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Changes in liver function test after laparoscopic surgery

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Abstract
Introduction: In this modern era Laparoscopic surgery has evoked marked changes in approach to surgical diseases. The "Minimally invasive surgery "(MIS), now turned into "Minimal Access Surgery" (MAS) has prompted us to prompted us to perform most of the operations by Laparoscopic technique. Main advantages of laparoscopic surgery include; reduction of tissue trauma due to small skin incisions and reduction in adhesion formation. All Laparoscopic procedures are usually performed by creating pneumoperitoneum. Carbon dioxide is most commonly used inert gas to create pneumoperitoneum. Apart from many advantages in Laparoscopic procedures; effects of pneumoperitoneum on the cardiovascular and respiratory system resulting in several pathophysiological changes in the patients have been reported. Recently many studies have disclosed 'unexplained' changes in postoperative liver function tests in patients undergoing laparoscopic procedures. These studies demonstrate that transient elevation of hepatic enzymes could occur after laparoscopic procedures. No causes for this elevation are documented so far. CO2 pneumoperitoneum might be one of the main reasons for the change of serum liver enzymes. So we decided to perform a study to correlate the changes in serum liver enzymes pre-operative and post operation.
Aim and Objective: The purpose of this study was to investigate the effect of laparoscopic surgeries on liver function test and the possible mechanisms behind such effect in our hospital in the Department of General Surgery at Sri Adichunchanagiri Hospital and Research Center (AH & RC), the teaching hospital attached to Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, Mandya by statistical analysis.
Material and Methods: This was a prospective study conducted in 100 patients who were undergoing various types of laparoscopic surgery performed using CO2 to create pneumoperitoneum under intraperitoneal pressure of 12-14mmHg during the period of 18 months from January 2017 to June 2018 in our Hospital. Blood sampling were collected both preoperatively and post operatively on day 1 and day 5 for liver function tests along with routine investigations.
Result: The level of serum bilirubin, serum aspartate amino transferase, serum alanine amino transferase and alkaline phosphatase increased significantly during the first 24 hours post operatively. These values returned to near pre-operative value by post-operative day 5.
Interpretation and Conclusion: In this study we conclude that there was a transient changes in serum Bilirubin and Liver Enzymes in the POD-1 which reverted back to near normal to the pre-operative level by POD-5. There was no complication, no morbidity and no mortality. It is concluded that the changes in LFT is probably due to CO2 pneumoperitoneum. Laparoscopic procedures can be done safely in a patient in the presence of normal Liver function test and may not be safe in presence of serious Liver disorder.

Keywords: liver, function test, laparoscopic surgery

1. Introduction

In this modern era Laparoscopic surgery has evoked marked changes in approach to surgical diseases. The "Minimally invasive surgery "(MIS), now turned into "Minimal Access Surgery" (MAS) has prompted us to prompted us to perform most of the operations by Laparoscopic technique. Main advantages of laparoscopic surgery include; reduction of tissue trauma due to small skin incisions and reduction in adhesion formation. The growing interest in laparoscopy is mostly attributable to cumulative evidence suggesting a reduction in patient morbidity, shortening of duration of hospital stay and early return to normal activity.

All Laparoscopic procedures are usually performed by creating pneumoperitoneum. Carbon dioxide is most commonly used inert gas to create pneumoperitoneum as it has got many advantages like non-combustibility, high diffusibility, rapid rate of absorption and excretion via the lungs. CO2 is 20 times more soluble in serum than room air or oxygen, also it has been shown to be absorbed 32 times more quickly than room air when used for double contrast Barium enemas. During most cases of the Laparoscopic surgery, a pneumoperitoneum of 12-14

mm Hg CO2 is established. Apart from many advantages in Laparoscopic procedures; effects of pneumoperitoneum on the cardiovascular and respiratory system resulting in several pathophysiological changes in the patients have been reported. Recently many studies have disclosed 'unexplained' changes in postoperative liver function tests in patients undergoing laparoscopic procedures. These studies demonstrate that transient elevation of hepatic enzymes could occur after laparoscopic procedures. No causes for this elevation are documented so far. These changes might be attributed to hepatocellular dysfunction secondary to one or combination of CO2 pneumoperitoneum, diathermy extruding liver, branch of the hepatic artery injured and general anesthesia. CO2 pneumoperitoneum might be one of the main reasons for the change of serum liver enzymes. So we decided to perform a study to correlate the changes in serum liver enzymes pre-operative and post operation.

