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ORIGINAL RESEARCH

Evaluation Of Effect Of Laproscopic Surgery On Hepatic Function

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Abstract

Background: Laparoscopic surgery is widely used for its minimally invasive benefits, but its impact on hepatic function due to CO_2 pneumoperitoneum remains a concern. This study evaluates postoperative hepatic biochemical changes and their clinical significance.**Methods:**A prospective observational study was conducted on patients undergoing laparoscopic surgery. Liver function tests, including ALT, AST, ALP, total and direct bilirubin, serum albumin, PT, and INR, were measured preoperatively and at 24 and 48 hours postoperatively. Statistical analysis assessed the significance of changes in these parameters.**Results:**A significant increase in ALT (22.88±8.75 to 35.37±10.42 U/L, $p < 0.001$) and AST (23.96±8.90 to 39.23±10.38 U/L, $p < 0.001$) was observed at 24 hours, followed by a decline at 48 hours. Total bilirubin (0.76±0.262 to 1.05±0.286 mg/dL, $p < 0.001$) and direct bilirubin (0.252±0.0962 to 0.37±0.111 mg/dL, $p < 0.001$) also increased significantly. ALP showed a mild rise ($p = 0.043$). PT and INR increased significantly ($p < 0.001$), indicating transient hepatic synthetic dysfunction. All parameters approached baseline by 48 hours.**Conclusion:**Laparoscopic surgery causes temporary hepatic biochemical alterations, likely due to pneumoperitoneum-induced perfusion changes. However, these effects are self-limiting and clinically insignificant in healthy individuals. Further research is required for patients with pre-existing liver disease.

Keywords: Laparoscopic surgery, hepatic function, liver enzymes, ALT, AST, bilirubin, pneumoperitoneum, prothrombin time, transient hepatic dysfunction.

Introduction

Laparoscopic surgery has revolutionized modern surgical practice by offering a minimally invasive alternative to traditional open procedures. It is widely used across various surgical specialties due to its advantages, including reduced postoperative pain, shorter hospital stays, and faster recovery times [1]. However, despite its benefits, concerns have been raised regarding its potential impact on hepatic function, particularly due to the physiological alterations induced by pneumoperitoneum and carbon dioxide (CO_2) insufflation [2].The liver plays a central role in metabolism, detoxification, and synthesis of vital proteins, making its function critical in the perioperative period. Laparoscopic procedures, especially those involving the upper abdomen, can affect hepatic function due to increased intra-abdominal pressure, reduced hepatic blood flow, and transient ischemia-reperfusion injury[3,4]. Previous studies have demonstrated alterations in liver enzymes, including transient elevations in alanine aminotransferase (ALT) and aspartate aminotransferase (AST), suggesting hepatocellular stress during laparoscopic surgery [5]. The extent of these changes varies based on factors such as operative time, patient comorbidities, and the degree of pneumoperitoneum used [6].Despite growing evidence on the physiological impact of laparoscopic surgery on hepatic function, there remains a need for comprehensive evaluation to determine the clinical significance of these biochemical alterations. Understanding these effects is essential for optimizing perioperative management and minimizing potential hepatic complications, particularly in patients with pre-existing liver disease[7]. This study aims to evaluate the effects of laparoscopic surgery on hepatic function by analyzing perioperative liver enzyme

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changes and assessing their correlation with surgical parameters.

Materials and Method

A prospective observational study was conducted at Département of Surgery, Government Medical College, (Singareni Institute of Medical Sciences) Ramgundam for period of one year. The study was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Patients undergoing elective laparoscopic surgery for various indications, including cholecystectomy, appendectomy, and hernia repair, were recruited.

Inclusion Criteria :

- Patients aged 18–65 years.
- ASA (American Society of Anesthesiologists) physical status I–II.
- Patients with normal baseline liver function tests (LFTs).

Exclusion criteria

- Patients with pre-existing liver disease.
- chronic alcohol consumption.
- Hepatitis B or C infection.
- history of hepatotoxic drug use,
- conversion to open surgery.

