European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 03, 2022

ORIGINAL RESEARCH

An Observational Study of the Effect of Laparoscopic Cholecystectomy on Liver Function Test

[1]Hari Om Dhaker, [2]Shyam Bhutra, [3]Yogendra Singh Chundawat, [4]Naresh Kumar, [5]Nani Dhaker, [6]Saranshi Singh

[1,3,4]Resident (IIIrd Year), Department of General Surgery, JLN Medical College, Ajmer, Rajasthan, India
[2]Senior Professor and Unit Head, Department of General Surgery, JLN Medical College, Ajmer, Rajasthan, India
[5]MBBS, RNT Medical College, Udaipur, Rajasthan, India
[6]MBBS, JLN Medical College, Ajmer, Rajasthan, India

Correspondence:
Naresh Kumar
Resident, Department of General Surgery, JLN Medical College, Ajmer, Rajasthan, India
Email: ghumawat1990@gmail.com

ABSTRACT

Background: Cholecystectomy is a common treatment of symptomatic gallstones and other gallbladder conditions. As it gained worldwide popularity, it has become one of the most common operations performed in general surgical practice. In this study we aimed to investigate to determine changes in liver function tests after laparoscopic cholecystectomy.

Material & Methods: A prospective observational study done on 100 patients who underwent elective laparoscopic cholecystectomy were taken up for the study in the department of General surgery at JLN medical college and hospital, Ajmer, Rajasthan, India during period between January 2020 to December 2021. All patients who gave consent for the study underwent a standard clinical and laboratory evaluation including USG. Pre-operative investigations included liver function tests i.e. prothrombin time, bilirubin (total and direct), alanine transaminase, aspartate transaminase, alkaline phosphatase, total proteins, serum albumin, GGT, and LDH. The subjects under inclusion criteria have taken up for the study. The liver function tests have repeated 24 hours, 3rd day, 7th days, 10th days after the operation and compared.

Result: The mean age of the study population was 43.3 years with a standard deviation of 13.35 yrs. A negative t-STAT shows that the value of serum total protein, serum albumin was falling after the laparoscopic procedure. A statistically significant increase in the bilirubin(total and direct), SGOT, SGPT, GGT, LDH, and serum alkaline phosphatase levels were noted after laparoscopic cholecystectomy and no statistical significance in prothrombin time.

Conclusion: We concluded that statistically significant increase in the bilirubin (total and direct), SGOT, SGPT, GGT, LDH, and serum alkaline phosphatase levels after Laparoscopic cholecystectomy. There was a decrease in total protein and albumin and no change for prothrombin time. However, further studies with larger sample sizes and multi-center trials would yield more definite results, along with meta-analyses. We strongly suggest the consideration of confounding factors such ascomorbidities, duration of surgery, CO2 pressure, utilized anesthetic agents, and also longer period follow-ups.

Keywords: Laparoscopic Cholecystectomy, Liver function test, Gall stone, SGOT, SGPT, GGT, LDH, and serum alkaline phosphatase levels.

INTRODUCTION

Cholecystectomy is a common treatment of symptomatic gallstones and other gallbladder conditions[1]. In 1882 Carl Langenbuch performed the first open cholecystectomy for gallstone disease. In 1985laparoscopic cholecystectomy was first performed by Eric Muhe in Boblingen, Germany, and in 1987 Philippe Mouret in Lyon. France. Since the introduction of laparoscopic cholecystectomy into general practice in 1990, it has rapidly become the dominant procedure for gallbladder surgery.

By the end of the decade, laparoscopic cholecystectomy had spread throughout the world. The importance of laparoscopic cholecystectomy was the cultural change it engendered rather than the operation it replaced. In terms of technique, laparoscopic cholecystectomy is now the gold standard for the treatment of symptomatic gallstone disease.