2. Aims & Objectives

The aim of our study is to find

1. Age and Sex distribution of patients undergoing Laparoscopic Surgery.
2. To study the incidence of alterations in liver function following Laparoscopic surgery

3. Material and Methods

This is a prospective study conducted in the Department of General surgery at Adichunchanagiri Hospital and Research Center, the teaching hospital attached to Adichunchanagiri Institute of Medical Sciences, B.G. Nagara during the period of 18 months from January 2017 to June 2018.

The changes in Liver function test in 100 patients undergoing Laparoscopic Surgeries performed using CO2 to create pneumoperitoneum under intraperitoneal pressure of 12-14mmHg are being studied.

Blood sampling for liver function tests were collected both preoperatively and post operatively on day 1 and day 5 by comparing the level of serum bilirubin, serum alanine amino transferase (ALT), serum aspartate amino transferase (AST) and serum alkaline phosphatase (ALP). The time duration of carbon-dioxide insufflation was also measured.

4. Sample size

The sample size was of 100 patients admitted in the Department of General Surgery, at Adichunchanagiri Hospital & Research Center, the teaching hospital attached to Adichunchanagiri Institute of Medical Sciences, B.G. Nagara for laparoscopic cholecystectomy or appendicectomy or umbalical hernia mesh repair.

5. Ethical committee clearance

The study was started only after obtaining clearence from the Institutional Ethical committee, Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, Mandya Dist., Karnataka-571448.

6. Inclusion criteria

- Patients between the age group of 18 to 70 Years of both sexes.
- Patients undergoing laparoscopic surgery- Laparoscopic Appendicectomy, Laparoscopic cholecystectomy and Laparoscopic umbilical hernia mesh repair.
- The patients who will give written consent to be part of the study group.

7. Exclusion criteria

- Patients below 18 years and above 70 years of age.
- Any patient with abnormal Liver Function Test.
- Patients with severe co-morbid conditions like Cardio-Respiratory and Renal disease.
- Immuno compromised Patients.
- Patients with Jaundice.
- Suspected chronic liver diseases
- Common bile duct pathology
- Conversion to open Surgery
- Hematological Disorders
- Patients who develop biliary complications.
- Patients who have undergone ERCP within one week before surgery.
- Patients who are recently treated for Pancreatitis.

8. Data collected includes

- Name, Age, Sex, In Patient no. (IP No), Investigation and Diagnosis.
- Along with routine investigation report, the reports of LFT done preoperatively and postoperative day 1 & 5
- Time of start and completion of the procedure.
- Duration of Pneumoperitoneum.
- Any intraoperative complications.

9. Plan for data analysis

- Demographic data were presented in mean & SD.
- All LFT parameters (Total Bilirubin, Direct Bilirubin, SGOT, SGPT, Alkaline phosphatase) and length of hospital stay was presented in mean & SD.
- Data will be analyzed for finding the significance of effect of laparoscopy on hepatic function by using student paired t test.

10. Results

All cases were evaluated clinically, only essential investigations necessary for diagnosis and preoperative assessment were carried out before operations. In all patients LFT carried out pre operatively and on post-operative Day-1 & Day-5. The patients of both sexes and of age group from 18-70 years were included in the study. The results obtained were recorded in the proforma prepared for the study and were analysed as follows.

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 20 version software. Categorical data was represented in the form of frequencies and proportions. Continuous data was represented as mean and standard deviation and p value was calculated using Paired t test. Repeated measures of ANOVA Test were used to check the overall Association between the three groups.