Sample Size

A sample size of 75 was calculated based on previous studies, considering a confidence level of 95% and a power of 80% to detect significant changes in hepatic function.

Surgical Procedure

All laparoscopic surgeries were performed under general anesthesia using standard protocols. Pneumoperitoneum was created using carbon dioxide (CO_2) insufflation, with intra-abdominal pressure maintained at 12–14 mmHg. Intraoperative hemodynamic parameters, duration of surgery, and any complications were recorded.

Biochemical Assessment :

Hepatic function was assessed preoperatively and postoperatively at 24 hours and 48 hours using the following liver function parameters:

- Serum Alanine Aminotransferase (ALT)
- Serum Aspartate Aminotransferase (AST)
- Serum Alkaline Phosphatase (ALP)
- Total and Direct Bilirubin
- Serum Albumin
- Prothrombin Time (PT) and International Normalized Ratio (INR)

Statistical Analysis

Demographic data, intraoperative parameters, and biochemical results were collected and analyzed using SPSS software version 25. Continuous variables were expressed as mean ± standard deviation (SD) and compared using paired t-tests or Wilcoxon signed-rank tests, depending on data distribution. Categorical variables were analyzed using the chi-square test. A p-value <0.05 was considered statistically significant.

Results and Observation

Table 1 : Demographic distribution among study population

Parameters	Frequency	Percentage
Age		
< 20 Years	6	8
21 - 30 Years	14	18.7
31 - 40 Years	17	22.7
41 - 50 Years	15	20
51 - 60 Years	15	20
> 60 Years	8	10.7
Gender		
Male	44	58.7
Female	31	41.3
ASA		
Grade I	34	45.3
Grade II	41	54.7
Body Mass Index		
Underweight (< 18.5)	1	1.3
Normal (18.6 - 24.9)	32	42.7
Overweight (25 - 29.9)	25	33.3
Obesity (> 30)	17	22.7
Type of Surgery		
Appendectomy	24	32
Cholecystectomy	30	40

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Hernia Repair	21	28

This table presents the demographic characteristics of the study population, including age, gender, ASA grade, body mass index (BMI), and type of surgery. The majority of the participants were aged between 31–40 years (22.7%), followed by 41–50 years (20%) and 51–60 years (20%). Males accounted for a larger proportion (58.7%) compared to females (41.3%). In terms of ASA classification, most patients fell under Grade II (54.7%), indicating mild systemic disease, while 45.3% were classified as Grade I (healthy individuals). Regarding BMI, 42.7% had a normal weight, 33.3% were overweight, and 22.7% were classified as obese, with only 1.3% being underweight. The most common surgical procedure was cholecystectomy (40%), followed by appendectomy (32%) and hernia repair (28%).

Table 2: Biochemical Assessment among study population at pre, after 24 hours, and 48 Hours.

Parameter	Pre Surgery	After 24 Hours	After 48 Hours	F-value	p-value
ALT	22.88±8.75	35.37±10.42	28.51±10.68	29.39	<0.001
AST	23.96±8.90	39.23±10.38	32.61±10.81	43.36	<0.001
ALP	77.65±23.88	87.32±23.99	80.78±23.89	3.195	0.043
Total Bilirubin	0.76±0.262	1.05±0.286	0.874±0.306	19.816	<0.001
Direct Bilirubin	0.252±0.0962	0.37±0.111	0.320±0.114	26.087	<0.001
Serum Albumin	4.199±0.432	3.88±0.461	4.00±0.464	9.45	<0.001
Prothrombin Time	12.38±0.84	12.95±0.835	12.657±0.837	8.864	<0.001
INR	1.05±0.085	1.175±0.097	1.117±0.1007	32.149	<0.001

This table evaluates key biochemical parameters before surgery, 24 hours postoperatively, and 48 hours postoperatively. A statistically significant increase in ALT (Alanine Aminotransferase) and AST (Aspartate Aminotransferase) was observed 24 hours after surgery ($p < 0.001$), indicating transient hepatic stress, which reduced slightly by 48 hours. Alkaline Phosphatase (ALP) also showed a modest increase postoperatively ($p = 0.043$), which may reflect hepatic or biliary response to surgical stress. Total and direct bilirubin levels significantly increased at 24 hours but started to decline by 48 hours, indicating temporary liver dysfunction due to surgical stress ($p < 0.001$). Serum albumin levels slightly decreased after 24 hours but remained within the normal range, suggesting transient postoperative changes ($p < 0.001$). Prothrombin time (PT) and INR increased significantly at 24 hours ($p < 0.001$), indicating mild coagulation alterations post-surgery but returning closer to baseline by 48 hours.

