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EFFECTS OF DIFFERENT INTRAPERITONEAL PRESSURE ON LIVER FUNCTION TESTS POST LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard for treating symptomatic cholelithiasis. However, pneumoperitoneum created during Laparoscopic cholecystectomy, particularly at higher intraperitoneal pressures, may temporarily alter hepatic perfusion, leading to transient elevations in liver function tests (LFTs). **Objective:** This study aimed to evaluate the effects of varying intraperitoneal pressures—low (10 mmHg), standard (12 mmHg), and high (14 mmHg)—on postoperative LFTs. **Methods:** A randomized controlled trial was conducted on 150 patients undergoing elective Laparoscopic Cholecystectomy, divided equally into three groups based on intraperitoneal pressure. Preoperative and postoperative LFTs, including total bilirubin, AST, ALT, and ALP, were measured on postoperative days 1 and 7. Statistical analyses were performed using ANOVA and post-hoc Tukey tests. **Results:** Postoperative day 1 showed a significant rise in LFTs, particularly in the high-pressure group. AST and ALT levels were significantly elevated in the High Pressure Laparoscopic Cholecystectomy (HPLC) group compared to Standard Pressure Laparoscopic Cholecystectomy (SPLC) and Low Pressure Laparoscopic Cholecystectomy ($p < 0.001$), while bilirubin and ALP also showed similar trends. By day 7, enzyme levels declined across all groups, though values in the HPLC group remained mildly elevated. No long-term hepatic dysfunction was observed. **Conclusion:** Higher intraperitoneal pressures during LC are associated with greater transient elevations in liver enzymes. Low-pressure pneumoperitoneum (10 mmHg) is a safer alternative with minimal hepatic stress, making it preferable, especially in patients with pre-existing liver conditions.

INTRODUCTION

Gall stone disease (cholelithiasis) remains one of the most common medical conditions leading to surgical intervention. Cholelithiasis continues to be a national and international health disorder. Asymptomatic gallstones can be managed expectantly but once gallstones become symptomatic, it becomes an indication for cholecystectomy.

Laparoscopic cholecystectomy is widely accepted as the treatment of choice for gallstone disease due to its minimally invasive nature. This technique has the advantages of a shorter hospital stay, an earlier return to normal activity, better cosmetic results, and lower rates of postoperative pain and complications than other techniques.

Pneumoperitoneum during laparoscopic cholecystectomy elevates the diaphragm, reducing lung compliance and impairing respiratory function. It also diminishes venous return to the heart, leading to a decrease in stroke volume and cardiac output. This reduction in cardiac output subsequently lowers renal, splanchnic, and hepatoportal blood flow, potentially affecting organ perfusion. Additionally, pneumoperitoneum contributes to venous stasis in the lower limbs, a condition further exacerbated by the reverse Trendelenburg position used during surgery.

By comparing varying insufflation pressures, we aimed to determine whether these biochemical changes are clinically significant. Additionally, this study seeks to help surgeons assess the impact of different intraperitoneal pressures on hepatoportal physiology and recommend optimal pressure settings wherever feasible. This approach aims to minimize hemodynamic variations while enhancing the already established benefits of laparoscopic surgery

MATERIALS AND METHODS

Study Design & Setting:

A prospective, randomized controlled trial conducted at a tertiary care center between August 2023 and February 2025.

Participants:

150 patients (aged 18–70) undergoing elective LC with normal baseline LFTs. Exclusion criteria included deranged LFTs, CBD stones, and refusal to consent.

Randomization:

Participants were randomly allocated into three groups:
LPLC (Low Pressure) – 10 mmHg
SPLC (Standard Pressure) – 12 mmHg
HPLC (High Pressure) – 14 mmHg

Surgical Procedure:

All surgeries followed a standardized protocol under general anesthesia. Pneumoperitoneum was created using CO_2 via Veress or Hasson technique. LFTs were measured preoperatively and on POD1 and POD7.

Data Analysis:

Statistical analysis was performed using SPSS. ANOVA and Tukey's post-hoc tests were used to compare groups. A p-value < 0.05 was considered significant.

RESULTS

Demographics:

Mean age: ~42 years. Female predominance (~82%). No significant differences in age, sex, comorbidities across groups.

Table: Age Distribution Among Patients Undergoing Laparoscopic Cholecystectomy with Different Intraperitoneal Pressures

Age Distribution (years)	HPLC Number(%)	SPLC Number(%)	LPLC Number (%)	p value
≤20	2(4)	4(8)	2(4)	0.196
21-30	8(16)	2(4)	9(18)	
31-40	14(28)	15(30)	8(16)	
41-50	13(26)	20(40)	23(46)	

51-60	8(16)	6(12)	3(6)	
>60	5(10)	3(6)	5(10)	
Mean±SD	42.48±13.36	41.40±11.67	41.80±11.87	

The p-value (0.196) indicates that the age distribution among the three groups does not show a statistically significant difference, suggesting that age was not a confounding factor in this study.

