

Original Research Article

Comparison of pre-operative and post-operative liver function tests in patients undergoing laparoscopic cholecystectomy at different intra-peritoneal pressures

Zahida Akhter¹, Naveed Nabi^{1*}, Showkat M. Kakroo², Sharik Mehraj¹

¹Department of General Surgery, Sheri-Kashmir Institute of Medical Sciences Medical College and Hospital, Srinagar, Jammu and Kashmir, India

²Jammu and Kashmir Health Services, Jammu and Kashmir, India.

Received: 26 November 2022

Revised: 28 December 2022

Accepted: 04 January 2023

*Correspondence:

Dr. Naveed Nabi,

E-mail: drnaveednabi58@gmail.com

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ABSTRACT

Background: Establishing pneumoperitoneum is a pre-requisite for any laparoscopic procedure. However, its adverse effects are not uncommon. Increased intra-peritoneal pressure during laparoscopic cholecystectomy is expected to alter the liver function test (LFT) in immediate post-operative period, which may raise concerns in surgeons' mind regarding integrity of biliary tract. The aim of our study was to compare the post-operative LFT with pre-operative values in patients undergoing laparoscopic cholecystectomy at different pneumoperitoneal pressures and to assess its clinical significance.

Methods: It was a prospective observational study in which the enrolled patients were divided into 2 groups. Group 1 patients underwent laparoscopic cholecystectomy at 12 mm Hg pressure and group 2 underwent the surgery at 15 mmHg pressure. Pre-operative LFT was compared with post-operative LFT done 24 hours and 2 weeks after surgery.

Results: Among 73 included patients, 41 constituted group 1 and 32 were included in group 2. Statistically significant difference was observed in hepatic transaminases between pre-operative and post-operative (1st POD) values. Mean AST in group 1: 34.7 versus 51.4 U/l; in group 2, the values were 35.1 versus 50.9 U/l respectively. Mean ALT in group 1: 36.3 versus 50.1 U/l; in group 2, values were 32.9 versus 45.6 U/l respectively. However, the enzymes normalized in all patients in 2 weeks without any adverse clinical outcome.

Conclusions: Early post-operative transient elevation of hepatic transaminases after laparoscopic cholecystectomy is not associated with any adverse clinical outcome.

Keywords: Hepatic dysfunction, Laparoscopic cholecystectomy, Pneumoperitoneum, Safe pressures

INTRODUCTION

Laparoscopic cholecystectomy (LC) continues to be the gold standard treatment for symptomatic cholelithiasis, owing to its advantages over open approach in terms of less post-operative pain, hospital stay and earlier return to work.¹⁻³ Establishing pneumoperitoneum is a pre-requisite for any laparoscopic procedure. However, pneumoperitoneum induced adverse effects are not uncommon. Cardiovascular, respiratory and renal system

functions are adversely affected by increased intra-peritoneal pressure during a laparoscopic procedure.^{4,5} The extent of adverse events is directly related with duration and level of intra-abdominal pressure.⁶

Increased intra-peritoneal pressure during laparoscopic cholecystectomy decreases portal venous blood flow and is expected to alter the liver function test (LFT) in immediate post-operative period, which may raise genuine concerns in surgeons' mind regarding integrity

of biliary tract.^{7,8} In our study, we compared the post-operative LFT with pre-operative values in patients undergoing laparoscopic cholecystectomy at different pneumoperitoneal pressures and assessed its clinical significance to allay surgeons' fear.

METHODS

Study design

It was a prospective observational study conducted in the department of general and minimal access surgery, Sheri-Kashmir Institute of Medical Sciences Medical College Hospital Srinagar. The study was duly approved by our Institutional Ethical Committee.

Study period

The study was conducted over a period of 2 years from January 2020 up to December 2021.

Study population

A total of 73 patients were included in the study after taking written informed consent. All patients admitted for elective laparoscopic cholecystectomy were included in the study with exclusion of the following: patients less than 20 years of age, grossly abnormal pre-operative LFT, patients with major medical comorbidities like cardio-respiratory compromise or hepatic dysfunction, patients who had either frozen calot's triangle or lot of adhesions between gall bladder and surrounding structures, resulting in prolongation of intraoperative time beyond one hour.