Approximately 20 million people in the United States have gallstones. Of these people, there are approximately 300,000 cholecystectomies performed annually. Ten percent to 15% of the population has asymptomatic gallstones. Of these, 20% are symptomatic (biliary colic). Of the 20% who are symptomatic approximately 1% to 4% will manifest complications (acute cholecystitis, gallstone pancreatitis, choledocholithiasis, gallstone ileus)[2]. The incidence of gallstones increases with an increase in age, with females more likely to form gallstones than males. Age 50 to 65 approximately 20% of women and 5% of men have gallstones. Overall, 75% of gallstones are composed of cholesterol, and the other 25% are pigmented[3].

The best diagnostic test for diagnosing gallstones and subsequent acute cholecystitis is a right upper quadrant abdominal ultrasound. If there is a suspected stone in the common bile duct based on ultrasound results, magnetic resonance cholangiopancreatography (MRCP) is the next step. If a common duct stone is identified on the MRCP, then the gold-standard test of an endoscopic retrograde cholangiopancreatogram (ERCP) should be performed by a gastroenterologist. A percutaneous transhepatic cholangiogram (PTHC) is also useful in diagnosing common bile duct stones if an ERCP is not possible[4].

As it gained worldwide popularity, it has become one of the most common operations performed in general surgical practice. Although LC offered many advantages over laparotomy, new concerns arose regarding the effects of a pneumoperitoneum on the cardiovascular and respiratory system.[5] One of the important hemodynamic changes is the transient reduction in hepatic blood flow caused by a pneumoperitoneum.[6-9] The pressure of a created pneumoperitoneum and its duration was shown to influence the degree of hepatic ischemia by causing elevations in liver enzymes.[10,11] In this study we aimed to determine the changes in liver function tests after laparoscopic cholecystectomy.

MATERIAL & METHODS

A prospective observational study done on 100 patients who underwent elective laparoscopic cholecystectomy were taken up for the study in the department of General surgery at JLN medical college and hospital, Ajmer, Rajasthan, India during period between January 2020 to December 2021. Those patients who fulfilled selection criteria have explained about the nature of the study and written informed consent obtain before the enrolment.

INCLUSION CRITERIA

Patients aged 15 years to 70 years with symptomatic gall stone disease undergoing laparoscopic cholecystectomy.

EXCLUSION CRITERIA

1. Patients refuse for laparoscopic cholecystectomy.
2. Suspected malignant gall bladder diseases and hepatobiliary malignancy.
3. Patient medically unfit for laparoscopic cholecystectomy.
4. Patients with concomitant bile duct stone.
5. High levels of enzymes before operation.
6. In whom complications such as bile duct injury or bleeding from the liver bed were observed or converted to open cholecystectomy.
7. Patients with co-morbidities such as diabetes mellitus and or positive serology for hepatitis B or C viruses.

STUDY PROCEDURE

All patients who gave consent for the study underwent a standard clinical and laboratory evaluation including USG. Pre-operative investigations included liver function tests i.e. prothrombin time, bilirubin (total and direct), alanine transaminase, aspartate transaminase, alkaline phosphatase, total proteins, serum albumin, GGT, and LDH. The subjects under inclusion criteria have taken up for the study. The liver function tests have repeated 24 hours, 3rd day, 7th days, 10th days after the operation and compared.

STATISTICAL ANALYSIS

Paired student t-test has been applied to all liver function tests parameter to measure the significant change in liver function. Appropriate statistical analyses have also been applied for comparing the incidences of adverse events and other complications.

RESULTS

Our study showed that out of 100 patients, 24% were male and 76% were females. Most of the patients were in the age group of 31-40yrs around 30% and 23% of patients were in the 41-50 yrs age group. The mean age of the study population was 43.3 years with a standard deviation of 13.35 yrs (table 1).

