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Original Research Article

Liver function and serum amylase alterations following laparoscopic and open cholecystectomy and its significance

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ABSTRACT

Background: Gall stone disease is the commonest gastro intestinal disease requiring surgical intervention, laparoscopic cholecystectomy (LC) which has replaced open cholecystectomy (OC). LC has more advantages over OC but has few drawback such as CO_2 pneumoperitoneum leading to altered liver functions. The study was done with the aim to compare liver function tests in patients undergoing LC & OC and to compare these values in two groups preoperatively and postoperatively at 24 hrs, 48 hrs, 72 hrs.
Methods: A total of 151 patients were admitted with cholelithiasis, out of which 72 patients underwent surgery between January 2018 to January 2019. Patients were selected by block randomization method into 2 groups containing 28 in each (Group 1- OC and Group 2- LC). SGPT, SGOT, LDH, TB, DB, IB, ALP and S. amylase were studied pre-operatively and at intervals of 24 hrs, 48 hrs, 72 hrs postoperatively. Comparison was made between both groups.
Results: Pre and postoperatively stage, the level of LFT in Group 1 and Group 2 were similar except IB, which was significantly high in Group 1. At 24 hrs the difference in TB, DB, SGPT and S. amylase were statistically significant ($p<0.05$) between the groups. At 48 hrs difference between Group 1 and Group 2 in TB, DB, SGOT and SGPT were statistically significant ($p<0.05$). At 72 hrs difference between Group 1 and Group 2 in only SGPT was statistically significant ($p<0.05$).
Conclusions: Cholecystectomy (OC and LC) lead to transient but reversible significant hepatic enzymes alterations. These alterations are self limited and return to reference values within 10 days of operation. The cause of alteration might be liver tractions, electrocoagulation's and manipulation of duct.

Keywords: Cholecystectomy, Liver enzymes, Serum amylase

INTRODUCTION

Gall stone disease is one of the commonest gastrointestinal tract diseases requiring surgical interventions. Today laparoscopic cholecystectomy (LC) has replaced the traditional open cholecystectomy (OC), and LC has become the gold standard for management of gall stone disease.[1,2]

Besides having many advantages LC has a few drawbacks mainly due to CO_2 pneumoperitoneum. Trials show that CO_2 pneumoperitoneum leads to compromised intra-abdominal blood flow which causes reduction in portal venous and, hepatic artery flow and altered liver function transaminases.[3-5]

CO_2 pneumoperitoneum has physiological effects, due to CO_2 absorption and chemo-dynamic effects caused by

increased intra-abdominal pressure.[6] Studies have shown that, during laparoscopic procedures, both the duration and level of intra-abdominal pressure are responsible for changes in liver function. Symptoms due to these changes usually do not occur in patients with preserved hepatic function. But patients with severe liver insufficiency should not be subjected to LC.[7]

The preoperative and postoperative levels of various liver enzymes was investigated in many studies and significant elevations after LC over OC is defined only for AST, ALT, ALP and LDH levels. The current study was aimed to investigate bio chemical parameters of liver function including bilirubin and serum amylase.

METHODS

This prospective study was done between January 2018 to January 2019 on patients of cholelithiasis undergoing LC or OC at DNB Department, Surgery, K. K. Hospital, Lucknow, U.P, India. After getting informed consent from the patients and approval from Institutional Ethics Committee, patients diagnosed with cholelithiasis, of age more than 18 years were included in the study.

A total of 151 patients of cholelithiasis were admitted, out of which 79 excluded due to exclusion criteria. Eligible were 72 patients. Sample size was calculated keeping alpha at 0.05 with 80% power. 22 subjects were required in each group. The power was increased to 90% with 0.05 alpha the required sample size was 28 in each group. 28 for each group were selected randomly by block randomization method. Total 14 blocks (size 4 each) were randomly chosen to determine the assignment of all 56 participants. This procedure resulted in 28 participants in both the groups. One group of patients underwent OC (Group 1) and other group was operated by LC (Group 2).

Complete serum biochemical parameters that include SGOT, SGPT, LDH, total bilirubin, direct bilirubin, indirect Bilirubin, ALP and serum amylase were analysed preoperatively and postoperatively at different time intervals (24 hrs, 48 hrs and 72 hrs).

Data collected was analyzed using Chi square and paired t-test and enzyme levels were calculated as mean ± SD for both groups pre and postoperatively. P values less than 0.05 was considered statistically significant.

RESULTS

A total of 56 patients were included in the study and were divided into two groups based on type of surgery performed. Group-I included 28 patients that underwent OC and Group-II included 28 patients who underwent LC. No postoperative morbidity and mortality was seen in the patients. Table 1 present the comparison of serum enzyme levels pre and postoperatively at different time intervals after OC and LC.