MS Excel and MS word was used to obtain various types of graphs such as bar diagram, Pie diagram. p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests. MS Excel**,** SPSS version 20 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

Table 1: Age wise distribution of Study subjects

		Count	Column N %
Age group	Less than 20 years	4	4.0%
	21-30 Years	29	29.0%
	31- 40 Years	22	22.0%
	41-50 Years	22	22.0%
	51-60 Years	12	12.0%
	More than 60 Years	11	11.0%

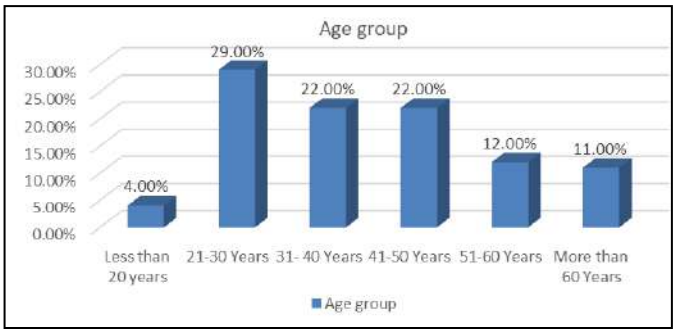

Fig 1: Age wise distribution of study subjects

In our study majority of the subjects were in 20 to 50 years of age group. Only 4 cases were less than 20 years and 11 cases were seen in subjects above 60 years of the age.

Table 2: Gender wise distribution of study subjects

		Count	Column N %
Gender	Female	57	57.0%
	Male	43	43.0%

Nearly 57% of the study participants were Female and 43% of Male were present in our study.

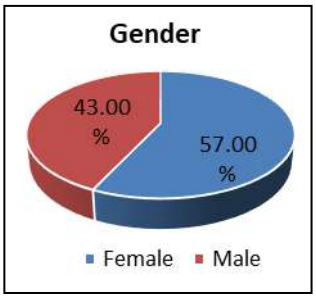

Fig 2: Gender wise distribution of Subjects

Table 3: Diagnosis of Cases

		Count	Column N %
Diagnosis	Appendicitis	18	18.0%
	Cholelithiasis	72	72.0%
	Umbilical Hernia	10	10.0%

In our study, Majority (72%) of the cases were diagnosed with Cholelithiasis, 18 % of the cases were Appendicitis and 10% of Umbilical Hernias, who have undergone laparoscopic procedures.

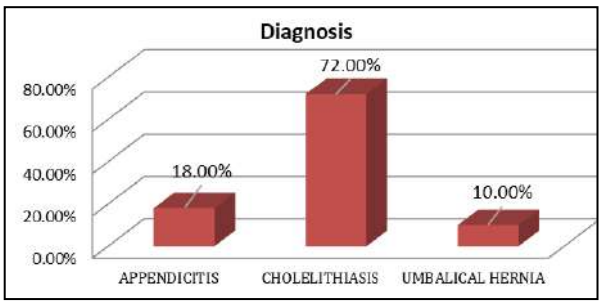

Fig 3: Diagnosis of the cases

Table 4: Mean CO2 Pressure used in the procedure

	Mean	Standard Deviation
CO2 Pressure Used (mm of Hg)	14	1

The mean pressure of carbon dioxide used in our study was 14 mm of Hg with Standard deviation of 1 mm of Hg.

Table 5: Mean Duration of Surgery

	Mean	Standard Deviation
Duration of Surgery (Min)	99	22

The mean total time taken to complete the surgery was 99 mins with standard deviation of 22 min.

Table 6: Mean Distribution of Liver function test Values on Preoperative day, Post-operative Day 1 and Day 5.

		Total Bilirubin		Direct Bilirubin		SGOT		SGPT		ALP	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group	Pre OP	0.58	0.29	0.22	0.10	34.8	10.9	31.5	11.2	78.9	17.3
	POD 1	0.73	0.23	0.23	0.09	61.1	14.1	60.6	15.2	98.1	14.2
	POD 5	0.44	0.18	0.15	0.06	34.8	9.1	32.2	9.2	76.2	12.7
Repeated Measures of ANOVA		F=690.377 P=0.000		F=534.65 P=0.000		F=1797.88 P=0.000		F= 1562.64 P=0.000		F=4598.58 P=0.000	