Table 1: Distribution of patients according to gender & age group wise

Gender	Age group (yrs)						Total
	<20 yrs	21-30 yrs	31-40 yrs	41-50 yrs	51-60 yrs	>60 yrs	
Male	0	1	9	7	4	3	24
Female	2	16	21	16	14	7	76
Total	2	17	30	23	18	10	100

The present study showed that there is a slight mean difference of prothrombin time was 0.1 sec with a p-value of >0.05 which shows that this difference was statistically insignificant. A negative t-STAT shows that the value of serum total protein, serum albumin was falling after the laparoscopic procedure. The mean value of serum total protein came to a statistically normal range on day 7th& 3rd day respectively after laparoscopic cholecystectomy (table 2).

Table 2: Liver function test in pre-operative and post-operative in different time interval

Liver function test	PRE-OP	Post Op In 24 Hrs		Post Op In 3rd Day		Post Op In 7th Day		Post Op In 10th Day	
		Mean±Sd	P-value	Mean±Sd	P-value	Mean±Sd	P-value	Mean±Sd	P-value
Prothrombin Time (sec.)	13.27 ± 1.07	13.37 ± 1.29	0.23	13.29 ± 1.23	0.45	13.29 ± 1.08	0.45	13.30 ± 1.12	0.40
S. Total protein	6.86 ± 0.61	6.23 ± 0.58	<0.001	6.51 ± 0.58	<0.001	6.86 ± 0.58	0.482	6.91 ± 0.55	0.056

(gm/dl)									
S. albumin (gm/dl)	4.28 ± 0.38	3.92 ± 0.34	<0.001	4.26 ± 0.30	0.356	4.24 ± 0.32	0.117	4.33 ± 0.31	0.062
S. Total Bilirubin (mg/dl)	0.66 ± 0.29	0.82 ± 0.38	<0.001	0.70 ± 0.31	0.002	0.62 ± 0.30	0.001	0.61 ± 0.28	<0.001
S. Direct Bilirubin (mg/dl)	0.22 ± 0.09	0.28 ± 0.13	<0.001	0.24 ± 0.11	0.001	0.21 ± 0.10	0.132	0.20 ± 0.09	<0.001
SGOT (IU/L)	33.66 ± 9.73	54.76 ± 10.69	<0.001	41.10 ± 9.66	<0.001	33.28 ± 8.60	0.048	33.87 ± 9.02	0.162
SGPT (IU/L)	27.21 ± 8.72	45.63 ± 12.81	<0.001	38.04 ± 7.76	<0.001	29.28 ± 7.66	0.011	26.49 ± 8.66	0.168
Serum GGT (IU/L)	23.11 ± 8.46	29.69 ± 9.76	<0.001	27.34 ± 8.14	<0.001	23.60 ± 7.41	0.028	23.72 ± 7.28	0.002
Serum LDH (IU/L)	368.1± 70.6	435.3 ± 91.7	<0.001	383.6 ± 70.6	0.010	390.9 ± 76.2	<0.001	360.3 ± 66.9	0.110
S. Alkaline Phosphate (U/L)	101.46 ± 23.72	122.33 ± 26.67	<0.001	96.40 ± 20.59	0.001	104.94 ± 26.70	0.031	98.68 ± 22.24	0.060

A positive t-STAT shows that the value of serum total bilirubin and direct bilirubin was increased after the laparoscopic procedure. The mean value of serum total bilirubin came to a statistically normal range between the 3rd and 7th days after laparoscopic surgery. The mean value of serum direct bilirubin came to a statistically normal range on the 7th day after laparoscopic surgery (table 2).

A positive t-STAT shows that the value of SGOT & SGPT was increased (71.02% & 67.69% respectively) after the laparoscopic procedure. The mean value of SGOT and SGPT was came to a statistically normal range in between the 7to 10th day after laparoscopic surgery (table 2).

A positive t-STAT shows that the value of serum GGT, serum LDH & serum alkaline phosphate was increased (28.47%, 18.2% & 20.55% respectively) after the laparoscopic procedure. The mean value of serum LDH & serum Alk. phosphate came to a statistically normal range on the 10th day after laparoscopic surgery (table 2).

