± 15 U/L and AST to 38 ± 14 U/L. By day 3, these levels slightly decreased to ALT 35 ± 12 U/L and AST 32 ± 11 U/L, and by day 7, they further normalized to ALT 28 ± 10 U/L and AST 25 ± 9 U/L. ALP, total bilirubin, and albumin levels showed minimal fluctuations, with ALP peaking at 80 ± 25 U/L on day 1 and normalizing to 70 ± 18 U/L by day 7. Total bilirubin and albumin levels remained stable, indicating minimal impact on these parameters. The postoperative outcomes show that 70% of patients had a hospital stay of less than 7 days, while 30% stayed 7 days or more. ICU admission was required for 20% of the patients, reflecting the severity or complications of their conditions. **Conclusion**: In conclusion, this study provides valuable insights into the demographic characteristics, intraoperative variables, and postoperative outcomes related to liver function in patients undergoing laparoscopic surgery. The findings corroborate existing literature, highlighting the transient and manageable nature of liver enzyme elevations post-surgery.

Keywords: laparoscopic surgery, liver function tests, bilirubin

INTRODUCTION

In this modern era Laparoscopic surgery has evoked marked changes in approach to surgical diseases. The "Minimally invasive surgery "(MIS), now turned into "Minimal Access Surgery" (MAS) has prompted us to prompted us to perform most of the operations by Laparoscopic technique. Main advantages of laparoscopic surgery include; reduction of tissue trauma due to small skin incisions and reduction in adhesion formation.[1] The growing interest in laparoscopy is mostly attributable to cumulative evidence suggesting a reduction in patient morbidity, shortening of duration of hospital stay and early return to normal activity. All Laparoscopic procedures are usually performed by creating pneumoperitoneum. Carbon dioxide is most commonly used inert gas to create pneumoperitoneum as it has got many advantages like non-combustibility, high diffusibility, rapid rate of absorption and excretion via the lungs. CO2 is 20 times more soluble in serum than room air or oxygen, also it has been shown to be absorbed 32 times more quickly than room air when used for double contrast Barium enemas. During most cases of the Laparoscopic surgery, a pneumoperitoneum of 12-

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14 mm Hg CO2 is established.[2-5] Apart from many advantages in Laparoscopic procedures; effects of pneumoperitoneum on the cardiovascular and respiratory system resulting in several pathophysiological changes in the patients have been reported. Recently many studies have disclosed 'unexplained' changes in postoperative liver function tests in patients undergoing laparoscopic procedures. These studies demonstrate that transient elevation of hepatic enzymes could occur after laparoscopic procedures. No causes for this elevation are documented so far. These changes might be attributed to hepatocellular dysfunction secondary to one or combination of CO2 pneumoperitoneum, diathermy extruding liver, branch of the hepatic artery injured and general anesthesia. CO2 pneumoperitoneum might be one of the main reasons for the change of serum liver enzymes.[6-9]

MATERIALS AND METHODS

The study included 50 patients who were scheduled to undergo elective laparoscopic procedures for various indications. Fifty patients were enrolled in the study based on the following inclusion and exclusion criteria:

Inclusion Criteria

1. Patients aged 18 years and older.
2. Patients scheduled for elective laparoscopic surgery, including cholecystectomy, hernia repair, or other abdominal procedures.
3. Patients who provided written informed consent to participate in the study.

Exclusion Criteria

1. Patients with pre-existing liver diseases, including cirrhosis, hepatitis, or liver metastases.
2. Patients undergoing emergency surgeries.
3. Patients with incomplete medical records.
4. Patients who were pregnant or lactating.

Methodology

Data were collected prospectively from all participants. The preoperative evaluation included a detailed medical history, physical examination, and baseline liver function tests (LFTs). The LFTs included measurements of serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total bilirubin, and albumin levels. These tests were performed using standard laboratory techniques.Intraoperative Data like Type of laparoscopic procedure performed. Duration of surgery (measured from the first incision to the closure of the last incision). Intraoperative complications, if any. Carbon dioxide (CO2) insufflation pressure used during the procedure.Postoperative Data: Liver function tests were repeated on postoperative days 1, 3, and 7. The occurrence of any postoperative complications, including infections, bile leaks, or hemorrhage. Length of hospital stay. Readmission rates within 30 days of surgery.The impact on liver function was assessed based on changes in the LFTs from baseline to the postoperative period. An elevation of more than 2 times the upper limit of normal for ALT or AST was considered significant. Changes in ALP, total bilirubin, and albumin levels were also monitored and analyzed. Patients were closely monitored during their hospital stay and followed up for 30 days post-surgery. The follow-up included clinical assessments and repeat LFTs to monitor liver function recovery. Patients were advised to report any symptoms suggestive of liver dysfunction, such as jaundice, dark urine, or fatigue.

Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics summarized the demographic and clinical characteristics of the patients. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Paired t-tests were used to compare preoperative and postoperative LFTs. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of Patients

The demographic data of the 50 patients who underwent elective laparoscopic procedures show a varied age distribution, with the majority falling within the 31-40 years age group (30%), followed by the 18-30 years group (24%), 41-50 years (20%), 51-60 years (16%), and those over 60 years (10%). Gender distribution was skewed towards males, who comprised 60% of the participants, while females accounted for 40%. This demographic spread provides a comprehensive overview of the study population, indicating a higher prevalence of male patients undergoing laparoscopic surgery in this cohort.

Table 2: Baseline Liver Function Tests (LFTs)

The baseline liver function tests (LFTs) for the patients show mean values within the normal range, indicating that the study population did not have pre-existing liver dysfunction. The mean ± SD values were: ALT 25 ± 8 U/L (normal range 7-56 U/L), AST 22 ± 7 U/L (normal range 10-40 U/L), ALP 75 ± 20 U/L (normal range 44-147 U/L), total bilirubin 0.8 ± 0.2 mg/dL (normal range 0.1-1.2 mg/dL), and albumin 4.0 ± 0.5 g/dL (normal range 3.5-5.0 g/dL). These results confirm the hepatic stability of the patients before undergoing surgery.

Table 3: Intraoperative Data

The intraoperative data reveal that the majority of surgeries were cholecystectomies (60%), followed by hernia repairs (30%), and other abdominal procedures (10%). Most surgeries (70%) were completed in less than 2 hours, while 30% took 2 hours or more. Regarding CO2 insufflation pressure, 60% of the surgeries used pressures ≥12 mmHg, and 40% used

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pressures <12 mmHg. This data is essential for understanding the surgical parameters and their potential impact on liver function postoperatively.

Table 4: Postoperative Liver Function Tests (LFTs)

The postoperative LFTs indicate a transient elevation in liver enzyme levels following laparoscopic surgery. On postoperative day 1, mean ALT levels increased to 40 ± 15 U/L and AST to 38 ± 14 U/L. By day 3, these levels slightly decreased to ALT 35 ± 12 U/L and AST 32 ± 11 U/L, and by day 7, they further normalized to ALT 28 ± 10 U/L and AST 25 ± 9 U/L. ALP, total bilirubin, and albumin levels showed minimal fluctuations, with ALP peaking at 80 ± 25 U/L on day 1 and normalizing to 70 ± 18 U/L by day 7. Total bilirubin and albumin levels remained stable, indicating minimal impact on these parameters.

Table 5: Postoperative Outcomes

The postoperative outcomes show that 70% of patients had a hospital stay of less than 7 days, while 30% stayed 7 days or more. ICU admission was required for 20% of the patients, reflecting the severity or complications of their conditions. Postoperative complications were reported in 16% of the patients, while 84% had no complications. Additionally, 10% of the patients required readmission within 30 days post-surgery, indicating potential late-onset complications or issues related to the surgical procedure.

Table 6: Significant Elevation in Liver Enzymes Post-Surgery

Significant elevations in liver enzymes post-surgery were observed in 20% of the patients for ALT (levels >2x upper limit of normal) and in 16% for AST. These findings suggest that while laparoscopic surgery is generally safe, a subset of patients may experience significant, albeit transient, liver enzyme elevations, warranting close monitoring of liver function in the immediate postoperative period.

Table 1: Demographic Characteristics of Patients

Variable	Frequency (n=50)	Percentage (%)
Age (years)		
18-30	12	24%
31-40	15	30%
41-50	10	20%
51-60	8	16%
>60	5	10%
Gender		
Male	30	60%
Female	20	40%

Table 2: Baseline Liver Function Tests (LFTs)

LFT Parameter	Mean ± SD	Normal Range
ALT (U/L)	25 ± 8	7-56
AST (U/L)	22 ± 7	10-40
ALP (U/L)	75 ± 20	44-147
Total Bilirubin (mg/dL)	0.8 ± 0.2	0.1-1.2
Albumin (g/dL)	4.0 ± 0.5	3.5-5.0

Table 3: Intraoperative Data

Variable	Frequency (n=50)	Percentage (%)
Type of Surgery		
Cholecystectomy	30	60%
Hernia Repair	15	30%
Other Abdominal Procedures	5	10%
Duration of Surgery		
<2 hours	35	70%
≥2 hours	15	30%
CO2 Insufflation Pressure		
<12 mmHg	20	40%
≥12 mmHg	30	60%

Table 4: Postoperative Liver Function Tests (LFTs)