Preoperatively the levels of serum enzyme levels in Group 1 and 2 were similar except indirect bilirubin (IB) and this difference was significantly high in Group 1 when compared to Group 2. Mean difference in the values of total bilirubin (TB), direct bilirubin (DB), SGPT and serum amylase at the interval of 24 hours were statistically significant ($p<0.05$) between the two groups. The difference in indirect bilirubin, SGOT, ALP and LDH of Group 1 and Group 2 was found to be statistically insignificant ($p>0.05$).

Table 1: Comparison of serum enzyme levels pre and postoperatively after OC and LC.

	Group 1 (n=28)		Group 2 (n=28)		Statistical significance	
	Mean	**SD**	**Mean**	**SD**	**'t'**	**p**
Preoperatively						
Total bilirubin (mg/dl)	0.83	0.10	0.78	0.13	1.337	0.187
Direct bilirubin (mg/dl)	0.32	0.08	0.34	0.09	-1.158	0.252
Indirect bilirubin (mg/dl)	0.51	0.08	0.44	0.10	2.744	0.008
SGPT (IU/litre)	27.32	9.84	26.64	8.19	0.281	0.780
SGOT (IU/litre)	29.00	10.24	26.36	6.73	1.141	0.259
ALP (IU/litre)	143.82	63.30	130.11	57.28	0.850	0.399
LDH (IU/litre)	307.29	105.30	300.39	38.43	0.325	0.746
S. amylase (IU/l)	37.29	14.87	38.89	7.30	-0.513	0.610
At 24 hours postoperatively						
Total bilirubin (mg/dl)	0.82	0.12	0.98	0.26	-3.064	0.003
Direct bilirubin (mg/dl)	0.30	0.06	0.42	0.15	-3.864	<0.001
Indirect bilirubin (mg/dl)	0.52	0.07	0.57	0.23	-1.021	0.312
SGPT (IU/litre)	33.86	10.19	42.07	10.19	-3.017	0.004
SGOT (IU/litre)	38.46	15.10	41.57	7.68	-0.971	0.336
ALP (IU/litre)	147.36	67.22	127.18	59.21	1.192	0.238
LDH (IU/litre)	312.71	83.39	302.61	46.10	0.561	0.577
S. amylase (IU/l)	28.89	12.15	34.89	9.28	-2.007	0.043

Continued.

	Group 1 (n=28)		Group 2 (n=28)		Statistical significance	
	Mean	SD	Mean	Mean	SD	Mean
At 48 hours postoperatively						
Total bilirubin (mg/dl)	0.78	0.12	0.90	0.21	-2.497	0.016
Direct bilirubin (mg/dl)	0.29	0.05	0.33	0.13	-1.588	0.118
Indirect bilirubin (mg/dl)	0.50	0.08	0.57	0.18	-1.945	0.057
SGPT (IU/litre)	29.93	9.05	38.29	10.83	-3.133	0.003
SGOT (IU/litre)	29.18	9.81	36.39	7.64	-3.071	0.003
ALP (IU/litre)	144.86	65.16	122.14	56.90	1.389	0.170
LDH (IU/litre)	303.18	81.06	290.71	43.35	0.718	0.476
S. amylase (IU/l)	28.64	11.69	31.46	7.44	-1.077	0.286
At 72 hours postoperatively						
Total bilirubin (mg/dl)	0.77	0.12	0.80	0.19	-0.542	0.590
Direct bilirubin (mg/dl)	0.30	0.06	0.29	0.10	0.462	0.646
Indirect bilirubin (mg/dl)	0.48	0.07	0.51	0.17	-0.928	0.358
SGPT (IU/litre)	25.79	7.83	31.93	11.55	-2.330	0.024
SGOT (IU/litre)	27.61	9.03	31.18	8.53	-1.521	0.134
ALP (IU/litre)	141.07	60.57	120.11	56.93	1.334	0.188
LDH (IU/litre)	297.79	66.30	289.86	41.55	0.536	0.594
S. amylase (IU/l)	27.57	10.84	33.39	8.32	-2.254	0.028

Table 2: Intra-group change in serum levels (from pre-operative) of study population (paired 't' test).