DISCUSSION

Many hospitals now provide lap cholecystectomy as a day-care treatment, with patients being discharged within 24 hours. In the current study, we found that the mean age of the study participants was 43.3yrs, with an overwhelming majority being females (76%) and the rest were males (24%). Several studies measuring the prevalence of the disease or relating to surgical procedures for cholelithiasis have reported similar figures[12].Astudy in Taiwan also found a higher incidence of cholelithiasis in females[13]. This is expected, as several studies have shown the female gender to be a risk factor for the development of gallstones[14]. The majority of the patients who underwent surgery were in the age group of 31-40 years in both sexes. The second highest was seen in the age group of 41-50 years. These two groups constituted 53% of the cases. Showing that the disease incidence increased after the age of 30 years.

The prothrombin times of patients when analyzed showed that the results were not uniform for all patients. While some showed an elevation in prothrombin time, there were a few who had decreased prothrombin time after surgery showing hypercoagulability. The mean of the prothrombin time before surgery and after 24hrs,3rd day,7th day, and 10th day was 13.27 sec, 13.37 sec, 13.29sec,13.29sec, and 13.30 sec respectively with SD of 1.07 sec, 1.29

sec,1.23sec, 1.08 sec, and 1.12sec respectively. These values when charted showed that the increase in the mean was statistically insignificant (p-0.23). Hence the prothrombin time can be considered to stay unchanged. The study goes in line with the study done by Pankaj Kumar Garg et al in 2008 at Maulana Azad medical college who also supported that there was no change in prothrombin time[15].

The total protein of patients when analyzed showed that the results were not uniform for all patients. The mean of the total protein before surgery and after 24hrs,3rd day,7th day, and 10th day was 6.86gm/dl,6.23 gm/dl, 6.51gm/dl, 6.86 gm/dl, and 6.91 gm/dl respectively with SD of 0.61, 0.58, 0.58, 0.58 and 0.55 respectively. These values when charted showed that the decrease in the mean was statistically significant (p-<0.05). Hence the total protein can be considered to decrease after surgery and came to statistically normal on day 7th after surgery.

The serum albumin of patients when analyzed showed that the results were not uniform for all patients. The mean of the total protein before surgery and after 24hrs,3rd day,7th day, and 10th day was 4.28 gm/dl, 3.92 gm/dl, 4.26 gm/dl, 4.24 gm/dl, and 4.33 gm/dl respectively with SD of 0.38, 0.34, 0.30, 0.32 and 0.31 respectively. Hence the serum albumin can be considered to decrease after surgery and came to statistically normal on 3rd day after surgery. Our results goes in line with another study done by Anil Kumar bellad et al (2013)[16] and Hans Barle et al (2004)[17] which shows similar results.

In a study by Guven et al liver enzymes, as well as LDH, was investigated in two groups of patients who had undergone laparoscopic and open cholecystectomy. According to their results, AST, ALT, and LDH (but not ALP) was significantly increased following laparoscopic cholecystectomy[18]. Our study also demonstrated similar results for AST, ALT, LDHexcept for ALP.

Hasukic et al[19]. showed that 48-hour post-intervention levels of AST and ALT were significantly higher in patients undergoing laparoscopic cholecystectomy in comparison to open surgery. However, they mentioned that LDH and ALP were remained unchanged after 48 Hrs.Our study also demonstrated similar elevations in AST and ALT but we also notice changes in ALP and LDH.

Considering another similar study by Halevy et al[20], it has been shown that after laparoscopic cholecystectomy, AST, ALT, ALP, and bilirubin levels were increased by 73%, 82%, 53%, and 14%, respectively. Our study also demonstrated similar elevations in AST, ALT, ALP, and total bilirubin which was goes in line with their study.

AnilkumarBellad et al[16], showed that there was a significant increase in bilirubin (total), AST, ALT, ALP, and decrease of serum albumin and total proteins after doing laparoscopic cholecystectomy when compared to normal values. The study was done by them also supported our results.