LFT Parameter	Postoperative Day 1	Postoperative Day 3	Postoperative Day 7
ALT (U/L)	40 ± 15	35 ± 12	28 ± 10
AST (U/L)	38 ± 14	32 ± 11	25 ± 9
ALP (U/L)	80 ± 25	78 ± 22	70 ± 18

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Total Bilirubin (mg/dL)	1.0 ± 0.4	0.9 ± 0.3	0.8 ± 0.2
Albumin (g/dL)	3.8 ± 0.6	3.9 ± 0.5	4.0 ± 0.5

Table 5: Postoperative Outcomes

Variable	Frequency (n=50)	Percentage (%)
Length of Hospital Stay		
<7 days	35	70%
≥7 days	15	30%
ICU Admission		
Yes	10	20%
No	40	80%
Postoperative Complications		
Yes	8	16%
No	42	84%
Readmission within 30 Days		
Yes	5	10%
No	45	90%

Table 6: Significant Elevation in Liver Enzymes Post-Surgery

LFT Parameter	Frequency (n=50)	Percentage (%)
ALT (>2x Upper Limit)	10	20%
AST (>2x Upper Limit)	8	16%

DISCUSSION

The study's demographic data revealed a predominant age group of 31-40 years (30%) and a higher prevalence of male patients (60%). These findings align with previous studies that have reported similar age and gender distributions in patients undergoing elective laparoscopic surgeries. For example, a study by Nakayama et al.[10] found that males were more likely to undergo laparoscopic procedures, particularly in middle-aged groups. This demographic skew could be due to the higher incidence of conditions requiring laparoscopic intervention, such as gallstones and hernias, in these populations.

The baseline LFTs indicated that the patients did not have pre-existing liver dysfunction, with mean values within normal ranges for ALT, AST, ALP, total bilirubin, and albumin. This is crucial as it establishes a clear baseline, ensuring that any postoperative changes in liver function can be attributed to the surgery itself rather than pre-existing conditions. Similar baseline liver function profiles were reported by Schilling et al.[11], who emphasized the importance of preoperative LFTs in assessing the impact of surgical procedures on liver function.

The intraoperative data showed that 60% of surgeries were cholecystectomies, and the majority (70%) were completed in less than 2 hours. CO2 insufflation pressures of ≥12 mmHg were used in 60% of cases. Previous studies, such as those by McMahon et al.[12], have highlighted the impact of prolonged surgery duration and higher insufflation pressures on postoperative outcomes, including liver function. Prolonged exposure to high insufflation pressures can impair hepatic blood flow and increase the risk of transient postoperative liver enzyme elevations.

Postoperative LFTs showed a transient elevation in liver enzymes, with ALT and AST levels peaking on postoperative day 1 and gradually normalizing by day 7. This pattern of enzyme elevation is consistent with findings by Hamad et al.[13], who observed similar transient increases in liver enzymes following laparoscopic surgery. The minimal fluctuations in ALP, total bilirubin, and albumin levels suggest that the impact on liver function is temporary and primarily affects hepatocellular rather than cholestatic or synthetic functions.

Postoperative outcomes indicated that 70% of patients had a hospital stay of less than 7 days, and 20% required ICU admission. Postoperative complications occurred in 16% of the patients, with a readmission rate of 10% within 30 days. These results are comparable to those reported by Hunter et al.[14], who found similar rates of ICU admission and complications in patients undergoing laparoscopic surgery. The relatively low complication and readmission rates suggest that laparoscopic surgery is generally safe, with manageable risks.

Significant elevations in ALT and AST were observed in 20% and 16% of patients, respectively. This finding is in line with a study by Joris et al.[15], which documented significant but transient postoperative liver enzyme elevations in a subset of patients undergoing laparoscopic cholecystectomy. These enzyme elevations are believed to result from the effects of pneumoperitoneum and CO2 insufflation, which can transiently reduce hepatic perfusion and cause mild hepatic ischemia.

The results of this study are consistent with previous research on the impact of laparoscopic surgery on liver function. The transient nature of liver enzyme elevations and the factors contributing to these

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changes, such as surgery duration and insufflation pressure, have been well-documented. Studies by Schilling et al.[11] and McMahon et al.[12] support the finding that while laparoscopic surgery can cause temporary liver function alterations, these changes are generally not clinically significant and resolve within a few days.

CONCLUSION

In conclusion, this study provides valuable insights into the demographic characteristics, intraoperative variables, and postoperative outcomes related to liver function in patients undergoing laparoscopic surgery. The findings corroborate existing literature, highlighting the transient and manageable nature of liver enzyme elevations post-surgery. Further research with larger sample sizes and diverse patient populations could provide more comprehensive data to refine clinical guidelines and improve patient outcomes.

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