Study method

All the study patients got admitted for elective laparoscopic cholecystectomy after proper pre-anesthesia evaluation and clearance. After admission informed consent was taken for inclusion in the study with due respect to patient's autonomy of decision. Pre-operative LFT was done on the day of admission. On the next day of admission, patients underwent standard 4-port laparoscopic cholecystectomy. Patients were randomly selected to be put in group 1 and group 2. Patients operated with intraperitoneal pressure of 12 mmHg were assigned group 1 and group 2 consisted of patients operated with pressure of 15 mmHg. For standardization, only those patients were included, who got operated by the same surgeon. Post-operative LFTs were done 24 hours after surgery and 2 weeks later (on follow up).

Statistical method

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as mean \pm standard deviation (SD) and categorical variables were

summarized as frequencies and percentages. For intergroup analysis of data, Student's independent t-test was employed. Intra-group analysis of data was carried by paired t-test. Chi-square test was applied for comparison of categorical variables. A p value of less than 0.05 was considered statistically significant.

RESULTS

A total of 73 patients were included in our study. More than half of patients in both groups (group 1- 58.6%; group 2- 59.4%) were aged between 30-49 years. In group 1, 80.5% and in group 2, 87.5% patients were females (Tables 1 and 2).

Table 1: Age distribution of study patients in two groups.

Age (years)	Group 1		Group 2		P value
	No.	%	No.	%	
20-29	8	19.5	4	12.5	0.231
30-39	12	29.3	9	28.1	
40-49	12	29.3	10	31.3	
50-59	6	14.6	6	18.8	
≥ 60	3	7.3	3	9.4	
Total	41	100	32	100	
Mean\pmSD (range)	38.1 \pm 11.35 (20-60)		41.4 \pm 11.85 (21-75)		

Group 1 (Intra-operative IAP=12 mmHg); Group 2 (Intra-operative IAP=15 mmHg)

Table 2: Gender distribution of study patients in two groups.

Gender	Group 1		Group 2		P value
	No.	%	No.	%	
Male	8	19.5	4	12.5	0.629
Female	33	80.5	28	87.5	
Total	41	100	32	100	

Mean preoperative and postoperative bilirubin in group 1 was 0.85 and 0.69 mg/dl respectively, and the difference was statistically significant (p value of 0.014). However, in group 2, this difference was found to be insignificant.

Mean preoperative and postoperative aspartate transaminase (AST) levels in group 1 were 34.7 and 51.4 U/l respectively. In group 2, the values were 35.1 and 50.9 U/l respectively. In both groups, the difference was statistically significant (p value of <0.001) (Tables 3 and 4).

In group 1, mean preoperative and postoperative alanine transaminase (ALT) levels were 36.3 and 50.1 U/l respectively. In group 2, the ALT values were 32.9 and 45.6 U/l respectively. In both groups, the difference between preoperative and postoperative value was statistically significant with a p value of <0.001 (Tables 3 and 4).

Table 3: Preoperative and postoperative liver function tests in group 1 (n=41).

Parameters	Preoperative		Postoperative		Mean difference	P value
	Mean	SD	Mean	SD		
Bilirubin	0.85	0.491	0.69	0.476	0.16	0.014*
AST	34.7	17.380	51.4	16.12	16.7	<0.001*
ALT	36.3	24.717	50.1	23.36	13.8	<0.001*
ALP	128.5	51.539	124.0	35.22	4.5	0.562
ALB	4.6	0.337	3.65	0.384	0.95	<0.001*

*Statistically significant difference (p value<0.05); p value by Paired t-test

Table 4: Preoperative and postoperative liver function tests in group 2 (n=32).

Parameter	Preoperative		Postoperative		Mean difference	P value
	Mean	SD	Mean	SD		
Bilirubin	0.82	0.365	0.75	0.428	0.07	0.121
AST	35.1	24.59	50.9	28.16	15.8	<0.001*
ALT	32.9	21.93	45.6	17.67	12.7	0.0005*
ALP	127.0	50.34	116.5	37.01	10.5	0.135
ALB	4.8	0.289	3.8	0.301	1.0	<0.001*

*Statistically significant difference (p value<0.05); p value by Paired t-test

Table 5: Difference between two groups in terms of changes between postoperative and preoperative liver functions tests.