Seyed Adel Maleknia et al[21] also showed that there was no significant difference was found in the serum levels of ALP in post-op 1 and 2 when compared both to each other and to the baseline. Regarding AST and ALT, there was a significant increase in post-op 1 and 2 compared to their baseline values. Compared to baseline levels, LDH had a significant increase after post-op 2; but not after post-op 1. Moreover, total bilirubin levels showed significant increases at post-op 1 and post-op 2 from the baseline and also in comparison with each other. The study was done by them also supported our finding of total bilirubin, ALP, ALT, AST, and LDH.

Nasir Zaheer Ahmad et al[22] also showed that Alterations in the serum AST, ALT, and GGT were seen on the first postoperative day. Minor changes were seen in bilirubin and ALP. An overall disturbance in the LFTs was seen in more than two-thirds of the cases. Repeat LFTs performed after 3 weeks on follow-up were found to be within normal limits. Our finding is also in line with their finding of AST, ALT, GGT, bilirubin, and ALP.

Their results were almost in line with our results, except for ALP levels and PT and the duration of follow-up. In our study, there was a trend toward normal values for direct bilirubin, AST, ALT, ALP, LDH, and GGT in between 7to 10th day after surgery and total bilirubin and albumin at 3rd day.

Most of the patients were discharged around postoperative day 3rd. No patient developed any complications. This signifies that the alterations in liver enzymes were temporary and without complications.

Disturbances in liver enzymes after laparoscopic cholecystectomy were first studied by Halevy et al[20] in 1994. The possible explanations included increased intra-abdominal pressure, squeeze pressure effect on the liver, excessive use of diathermy, pulling on the gallbladder, or passage of micro-calculi into the bile duct. However, many studies have shown that changes in liver enzymes, bilirubin, and LDH are commonly expected after laparoscopic surgeries with different etiologies being hypothesized.

More work was performed to evaluate the causes of this alteration after laparoscopic procedures, and it was found that low pneumoperitoneum pressure was associated with fewer adverse effects on liver function[9]. The pneumoperitoneum pressure used for laparoscopic cholecystectomy is higher than the pressure in the portal venous system. This pressure impedes portal circulation and reduces portal flow up to 50%, which may cause depression of the hepatic reticular endothelial system[23] this observation explains why the change in liver function test.

CONCLUSION

We concluded that there was a statistically significant increase in the bilirubin(total and direct), SGOT, SGPT, GGT, LDH, and serum alkaline phosphatase levels after laparoscopic cholecystectomy. There was a decrease in total protein and albumin and no change for prothrombin time. However, further studies with larger sample sizes and multi-center trials would yield more definite results, along with meta-analyses. We strongly suggest the consideration of confounding factors such ascomorbidities, duration of surgery, CO2 pressure, utilized anesthetic agents, and also longer period follow-ups.

REFERENCES

1. Abraham S, Rivero HG, Erlikh IV, Griffith LF, Kondamudi VK. Surgical and nonsurgical management of gallstones. Am Fam Physician. 2014 May 15;89(10):795-802.
2. Blythe J, Herrmann E, Faust D, Falk S, Edwards-Lehr T, Stockhausen F, Hanisch E, Buia A. Acute cholecystitis - a cohort study in a real-world clinical setting (REWO study, NCT02796443). PragmatObs Res. 2018; 9:69-75.
3. Kose SH, Grice K, Orsi WD, Ballal M, Coolen MJL. Metagenomics of pigmented and cholesterol gallstones: the putative role of bacteria. Sci Rep. 2018 Jul 25;8(1):11218.
4. Hiwatashi K, Okumura H, Setoyama T, Ando K, Ogura Y, Aridome K, Maenohara S, Natsugoe S. Evaluation of laparoscopic cholecystectomy using indocyanine green cholangiography including cholecystitis: A retrospective study. Medicine (Baltimore). 2018 Jul;97(30):e11654.
5. Odeberg-Wernerman S. Laparoscopic surgery - effects on circulatory and respiratory physiology: an overview. Eur J SurgSuppl2000;585:4-11.
6. Saber AA, Laraja RD, Nalbandian HI, Pablos-Mendez A, Hanna K. Changes in liver function tests after laparoscopic cholecystectomy: not so rare, not always ominous. Am Surg2000;66:699-702.
7. Morino M, Giraudo G, Festa V. Alterations in hepatic function during laparoscopic surgery. An experimental clinical study. SurgEndosc1998;12:968-972.