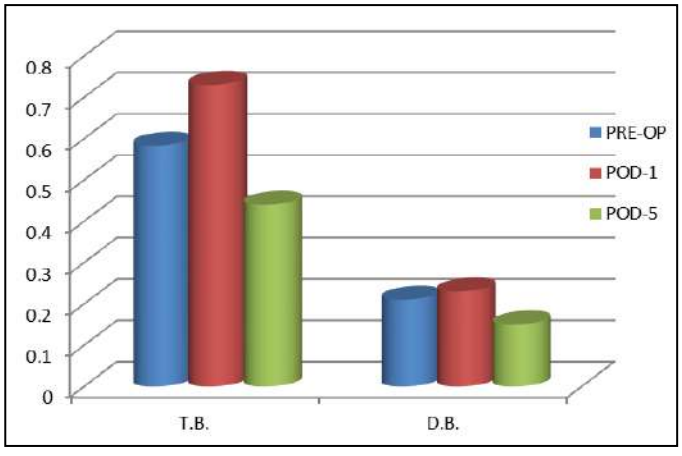

Fig 4: Changes in Serum Bilirubin after laparoscopic surgery

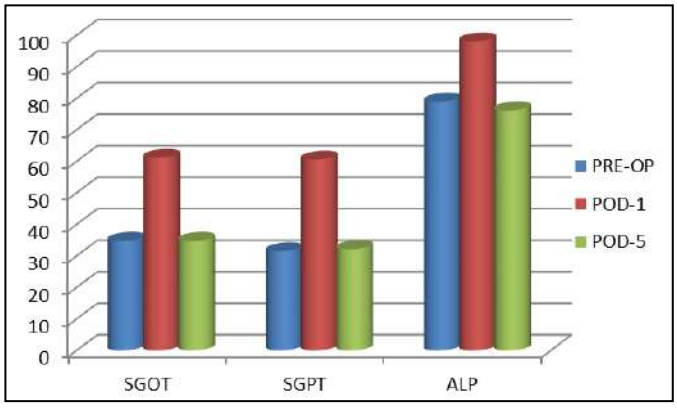

Fig 5: Changes in Liver Enzymes after laparoscopic surgery

In figures 4 & 5, when compared to the pre-operative values,

mean values of serum bilirubin, AST, ALT and ALP increased significantly ($p < 0.001$) by post-operative day 1 and they came down to near pre-op values by post-op day 3.

Table 7: Association of Total Bilirubin levels of Preoperative Day, Post-operative Day 1 &5

	Paired T test value	Inference
Pre OP Total Bilirubin and POD 1 Total Bilirubin	-8.545	Highly Significant
Pre OP Total Bilirubin and POD 5 Total Bilirubin	9.252	Non-Significant
POD 1 Total Bilirubin and POD 5 Total Bilirubin	19.707	Highly Significant

In Table-7, the Mean Difference of Total bilirubin level was found to be statistically significant when compared between Preoperative day vs Post-operative Day1, and Post-operative Day 1 vs Post-operative Day 5 but non-significant between Preoperative day vs Post-operative Day 5

Table 8: Association of Direct Bilirubin levels of Preoperative Day, Post-operative Day 1 & Post-operative Day 5

	Paired T test value	Inference
Pre OP Direct Bilirubin and POD 1 Direct Bilirubin	-2.044	Highly Significant
Pre OP Direct Bilirubin and POD 5 Direct Bilirubin	8.343	Non-Significant
POD 1 Direct Bilirubin and POD 5 Direct Bilirubin	5.000	Highly Significant

In Table-8, the Mean Difference of Direct bilirubin level was found to be statistically significant when compared between Preoperative day vs Post-operative Day 5 and between Post-operative Day 1 vs Post-operative Day 5. The mean Difference of Direct Bilirubin between Preoperative Day and Post-operative Day 1 was found to be non-significant statistically.

Table 9: Association of SGOT levels of Preoperative Day, Post-operative Day 1 and 5

	Paired T test value	Inference
Pre OP SGOT and POD 1 SGOT	-24.381	Highly Significant
Pre OP SGOT and POD 5 SGOT	1.436	Non-Significant
POD 1 SGOT and POD 5 SGOT	25.466	Highly Significant

In Table-9, the Mean Difference of SGOT level was found to be statistically significant when compared between Preoperative day vs Post-operative Day 1 and between Post-operative Day 1 vs Post-operative Day 5. The mean Difference of SGOT between Preoperative Day and Post-operative Day 5 was found to be non-significant statistically.