Table: Gender Distribution Among Patients Undergoing Laparoscopic Cholecystectomy with Different Intraperitoneal Pressures

Gender	HPLC	SPLC	LPLC	p value
	Number(%)	Number(%)	Number(%)	
Female	36(72)	43(86)	44(88)	0.102
Male	14(28)	7(14)	6(12)	

The p-value of 0.102 indicates no statistically significant difference in gender distribution among the three groups.

Table: Distribution Among Patients Undergoing Laparoscopic Cholecystectomy with Different Intraperitoneal Pressures on the Basis of Residence

Residence	HPLC	SPLC	LPLC	p value
	Number(%)	Number(%)	Number(%)	
Rural	41(82)	39(78)	44(88)	0.453
Urban	9(18)	11(22)	6(12)	

The p-value of 0.453 indicates no statistically significant difference in the residence distribution among the three groups

Table: Distribution of Patients Based on History of Hypertension Across Different Intraperitoneal Pressure Groups

h/o Hypertension	HPLC	SPLC	LPLC	p value
	Number(%)	Number(%)	Number(%)	
No	46(92)	47(94)	47(94)	0.898
Yes	4(8)	3(6)	3(6)	

The p-value of 0.898 indicates no statistically significant difference.

Table: Distribution of Patients Based on History of Diabetes Mellitus Across Different Intraperitoneal Pressure Groups

h/o DM	HPLC	SPLC	LPLC	p value
	Number(%)	Number(%)	Number(%)	
No	43(86)	48(96)	46(92)	0.238
Yes	7(14)	2(4)	4(8)	

The p-value of 0.238 suggests that there is no statistically significant difference

Liver Function Test Trends:

Bilirubin: POD1 elevation significant in HPLC (1.13 ± 0.33 mg/dL) vs SPLC (0.81 ± 0.16) and LPLC (0.68 ± 0.1); $p < 0.001$

Table: Total Bilirubin Levels Across Different Intraperitoneal Pressure Groups

Total Billrubin	HPLC	SPLC	LPLC	p value
	Mean±SD	Mean±SD	Mean±SD	
Preoperative	0.57±0.13	0.58±0.12	0.58±0.12	0.884
At Day 1	1.13±0.33	0.81±0.16	0.68±0.1	<0.001
At Day 7	0.67±0.17	0.59±0.13	0.61±0.12	0.021

AST: POD1 highest in HPLC (68.76 ± 16.37 U/L); SPLC (40.86 ± 9), LPLC (43.1 ± 7.05); $p < 0.001$

Table: Aspartate Aminotransferase Levels Across Different Intraperitoneal Pressure Groups

AST	HPLC	SPLC	LPLC	p value
	Mean±SD	Mean±SD	Mean±SD	
Preoperative	28.2±2.91	26.98±3.54	28.5±3.37	0.053
At Day 1	68.76±16.37	40.86±9	43.1±7.05	<0.001
At Day 7	32.14±8.46	26.1±2.87	28.66±3.51	<0.001

ALT: HPLC showed significant POD1 elevation (44.22 ± 10.73 U/L); SPLC (31.76 ± 8.98), LPLC (32.66 ± 9.21); $p < 0.001$

Table: Alanine Aminotransferase Levels Across Different Intraperitoneal Pressure Groups

ALT	HPLC	SPLC	LPLC	p value
	Mean±SD	Mean±SD	Mean±SD	
Preoperative	27.24±3.5	27.26±3.77	28.62±3.18	0.080
At Day 1	44.22±10.73	31.76±8.98	32.66±9.21	<0.001
At Day 7	34.46±8.91	28.5±6.59	27.48±3.59	<0.001

ALP: Modest increase noted on POD1 in HPLC (91.22 ± 7.05 U/L), statistically significant ($p = 0.025$)

Table: Alkaline Phosphatase Levels Across Different Intraperitoneal Pressure Groups

ALP	HPLC	SPLC	LPLC	p value
	Mean±SD	Mean±SD	Mean±SD	
Preoperative	80.82±12.14	82.9±8.71	82.28±9.54	0.581
At Day 1	91.22±7.05	86.12±11.07	88.52±9.25	0.025
At Day 7	86.64±13.35	82.6±13.65	83.32±8	0.200

All markers normalized or showed declining trends by POD7, except mild persistence in HPLC group.

DISCUSSION

Our findings align with previous literature reporting transient hepatic dysfunction post-LC, especially at higher pressures. The hemodynamic impact of increased intra-abdominal pressure includes reduced hepatic perfusion and transient enzyme elevation. The study confirms that low-pressure LC results in significantly lower hepatic stress without compromising surgical outcomes.

The use of 10 mmHg pressure demonstrates favorable hepatic profiles and should be considered in routine and high-risk liver cases.

CONCLUSION

Liver enzyme elevation following LC is pressure-dependent and reversible. Low-pressure pneumoperitoneum (10 mmHg) offers a safer profile in preserving hepatic function and minimizing postoperative enzyme elevation.

Conflict Of Interest

The authors declare no conflict of interest.

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Ethical Approval

Approved by the Institutional Ethics Committee of Sri Guru Ramdas Institute Of Medical Sciences And Research, Vallah, Amritsar. Informed consent obtained from all participants.

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