Research Paper

Volume : 3 | Issue : 9 | September 2014 • ISSN No 2277 - 8179

Effect of Carbondioxide Pneumoperitoneum on Liver Function in Laparoscopic Cholecystectomy at Vims, Bellary

Medical Science

KEYWORDS : Pneumoperitoneum,CO2, Cholecystectomy

Dr Praveen Khandelwal	Department of Surgery, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka
Dr Pradeep Y M	Department of Surgery, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka
Dr Vidyadhar A Kinhal	Department of Surgery, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka
*** Dr Ramesh K**	Department of Community Medicine, Vijayanagara Institute of Medical Sciences, Bellary, Karnataka. * Corresponding author

ABSTRACT

Introduction: The laparoscopic cholecystectomy offers many advantages that include a markedly reduction in hospital stay and decreased cost. Because of these distinct advantages, the procedure has gained worldwide popularity and has now become one of the most common operations performed in general surgical practice.

Aim of the study: The purpose of this study was to investigate the effect of laparoscopic cholecystectomy on liver function in humans and the possible mechanisms behind such effect.

Methods: Blood samples were collected from 50 patients undergoing laparoscopic cholecystectomy preoperatively once and post operatively on day 1. They were tested for liver function by comparing the level of serum bilirubin(total and direct), serum alanine amino transferase (ALT), serum aspartate aminotransferase (AST) , serum alkaline phosphatase and serum gamma glutamyl transferase. Post operative oral feeds and length of hospital stay was also measured.

Results : The level of serum AST, ALT, bilirubin (total and direct),ALP and GGT increased significantly during the first 24 hrs. post operatively after laparoscopic cholecystectomy as compared to baseline values.

Conclusion: Transient elevation of hepatic enzymes occurs after laparoscopic cholecystectomy and the major causative factor seemed to be CO2 pneumoperitoneum.

Introduction:

Laparoscopic cholecystectomy, a minimal-access approach surgery for the removal of the gallbladder, was first performed by Mouret in 1987.[1,2] For over 25 years, laparoscopic cholecystectomy has replaced open cholecystectomy in the management of benign gallbladder diseases and has become the gold standard for symptomatic cholelithiasis. It is also the procedure of choice for most patients referred for elective cholecystectomy.

The laparoscopic surgery is performed by the insufflation of gas into the peritoneal cavity. Carbon dioxide is the standard gas used, largely because it does not support combustion. After absorption from the peritoneum, it is readily excreted via the lungs.3 Carbon dioxide is 20 times more soluble in serum than room air or oxygen and has been shown to be absorbed 32 times more quickly than room air when used for double-contrast barium enemas.[4]

Pneumoperitoneum is likely to be smaller in volume and shorter in duration after laparoscopic cholecystectomy than after open laparotomy. During most cases of the surgery, a pneumoperitoneum of 12-14 mm Hg CO2 is established. [5-7]

Although LC offered many advantages over laparotomy, new concerns arose regarding the effects of a pneumoperitoneum on the cardiovascular and respiratory system.8 These changes are well tolerated even in older and more debilitated patients, and except for a slight increase in the incidence of cardiac arrhythmias, no other significant cardiovascular complications occur.[9]

One of the important hemodynamic changes is the transient reduction in hepatic blood flow caused by a pneumoperitoneum5,10-12. The pressure of the created pneumoperitoneum and its duration was shown to influence the degree of hepatic ischemia. This results in elevations in liver enzymes alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase, gamma glutamyl transferase, bilirubin, and international normalized ratio (INR). Though, the LC is associated with transient elevation of liver enzymes, the disturbances after LC are self-limited and not associated with any morbidity in patients with a normal liver function.[5,12,13]

Moreover, despite the popularity of laparoscopic surgery, the frequency and duration of postoperative pneumoperitoneum are not well established. Knowledge of the normal resorption pattern for pneumoperitoneum in cholecystectomy patients is necessary for an accurate evaluation of postoperative radiographs. The latter is of particular importance when a perforated viscus is suspected clinically. This information is well documented for conventional laparotomy.14

Though, the various studies on laparoscopic cholecystectomy are available, the frequency and duration of postoperative pneumoperitoneum are not well established. Moreover, the observation of hemodynamic and metabolic impairment related to CO2 pneumoperitoneum and postoperative mesenteric ischemia reports following laparoscopic procedures have raised concern about local and systemic effects of increased intra abdominal pressure during laparoscopic procedures. This study aims to investigate the alterations in the serum levels of liver enzymes after LC performed under constant intraperitoneal pressure (14mmHg) at Vijayanagara institute of medical sciences, Bellary, Karnataka. India

Methodology:

The study was conducted on 50 patients who underwent LC under constant intraperitoneal pressure (14mmHg) in Vijayanagara Institute of Medical Sciences, Bellary. The study was designed to evaluate the complications of LC especially the changes in liver enzymes.