	Group 1 (n=28)					Group 2 (n=28)				
	Mean change	SD	% change	't'	'p'	Mean change	SD	% change	't'	'p'
At 24 hours										
Total bilirubin	-0.01	0.05	-0.75	0.614	0.544	0.20	0.21	25.52	-5.131	<0.001
Direct bilirubin	-0.02	0.07	-5.52	1.239	0.226	0.08	0.09	22.11	-4.314	<0.001
Indirect bilirubin	0.01	0.08	2.23	-0.786	0.439	0.12	0.18	28.18	-3.706	0.001
SGPT	6.54	4.94	23.92	-7.000	<0.001	15.43	5.46	57.91	-14.953	<0.001
SGOT	9.46	10.93	32.64	-4.581	<0.001	15.21	4.15	57.72	-19.405	<0.001
ALP	3.54	10.56	2.46	-1.771	0.088	-2.93	11.78	-2.25	1.315	0.200
LDH	5.43	28.88	1.77	-0.995	0.329	2.21	26.11	0.74	-0.449	0.657
S. amylase	-8.39	10.51	-22.51	4.225	<0.001	-4.00	5.79	-10.28	3.658	0.001
At 48 hours										
Total bilirubin	-0.04	0.06	-5.24	3.520	0.002	0.11	0.19	14.54	-3.258	0.003
Direct bilirubin	-0.03	0.07	-9.61	2.360	0.026	-0.01	0.10	-4.17	0.791	0.436
Indirect bilirubin	-0.01	0.07	-2.51	0.933	0.359	0.13	0.18	29.07	-3.852	0.001
SGPT	2.61	5.04	9.54	-2.740	0.011	11.64	6.28	43.70	-9.803	<0.001
SGOT	0.18	9.35	0.62	-0.101	0.920	10.04	5.22	38.08	-10.178	<0.001
ALP	1.04	10.14	0.72	-0.541	0.593	-7.96	10.20	-6.12	4.130	<0.001
LDH	-4.11	28.53	-1.34	0.762	0.453	-9.68	27.45	-3.22	1.866	0.073
S. amylase	-8.64	9.95	-23.18	4.599	<0.001	-7.43	6.37	-19.10	6.167	<0.007
At 72 hours										
Total bilirubin	-0.05	0.05	-6.16	5.048	<0.001	0.01	0.16	1.69	-0.441	0.663
Direct bilirubin	-0.02	0.08	-6.42	1.409	0.170	-0.06	0.07	-16.27	3.959	<0.001
Indirect bilirubin	-0.03	0.08	-6.00	2.146	0.041	0.07	0.15	15.63	-2.506	0.019
SGPT	-1.54	4.37	-5.62	1.861	0.074	5.29	5.92	19.84	-4.726	<0.001
SGOT	-1.39	8.04	-4.80	0.916	0.368	4.82	4.56	18.29	-5.591	<0.001
ALP	-2.75	8.15	-1.91	1.785	0.086	-10.00	11.25	-7.69	4.704	<0.001
LDH	-9.50	48.38	-3.09	1.039	0.308	-10.54	25.76	-3.51	2.164	0.039
S. amylase	-9.71	9.01	-26.05	5.708	<0.001	-5.50	4.76	-20.64	6.118	<0.001

At the interval of 48 hours, mean difference between Group 1 and 2 in TB, IB, SGOT and SGPT were statistically significant ($p<0.05$). DB, ALP, LDH and S. amylase levels were insignificant ($p>0.05$). At 72 hours, mean difference between Group 1 and 2 in only SGPT was statistically significant ($p<0.05$).

Enzyme alterations in two groups preoperatively and post operatively at different time intervals was shown in Table 2. At 24 hours, in Group 1 change in SGPT, SGOT and S. amylase from preoperative levels was found to be statistically significant ($p>0.05$). In Group 2 change in TB, DB, IB, SGPT, SGOT and S. amylase was found to be statistically significant ($p<0.05$) from the preoperative level.

At 48 hours, in Group 1 change in TB, DB and SGPT were found to be ($p<0.05$) statistically significant from preoperative levels. Significant change in TB, IB, SGPT, SGOT, ALP, LDH and S. amylase were found in Group 2 ($p<0.05$) when compared from preoperative levels.

At 72 hours, in Group 1 change in only TB was found to be statistically significant ($p<0.05$) from preoperative levels. In Group 2 mean values in DB, IB, SGPT, SGOT, ALP and S. amylase were found to be statistically significant ($p<0.05$) when compared with preoperative values.