Discussion

Laparoscopic surgery has gained widespread acceptance due to its advantages, including reduced postoperative pain, shorter hospital stays, and faster recovery. However, concerns regarding its impact on hepatic function, particularly due to CO_2 pneumoperitoneum, persist. This study assessed hepatic biochemical markers before and after laparoscopic surgery to evaluate transient hepatic dysfunction.

Our study demonstrated a significant rise in liver enzymes, particularly ALT and AST, at 24 hours postoperatively, followed by a decline at 48 hours. ALT increased from 22.88±8.75 to 35.37±10.42 U/L at 24 hours ($p < 0.001$), while AST increased from 23.96±8.90 to 39.23±10.38 U/L ($p < 0.001$). This transient hepatic stress aligns with findings from previous studies. A study by Jain et al. [8] on laparoscopic cholecystectomy patients in India also reported significant postoperative increases in AST and ALT levels, peaking at 24 hours before normalizing within 48–72 hours. This elevation is hypothesized to result from hepatic ischemia due to CO_2 pneumoperitoneum-induced splanchnic hypoperfusion.

Similar findings have been observed in both Indian and international studies. A study conducted by Sharma et al. [9] in India reported a significant rise in AST and ALT levels following laparoscopic appendectomy and cholecystectomy, correlating with intra-abdominal pressure during surgery. Additionally, a study by Schmandra et al. [10] in Germany found that hepatic enzyme elevation was directly proportional to the duration and pressure of pneumoperitoneum, suggesting that reducing insufflation pressure might mitigate hepatic dysfunction.

The increase in total bilirubin (from 0.76±0.262 to 1.05±0.286 mg/dL, $p < 0.001$) and direct bilirubin (from 0.252±0.0962 to 0.37±0.111 mg/dL, $p < 0.001$) was significant in our study. This transient hyperbilirubinemia is consistent with findings from a study by Kim et al. [11], where bilirubin levels peaked postoperatively but normalized within 48 hours, suggesting temporary cholestasis due to surgical stress rather than permanent hepatic dysfunction.

A significant increase in prothrombin time (PT) and INR was noted at 24 hours postoperatively ($p < 0.001$). This suggests a mild but reversible hepatic synthetic dysfunction, which has been reported in previous studies [12]. A study by El-Labban et al. [13] indicated that PT prolongation post-laparoscopic surgery was mild and self-limiting, suggesting it is unlikely to impact clinical outcomes significantly.

Despite these transient biochemical changes, none of the patients in our study exhibited clinical signs of hepatic dysfunction such as jaundice or hepatic

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failure. This finding reinforces that laparoscopic surgery is safe for patients with normal hepatic function, with changes being self-limiting and not requiring additional interventions. However, in patients with pre-existing liver disease, close perioperative monitoring is essential to mitigate potential hepatic decompensation.

This study had a relatively small sample size, and hepatic function was not assessed beyond 48 hours postoperatively. Further studies with longer follow-up and larger cohorts are required to evaluate whether hepatic changes persist beyond this period.

Conclusion

Laparoscopic surgery induces transient hepatic biochemical alterations, particularly elevated AST, ALT, bilirubin, PT, and INR, most pronounced at 24 hours postoperatively and resolving within 48 hours. These findings are consistent with previous Indian and international studies, supporting the notion that laparoscopic surgery is safe for individuals with normal hepatic function. However, further research is warranted in patients with pre-existing liver disease to assess potential long-term effects.

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Conflict of Interest : None

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