Table 10: Association of SGPT levels of Preoperative Day, Post-operative Day 1 and 5

	Paired T test value	Inference
Pre OP SGPT and POD 1 SGPT	-24.640	Highly Significant
Pre OP SGPT and POD 5 SGPT	-1.022	Non-Significant
POD 1 SGPT and POD 5 SGPT	23.241	Highly Significant

In Table-10, the Mean Difference of SGPT level was found to be statistically significant when compared between Preoperative day vs Post-operative Day 1 and between Post-operative Day 1 vs Post-operative Day 5. The mean Difference of SGPT between Preoperative Day and Post-operative Day 5 was found to be non-significant statistically.

Table 11: Association of ALP levels of Preoperative Day, Post-operative Day 1 and 5

	Paired T test value	Inference
Pre OP ALP and POD 1 ALP	-10.866	Highly Significant
Pre OP ALP and POD 5 ALP	2.733	Non-Significant
POD 1 ALP and POD 5 ALP	15.516	Highly Significant

In Table-11, the Mean Difference of ALP level was found to be statistically significant when compared between Preoperative day vs Post-operative Day1 and Post-operative Day 1 vs Post-operative Day 5 but non-significant between Preoperative day vs Post-operative Day 5.

Table 12: Discharge at Post-Op day

Discharge (POD)	No. of Patients	Percent
2	3	3%
3	12	12%
4	26	26%
5	58	58%
6	1	1%

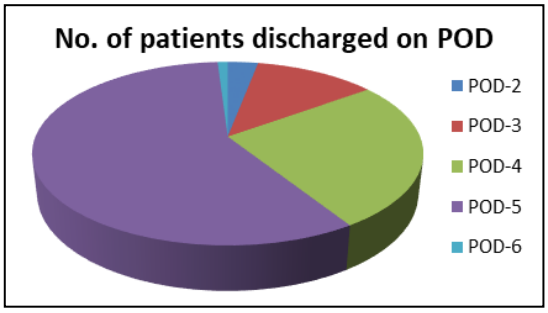

Fig 6: No. of patients discharged on POD

In Table-12 and Fig.6 shows patients got discharged on different post-operative days.

Table 13: Correlation of CO 2 pressure with various parameters of LFT on Post-op Day 1 and Post-op Day 5

Correlations												
		CO2 PRESSURE USED (mm of Hg)	**POD 1 TB**	**POD 1 DB**	**POD 1 SGOT**	**POD 1 SGPT**	**POD 1 ALP**	**POD 5 TB**	**POD 5 DB**	**POD 5 SGOT**	**POD 5 SGPT**	**POD 5 ALP**
CO2 PRESSURE USED (mm of Hg)	Pearson Correlation	1	.103	-.122	-.071	-.230*	-.238*	.141	.111	-.136	-.230*	-.047
	Sig. (2-tailed)		.309	.229	.484	.022	.017	.160	.270	.179	.021	.640
	N	100	100	100	100	100	100	100	100	100	100	100
POD 1 TB	Pearson Correlation	.103	1	.239*	.060	-.072	.096	.773**	.585**	.175	-.018	-.169
	Sig. (2-tailed)	.309		.017	.555	.475	.344	.000	.000	.082	.855	.092
	N	100	100	100	100	100	100	100	100	100	100	100
POD 1 DB	Pearson Correlation	-.122	.239*	1	.065	-.061	.266**	.138	.124	.104	-.015	-.090
	Sig. (2-tailed)	.229	.017		.520	.549	.008	.173	.221	.303	.879	.375
	N	100	100	100	100	100	100	100	100	100	100	100
POD 1 SGOT	Pearson Correlation	-.071	.060	.065	1	.381**	.140	-.011	-.013	.653**	.165	.049
	Sig. (2-tailed)	.484	.555	.520		.000	.165	.916	.899	.000	.101	.629
	N	100	100	100	100	100	100	100	100	100	100	100
POD 1 SGPT	Pearson Correlation	-.230*	-.072	-.061	.381**	1	.255*	-.229*	-.115	.209*	.593**	.125
	Sig. (2-tailed)	.022	.475	.549	.000		.010	.022	.253	.037	.000	.216
	N	100	100	100	100	100	100	100	100	100	100	100
POD 1 ALP	Pearson Correlation	-.238*	.096	.266**	.140	.255*	1	.042	.101	.165	.170	.465**
	Sig. (2-tailed)	.017	.344	.008	.165	.010		.679	.318	.101	.091	.000
	N	100	100	100	100	100	100	100	100	100	100	100
POD 5 TB	Pearson Correlation	.141	.773**	.138	-.011	-.229*	.042	1	.733**	.104	-.120	-.098
	Sig. (2-tailed)	.160	.000	.173	.916	.022	.679		.000	.303	.236	.331
	N	100	100	100	100	100	100	100	100	100	100	100
POD 5 DB	Pearson Correlation	.111	.585**	.124	-.013	-.115	.101	.733**	1	.119	.066	-.159
	Sig. (2-tailed)	.270	.000	.221	.899	.253	.318	.000		.237	.513	.114
	N	100	100	100	100	100	100	100	100	100	100	100
POD 5 SGOT	Pearson Correlation	-.136	.175	.104	.653**	.209*	.165	.104	.119	1	.320**	.003
	Sig. (2-tailed)	.179	.082	.303	.000	.037	.101	.303	.237		.001	.975
	N	100	100	100	100	100	100	100	100	100	100	100
POD 5 SGPT	Pearson Correlation	-.230*	-.018	-.015	.165	.593**	.170	-.120	.066	.320**	1	.072
	Sig. (2-tailed)	.021	.855	.879	.101	.000	.091	.236	.513	.001		.475
	N	100	100	100	100	100	100	100	100	100	100	100
POD 5 ALP	Pearson Correlation	-.047	-.169	-.090	.049	.125	.465**	-.098	-.159	.003	.072	1
	Sig. (2-tailed)	.640	.092	.375	.629	.216	.000	.331	.114	.975	.475	
	N	100	100	100	100	100	100	100	100	100	100	100