DISCUSSION

It is a well-known finding that liver enzymes such as serum ALT and AST will elevate after non-complicated cholecystectomy. Clinical importance of these elevated enzymes after LC was still unknown, but transient hepatic malfunction was noticed in previous studies.[6,8]

The main concern during LC, was increased pneumperitoneal pressure leading to hepatic dysfunction. This increased pressure decrease in cardiac output, and stroke volume. The intraperitoneal pressure created during LC was higher than the pressure in the portal venous system which in turn blocks portal circulation and reduces portal flow up to 50%, therefore results in depression of the hepatic reticular endothelial system.[9] Thus variations in liver function tests are directly proportional to the duration and pressure used for pneumoperitoneum. Hence, LC is not the choice of treatment in patients with severe liver diseases or liver cirrhosis because it can deteriorate the liver function further.[7,10]

Some of the recent studies also shows that LC can be safely performed in cirrhosis type A and B with not much substantial complications.[11] Many studies were conducted to compare the alterations in liver enzyme levels between LC and non-cholecystectomy laparoscopic surgeries to examine the effects of pneumoperitoneum on these changes more accurately. All these studies showed significant enzyme elevations after LC suggesting that pneumoperitoneum plays the key role in transient hepatic ischemia triggering enzyme elevations.[8,10]

Preoperative and postoperative levels of ALT, AST, ALP, LDH and bilirubin were investigated in various studies to determine the physiological role of hepatic malfunction. But however significant elevations were noted only for ALT and AST.[5,8,12] Some studies have shown that the elevated enzyme levels last for about 3 days postoperatively and the significant difference between LC and OC values fades after 48-72 hours.[8,10]

In our study, the alterations in serum enzyme levels and serum amylase before and after (24, 48 and 72 hours) the operation in LC patients and compare these changes with the OC patients who were undergone the surgeries with the same protocol. Serum ALT, AST, ALP levels were increased and serum amylase was decreased significantly when the difference was compared preoperatively and postoperatively at different time intervals in both LC and OC groups. After 72 hours, the difference in the values was declined. An increase in total bilirubin, direct bilirubin, ALT, AST and serum amylase was seen in LC group compared to OC group. Rise in ALP and LDH was noticed in OC group than LC group.

CONCLUSION

To conclude, our study demonstrates that cholecystectomy, either OC and LC leads to transient but reversible significant hepatic enzyme and serum amylase alteration. LC causes more alteration compared to OC. The alteration in LFT and S. amylase after surgery are self limiting, are not associated with any morbidities in patient with normal LFT, these alterations returned to reference values within 10 days of operation. The possible causes of these alterations might be liver tractions, Electro cauterization, manipulation of duct. The additional major positive factors in the LC groups seem to be CO_2 pneumoperitoneum, increased intra abdominal pressure and duration of pneumoperitoneum.

Limitations of the study

The study was carried out at the single center without any blind method, hence there might be chances of bias in the study

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REFERENCES

1. Odeberg-Wernerman S. Laparoscopic surgery - effects oncirculatory and respiratory physiology: an overview. Eur J Surg. 2000;585:4-11.
2. Jani K, Rajan P S, Sendhilkumar K, Palanivelu C. Twenty years after Erich Muhe; Persisting

controversies with the gold standard of laparoscopic cholecystectomy. J Minimal Access Surgery. 2006;2(2):49-59.
3. Sakorafas G, Anagnostopoulos G, Stafyla V, Koletis T, Kotsifopoulos N, Tsiakos S, et al. Elevation ofserum liver enzymes after laparoscopic cholecystectomy. N Z Med J. 2005;118:U1317.
4. Hasukic S. Postoperative changes in liver function tests:randomized comparison of low and high-pressure laparoscopiccholecystectomy. Surg Endosc. 2005;19:1451-5.
5. Giraudo G, Brachet Contul R, Caccetta M, Morino M. Gaslesslaparoscopy could avoid alterations in hepatic function. Surg Endosc. 2001;15:741-6.
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 Surg. 2000;66:699-702.
7. Curro G, Iapichino G, Melita G, Lorenzini C, Cucinotta E. Laparoscopic cholecystectomy in Child-Pugh class C cirrhoticpatients. J Soc Laparoendosc Surg. 2005;9:311-5.
8. Morino M, Giraudo G, Festa V. Alterations in hepatic functionduring laparoscopic surgery. An experimental clinical study. Surg Endosc. 1998;12:968-72.
9. Jakimowicz J, Stultiens G, Smulders F. Laparoscopic insufflation of the abdomen reduces portal venous flow. Surg Endosc. 1998;12(2):129-32.
10. Tan M, Xu FF, Peng JS, Li DM, Chen LH, Lv BJ, et al. Changes in the level of serum liver enzymes after laparoscopic surgery. World J Gastroenterol. 2003;9:364-7.
11. Pavlidis TE, Symeonidis NG, Psarras K, Skouras C, Kontoulis TM, Ballas K, et al. Laparoscopic cholecystectomy in patients with cirrhosis of the liver and symptomatic cholelithiasis. JSLS. 2009;13(3):342-5.
12. Andrei VE, Schein M, Margolis M, Rucinski JC, Wise L. Liverenzymes are commonly elevated following laparoscopiccholecystectomy: is elevated intra-abdominal pressure thecause? Dig Surg. 1998;15:256-9.

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