All patients with undergoing laparoscopic cholecystectomy were invited to participate in the study and written informed consent was taken. All patients underwent a standard clinical and laboratory evaluation that includes briefly information about age, sex, address and routine investigation including ultra sound abdomen, which are done pre operatively.

Pre-operative investigations include liver function tests (ALT,

AST, alkaline phosphatase, gamma glutamyl transferase, bilirubin (direct), and bilirubin (total)).

The subject satisfying inclusion and exclusion criteria were enrolled in the study. All such patients underwent LC.

The liver function tests were further done 24 hrs later and in some patients liver function test were repeated to monitor liver function. Along with, adverse events were noted in all the patients. Finally the duration of hospital stay was noted. The patients who developed intra-abdominal complications were excluded from the study.

- Demographic data were presented in mean and SD.
- All liver function tests parameter (ALT, AST, alkaline phosphatase, gamma glutamyl transferase, bilirubin (direct), and bilirubin (total)) and length of hospital stay was presented in mean and SD.
- Paired t test was applied to all liver function tests parameter to measure the significant change in liver function.

Appropriate statistical analysis was applied for comparing the incidences of adverse events and other complications. Additional exploratory (parametric as well as non-parametric) analysis of the data was performed as deemed essential by using appropriate statistical tests.

Results:

We studied 50 patients who underwent laparoscopic cholecystectomy and among them, 35 patients were females and 15were males. The mean age was 42 years.

We observed significant increase in Bilirubin (total), Bilirubin (direct), AST, ALT, ALP and GGT after performing laparoscopic cholecystectomy as compared to baseline values.

Bilirubin (total) pre operative was 0.716±0.152 mg/dl, increased 24 hours after surgery to 1.158±0.336 mg/dl (p value <0.0001)

Bilirubin (direct) increased from 0.388±0.159 mg/dl to 0.826±0.275 mg/dl

AST and ALT were found to be significantly elevated from 22.28±5.19 U/l to 39.16±12.59 U/l (p value <0..0001) and from 17.02±4.50 U/l to 30.04±10.11 U/l (p value <0.0001) respectively

Alkaline phosphatase showed elevation from pre operative values of 105.20±24.46 U/l to 146.12±38.26 after 24 hours (p value <0.0001)

GGT increased from 20.26±5.75 U/l to 38.14±5.84 (p value <0.0001)

Paired t test applied. P value is significant if <0.05, highly significant if <0.001

Table.no1: Comparison of Liver function tests

Variables	Pre op (mean) mg/dl	Post op (mean)mg/dl	P value
Serum Total Bilirubin	0.716	1.158	0.001
Serum Direct Bilirubin	0.308	0.826	0.001
Serum ALT levels	17.02	30.04	0.001
Serum AST levels	22.28	39.16	0.001
Serum ALP levels	105.20	146.12	0.001
Serum GGT levels	20.26	38.14	0.001

Discussion:

In our study of 50 subjects of mean age of 42 years, we observed significant increase in Bilirubin (total), Bilirubin (direct), AST, ALT, ALP and GGT after performing laparoscopic cholecystectomy as compared to baseline values. The finding of our study is in the line with the reported literature[10,12] However, the clinical importance of these enzyme elevations has not been clarified.

Guven also investigated the alterations in AST, ALT, GGT, LDH and ALP levels before and 24 hours after the operations in LC patients and compared this change with the OC patients who were anesthetized with the same protocol. He observed that the AST, ALT, GGT and LDH levels were elevated significantly 24 hours after LC.

Though the exact mechanism for changes in liver enzyme is not known, following several mechanisms are cited to explain the condition.

1. The "squeeze" pressure effect on the liver by the traction of the gallbladder may free these enzymes into the blood stream. But this should be studied using an animal model to determine the response.
2. Prolonged use of diathermy to the liver surface and spread of heat to the liver parenchyma. Some surgeons use diathermy to excise the gallbladder while performing open cholecystectomy.
3. Pulling on the gallbladder creates a transient kink in the extrahepatic ducts, which could induce an increase in the endoluminal pressure and a subsequent increase in enzyme levels.
4. Another issue is the passage of a small stone.
5. Inadvertent clipping of the right branch of the hepatic artery, or any other aberrant arterial branch supplying blood to the liver.
6. The combination of more than one cause.[15]

In a study comparing hepatic enzyme alterations in LC, gasless LC and LC under low pressure (below 10mmHg) pneumoperitoneum, Giraudo et al found significant enzyme level rises after LC that are not seen after gasless or low pressure LC, underlining the absolute effect of intraperitoneal pressure on hepatic perfusion by means of enzyme level changes[16].