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The pressure of CO2 Used in the laparoscopy surgery was found to be Positively Correlated with Total bilirubin on both Day 1 and 5, Direct Bilirubin on Day 5 and all the other Liver function test enzymes.

From this study we have observed that the disturbances in liver function tests are not related to the age or sex in relation to laparoscopy. Carbon dioxide pneumoperitoneum, one of the main common factor which is used in all laparoscopic procedures done in my study might be one of the major causative factors.

11. Discussion

Laparoscopic surgery has become the established method of treatment for many surgical conditions. The progress in laparoscopic procedures has largely been due to the technological advances in endoscopic optics, video cameras and endoscopic instrumentation. Smaller incisions, reduced postoperative pain, shorter hospital stay, early ambulation and return to work are some of the advantages that increased the popularity of laparoscopic procedures. Also from past decades, many studies disclosed unexplained changes in LFT in patients undergoing laparoscopic procedures. This may be due to CO2 pneumoperitoneum created while performing Lap procedures.

There are not many studies in our setting, to evaluate the potential deleterious effects of CO2 pneumoperitoneum on Liver function. This study is therefore intended to assess the clinical significance of unexplained disturbances in liver enzymes following laparoscopic surgeries. The post-operative increase seen in the levels of serum bilirubin and liver enzymes was transient and occurred irrespective of the type of laparoscopic surgery they underwent. The values returned to near pre-operative levels within 5 days of surgery. None of the patients presented with post-operative clinical hepatic dysfunction in the follow up period. The Mean Difference of Total bilirubin level, direct bilirubin, SGOT, SGPT & ALP were found to be statistically significant when compared between Preoperative day vs Post-operative Day-1. The first factor to be considered here is carbon dioxide pneumoperitoneum. All the patients in our study were subjected to carbon dioxide pneumoperitoneum and they showed changes in post-operative serum liver enzymes level. This is consistent with the results of other similar studies. The intra-abdominal pressure of 12 – 14 mmHg used in our study was higher than the normal portal venous pressure of 7 – 10mmHg. This might cause a reduction in portal blood flow and lead to alterations in liver function.