8. Sakorafas G, Anagnostopoulos G, Stafyla V, et al. Elevation of serum liver enzymes after laparoscopic cholecystectomy. N Z Med J 2005;118:U1317.
9. Hasukic S, Kosuta D, Muminhodzic K. Comparison of postoperative hepatic function between laparoscopic and open cholecystectomy. Med PrincPract 2005;14(3):147-150.
10. Hasukic S. Postoperative changes in liver function tests: randomized comparison of low and high-pressure laparoscopic cholecystectomy. SurgEndosc2005;19:1451-1455.
11. Giraudo G, BrachetContul R, Caccetta M, Morino M. Gasless laparoscopy could avoid alterations in hepatic function. SurgEndosc2001;15:741-746.
12. Naeem M, Rahimnajjad NA, Rahimnajjad MK, et al.: Assessment of characteristics of patients with cholelithiasis from economically deprived rural Karachi, Pakistan. BMC Res Notes. 2012, 5:334.
13. Hung SC, Liao KF, Lai SW, Li CI, Chen WC: Risk factors associated with symptomatic cholelithiasis in Taiwan: a population-based study. BMC Gastroenterol. 2011, 11:111.
14. Zamani F, Sohrabi M, Alipour A, et al.: Prevalence and risk factors of cholelithiasis in Amol city, Northern Iran: a population-based study. Arch Iran Med. 2014, 17:750-754.
15. Garg, P. K., Teckchandani, N., Hadke, N. S., Chander, J., Nigam, S., & Puri, S. K. Alteration in coagulation profile and incidence of DVT in laparoscopic cholecystectomy. International journal of surgery (London, England),2009; 7(2):130–35.
16. Bellad A, Sahu K. An observational study on effect of carbon dioxide pneumoperitoneum on liver function test in laparoscopic cholecystectomy. Int Surg J 2019; 6:2751-6.
17. Barle, H., Hållström, L., Essèn, P., Thörne, A., McNurlan, M. A., Garlick, P. J., &Wernerman, J. The synthesis rate of albumin decreases during laparoscopic surgery. Clinical physiology and functional imaging,2004; 24(2): 91–95.
18. Güven, Erhan & Oral, Suleyman. Liver Enzyme Alterations after Laparoscopic Cholecystectomy. Journal of gastrointestinal and liver diseases: JGLD. 2004;16:391-4.
19. Hasukic S, Kosuta D, Muminhodzic K. Comparison of postoperative hepatic function between laparoscopic and open cholecystectomy. Medical Principles and Practice. 2005;14(3):147–150.
20. Halevy, A., Gold-Deutch, R., Negri, M., Lin, G., Shlamkovich, N., Evans, S., Cotariu, D., Scapa, E., Bahar, M., &Sackier, J. M. Are elevated liver enzymes and bilirubin levels significant after laparoscopic cholecystectomy in the absence of bile duct injury?. Annals of surgery,1994; 219(4): 362–36.
21. Maleknia, S. A., & Ebrahimi, N. Evaluation of Liver Function Tests and Serum Bilirubin Levels After Laparoscopic Cholecystectomy. Medical archives (Sarajevo, Bosnia and Herzegovina),2020;74(1):24–27.
22. Ahmad N. Z. Routine testing of liver function before and after elective laparoscopic cholecystectomy: is it necessary?. JSLS: Journal of the Society of Laparoendoscopic Surgeons,2011;15(1):65–69.
23. Jakimowicz J, Stultiens G, Smulders F. Laparoscopic insufflation of the abdomen reduces portal venous flow. SurgEndosc. 1998;12(2):129-132.