Morino et al investigated the duration of pneumoperitoneum at constant pressure and found that when the duration of operation exceeds 60 minutes, elevations in AST and ALT levels become more significant [12].

The same significant enzyme level elevations were also observed in laparoscopic colectomy patients suggesting that a pneumoperitoneum plays the key role in transient hepatic ischemia causing enzyme elevations [12].

Various studies investigated determined the physiological basis of hepatic malfunction (10,61,68). However significant elevations after LC compared with OC have been defined for only AST and ALT levels.Studies have shown that these enzyme elevations last for about 3 days postoperatively and the significance between LC and OC values fade away after 2 days[17,18].

In our study, all the patients were discharged within four days after surgery. 52 % patients took three days and 42 % of patients took two days after surgery. Moreover, no patients developed any complication or significant disability or adverse event. These signify that the changes in the liver enzymes are transient and recovered without any sequelae.

Conclusion:

Laparoscopic cholecystectomy offers many advantages and is the gold standard for symptomatic cholelithiasis. During

Volume : 3 | Issue : 9 | September 2014 • ISSN No 2277 - 8179

the surgery, the hemodynamic changes occur that includes transient reduction in hepatic blood flow, which is caused by pneumoperitoneum. These result in elevation in liver enzymes bilirubin (Direct and total), AST, ALT, ALP and GGT. These changes may be attributed to the reduction of portal venous flow under high pressures of a pneumoperitoneum.

REFERENCE

1. Mouret.P. How I developed laparoscopic cholecystectomy. Ann Acad Med | Singapore,1996, 25(5):744-7 | 2. Brandon.J.C et al., Laparoscopic cholecystectomy: evolution,early results,and impact on non surgical gallstone therapies..AJR Am J Roentgenol,1991.157(2):235-9 | 3. Cuschieri A., Laparoscopic biliary surgery, 2nd ed. Oxford: Blackwell Scientific Publications., 28.1992. | 4. Dobranowski J et al., Procedures in gastrointestinal radiology.New York: Sponger – Verlag, 7.1990 | 5. Hasulic.S, D.Kosuta, K.Muminhodzic, Comparison of post operative hepatic function between laparoscopic and open cholecystectomy. Med Princ Pract. 2005. 14(3):147-50. | 6. Ibraheim O.A et al, Lactate and acid base changes during laparoscopic cholecystectomy Middle East J Anesthesiol, 2006. 18(4): 757-68 | 7. Schwenk.W., O.Haase, and T.Junghans, Perspectives in sequential pneumatic compression of the lower extremities for laparoscopic surgery. Acta Chir Belg, 2002. 102(2):83-91 | . 8. Odeberg-Wernerman, S., Laparoscopic surgery--effects on circulatory and respiratory physiology: an overview.Eur J Surg Suppl, 2000(585):4-11. | 9. Gutt, C.N., et al., Circulatory and respiratory complications of carbon dioxide insufflation.Dig Surg, 2004. 21(2):95-105. | 10. Saber, A.A., et al., Changes in liver function tests after laparoscopic cholecystectomy: not so rare, not always ominous.Am Surg, 2000. 66(7):699-702. | 11. Sakorafas, G., Anagnostopoulos G, Stafyla V, et al., Elevation of serum liver enzymes after laparoscopic cholecystectomy.N Z Med J, 2005. 118(1210):U1317. | | 12. Morino, M., G. Giraudo, and V. Festa, Alterations in hepatic function during laparoscopic surgery. An experimental clinical study.Surg Endosc, 1998. 12(7):968-72. | 13. Hasukic, S., Postoperative changes in liver function tests: randomized comparison of low- and high-pressure laparoscopic cholecystectomy.Surg Endosc, 2005. 19(11):1451-5. | 14. Bryant, L.R., J.F. Wiot, and R.J. Kloecker, A Study of the Factors Affecting the Incidence and Duration of Postoperative Pneumoperitoneum.Surg Gynecol Obstet, 1963. 117:145-50. | 15. Halevy A, G.-D.R., Negri M, et al, Are elevated liver enzymes and bilirubin levels significant after laparoscopic cholecystectomy in the absence of bile duct injury? . Ann Surg., 1994. 219: p. 362–364 | 16. Giraudo G, B.C.R., Caccetta M, Morino M. , Gasless laparoscopy could avoid alterations in hepatic function.Surg Endosc 2001. 15:741-746. | 17. Tan M, X.F., Peng JS, et al Changes in the level of serum liver enzymes after laparoscopic surgery. World J Gastroenterol., 2003. 9: p. 364-367. | 18. S., H., Postoperative changes in liver function tests: randomized comparison of low and high-pressure laparoscopic cholecystectomy. .Surg Endosc, 2005. 19:1451-1455. |