The local effect of prolonged use of diathermy to the liver surface in laparoscopic cholecystectomy and the spread of heat to liver parenchyma may be another possibility[1]. This hypothesis is supported by some studies. However, it remains to be explained why there is hepatic enzyme elevation in laparoscopic surgeries where the focus is far away from the liver. Tauro LF, Sheethal CM et.al[2] explained the squeeze pressure effect on the liver may be another possible mechanism for alterations of serum liver enzymes after laparoscopic cholecystectomy. The traction of the gall bladder may free the liver enzymes into the blood stream. But it is not significant as similar changes are seen in other laparoscopic surgeries like appendicectomy and hernia repairs, where the liver was not handled at all. Rikki Singal *et al.*

[3] in their study they have mentioned an intra-abdominal pressure which is created during pneumoperitoneum of 12-14 mmHg is higher than normal portal blood pressure of 7-10 mmHg, and is therefore capable of reducing portal blood flow and of causing alteration of the hepatic function. From this study we have observed that the disturbances in liver function tests are not related to the age or sex in relation to laparoscopy. It was thought that changes in LFT after laparoscopic cholecystectomy might be due to the squeeze pressure effect on the liver, the traction & shearing effect of the gall bladder. In our study also it showed increase in Serum Bilirubin & Liver enzymes after Laparoscopic Appendicectomy, Laparoscopic Umbilical Hernia mesh repair as well as in Laparoscopic cholecystectomy These changes in the Serum Bilirubin & Liver enzymes may be due to the Pneumoperitoneum rather than thermal injury to the liver, shearing force to gall bladder which will not occur in Laparoscopic Appendicectomy & Laparoscopic Umbilical Hernia mesh repair. Pneumoperitoneum is the common factor in all these three procedures, which may be the cause for these changes in Serum Bilirubin and Liver Enzymes. These similar changes are observed in Halvey A *et al* [4]. in their study and they concluded that low pressure pneumoperitoneum causes lesser side effects on liver function.

Min Tan, Feng Feng Xu, Peng JS *et.al* [5] in his study compared the preoperative and postoperative changes in AST between open and laparoscopic cholecystectomy (LC) as well as open and laparoscopic colorectal cancer resection (LCR) in 286 patients. The levels of serum SGOT and SGPT raised symbolically within 24-48 hours following LC and LCR whereas both open surgeries had normal levels and this was attributed to C02 pneumoperitoneum. In 2005 a study by George Sakorafas [6], concluded that 24 hours after the procedure SGOT and SGPT raised statistically significant. Levels returned to normality occurred 7-10 days after the procedure. ALT (24, 87.1 +/- 24.2 U/L, P <.001) AST (24, 82.8 +/- 19.1, P<.001). In 2005, a study by Guven HE [7] performed in 86 patients who underwent LC to investigate the alterations in serum enzymes levels. He concluded that the differences between elevations of enzymes levels were significant for LC. Tauro LF, Sheethal CM *et.al* [1] Evaluation of effects of laparoscopic surgery on hepatic function in the year 2008, concluded that all types of laparoscopic procedures can cause transient elevation of hepatic enzymes and serum bilirubin for which C02 pneumoperitoneum is the causative factor. Halevy *et.al* first studied alterations in liver enzymes after laparoscopic surgeries. The possible mechanism included increased intra-abdominal pressure, squeeze pressure effect on the liver, pulling on the gall bladder, excessive use of diathermy". Vast investigation was done to evaluate the causes of this elevation and concluded that low pressure pneumoperitoneum was combined with lesser side effects on liver function. Syed Ibrahim *et al.* [8], in his study on 60 patients, noticed The level of serum bilirubin, serum aspartate amino transferase, serum alanine amino transferase and alkaline phosphatase increased significantly during the first 24 hours post operatively. Doubling of pre-op values of AST was seen in 46%, ALT in 32% and S. Bilirubin in 35% patients. These values returned to near pre-operative value by the 7th day post operation. They concluded that there was a transient elevation of hepatic enzymes after laparoscopic surgery and major causative factor would be the CO2 pneumoperitoneum.

The pneumoperitoneum pressure was above than the pressure in portal venous system which is used for laparoscopic procedure. This pressure disrupts portal circulation and decreases portal flow up to 50%, which causes abasement of the hepatic reticular endothelial system [9]. In our study also, the time of C02 pneumoperitoneum increased, there is elevation of intra-abdominal pressure resulting in increased levels of serum liver enzymes and is the causative factor. The elevation and depression of intra-abdominal pressure in a small period during the laparoscopic surgery efficacy also be innovative as the sudden alteration of intra-abdominal pressure would affect the portal blood flow. This re-creation of blood flow and organs would lead to ischemia and re-creation damage of organs and tissues, mainly the kupffer and endothelial cells of hepatic sinusoids". This can cause free-radical generation". The reperfusion relevant system after laparoscopy and the generation of free radicals are however smaller than open surgery.