Parameter	Group 1		Group 2		P value
	Mean	SD	Mean	SD	
Bilirubin	0.33	0.253	0.23	0.118	0.136
AST	18.2	12.95	19.4	9.78	0.682
ALT	17.4	11.94	18.6	12.16	0.677
ALP	34.1	36.33	33.2	22.07	0.901
ALB	0.95	0.259	0.94	0.253	0.862

P value by Student's independent t-test

Similarly, mean preoperative and postoperative albumin levels were 4.6 and 3.6 g/dl respectively in group 1 and in group 2, the mean values were 4.8 and 3.8 respectively. The difference in both groups was again found to be statistically significant (Tables 3 and 4).

The differences between two groups in terms of change in liver function tests were compared using student's independent t-test and the differences were found to be statistically insignificant.

Postoperatively on follow up after 2 weeks, ALT and AST levels returned close to pre-operative values in majority of the patients.

DISCUSSION

Our study endorsed the available literature about cholelithiasis being 3-4 times more common in females.⁹ Estrogenic effect causes cholesterol super-saturation of bile which increases the risk of gallstones in females.

In our study, we observed statistically significant elevation of liver enzymes (AST and ALT) after laparoscopic cholecystectomy. The observation of

postoperative elevation in liver enzymes after laparoscopic cholecystectomy was first reported in the literature by Halevy et al who demonstrated an increase of up to 80% from the baseline level of LFTs, without adverse clinical outcome.¹⁰ Morino et al also studied pneumoperitoneum induced alteration in liver function tests after laparoscopic surgeries and the magnitude of alteration correlated with the level and duration of pneumoperitoneum.¹¹

The postoperative elevation of both ALT and AST is possibly caused by hepatocellular injury, which is contributed mostly by the reduction in hepatic blood flow due to an increase in intra-abdominal pressure.¹²⁻¹⁵ Pneumoperitoneum decreases portal venous inflow, causing liver hypo-perfusion and inadequate oxygen supply, resulting in hepatocellular injury.¹⁶ Moreover, carbon dioxide being used to establish pneumoperitoneum has a vasoconstrictive effect, which can reduce visceral blood flow.⁷ Also, the anaesthetic procedures and drugs like halothane and nitrous oxide used can induce hepatic toxic injury.¹⁷⁻¹⁹

Our study showed no significant difference with respect to change in LFT between group 1 (intraperitoneal

pressure =12 mmHg) and group 2 (intraperitoneal pressure =15 mmHg). However, some studies have claimed superiority of low-pressure pneumoperitoneum (10 mmHg versus 14 mm Hg) in laparoscopic cholecystectomy.²⁰

The limitations of our study include a smaller sample size which may preclude application of final results over a much larger cohort of patients, of which our study patients constituted a small sample; and exclusion of patients with hepatic dysfunction, because such patients may be adversely affected by post-operative worsening of LFT after laparoscopic cholecystectomy.

CONCLUSION

Our present study concluded that early post-operative transient elevation of hepatic transaminases after laparoscopic cholecystectomy is not associated with any adverse clinical outcome. In majority of patients, it has returned to pre-operative values at 2 weeks follow up. Obtaining a routine post-operative LFT after laparoscopic cholecystectomy is not advisable, unless indicated in selected cases.

Pneumoperitoneum ranging from 12-15 mmHg can be safely employed to perform a safe cholecystectomy. Use of low pneumoperitoneal pressures at the cost of a safe surgical field can prove catastrophic and, may not be advocated. However, laparoscopic cholecystectomy may not be a procedure of choice in patients with pre-existing hepatic dysfunction.

Further studies having larger sample sizes are required to reinforce our conclusion and to determine the optimum intra-peritoneal pressures to perform a safe laparoscopic cholecystectomy and also to evaluate the feasibility of using laparoscopy in patients with significant hepatic dysfunction.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Akhter Z, Nabi N, Kakroo SM, Mehraj S. Comparison of pre-operative and post-operative liver function tests in patients undergoing laparoscopic cholecystectomy at different intra-peritoneal pressures. *Int J Res Med Sci* 2023;11:595-9.