These changes in the Liver enzymes and Serum Bilirubin are transient as the values of LFT revert back to near pre-operative values by Post Op day-5. Hence Laparoscopic procedures can be safely performed in the absence of serious Liver disorders. However further studies are required in this regard.

12. Conclusion

In our study, that there was a transient elevation of hepatic enzymes and serum bilirubin in Laparoscopic Appendicectomy, Laparoscopic Cholecystectomy and Laparoscopic Umbilical hernia Mesh repair due to short-term reduction in hepatic blood flow, caused by C02 pneumoperitoneum. No apparent clinical changes were seen in the patients. Hence, as its benefits overcome its limitations, Laparoscopic surgery is soon emerging to be a gold standard for various surgical conditions. It is concluded that it is safe to perform Laparoscopic procedures in the presence of healthy liver. However it may not be safe to perform Laparoscopic surgeries in presence of serious Liver disorder.

13. Summary

- This is a prospective, observational and comparative study conducted in Department of General Surgery at Sri Adichunchanagiri Hospital and Research Center (AH & RC), the teaching hospital attached to Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, Mandya.
- Study sample consists of 100 patients who have undergone Laparoscopic procedures which include Laparoscopic Appendicectomy, Laparoscopic Cholecystectomy and Laparoscopic Umbilical hernia Mesh repair.
- Changes in the Liver function test were studied pre operatively, post-operative day-1 & 5 among these patients.
- There was a transient changes in serum Bilirubin and Liver Enzymes in the POD-1 which reverted back to near normal to the pre-operative level by POD-5.
- There was no complication, no morbidity and no mortality.
- It is concluded that the changes in LFT is probably due to CO2 pneumoperitoneum.
- Laparoscopic procedures can be done safely in a patient in the presence of normal Liver function test and may not be safe in presence of serious Liver disorder.
- Since sample size is small in our study, further studies are required to support this study.

14. References

1. Tulikangas PK, Smith T, Falcone T, Boparai N, Walters MD. Gross and histologic characteristics of laparoscopic injuries with four different energy sources. Ferti Steril. 2001; 75:806-810.
2. Tauro LF, Sheetal CM, Aithala PSM, Shetty SR, D"Souza CS, Rao BSS, *et al*. Evaluation of effects of laparoscopic

surgery on hepatic function. Journal of Clinical Diagnosis and Research. 2008; 2(6):1155-62.
3. Rikki Singal, Rajinder Pal Singal, Karamjot Sandhu, Bir Singh, Gaurav Bhatia, Abhishek Khatri, *et al.* Evaluation and comparison of postoperative levels of serum bilirubin, serum transaminases and alkaline phosphatase in laparoscopic cholecystectomy versus open cholecystectomy, J Gastrointest Oncol. 2015; 6(5):479-486.
4. Halevy A, Gold-Deutch 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(4):362-364.
5. Tan M, Xu FF, Peng JS, *et al.* Changes in the level of serum liver enzymes after laparoscopic surgery. World J Gastroenterol. 2003; 9(2):364-367.
6. George sakorafas, Vania statyla. Evaluation of serum liver enzymes after laparoscopic cholecystectomy NZ Med J, 118(1210), 1317.
7. Guven HE. Liver enzymes alterations after laparoscopic cholecystectomy. J Gastro intestine liver Dis. 2007; 16(4):391-4.
8. Dr. AM Syed Ibrahim MS. Dr. Venkata Bhargava Boppana2m.S, Dr. Manivannan Palani3 M.S. Evaluation of the Effects of Laparoscopic Surgeries on Hepatic Enzymes, IOSR-JDMS, e-ISSN: 2279-0853, p-ISSN: 2279-0861. 2017; 16(8):22-28.
9. Yang W, Benjamin IS, Sherwood R, Alexander B. Correlation of endothelium dependent and -independent vasodilatation with liver function tests during prolonged perfusion of the rat liver. J Pharmacol Toxicol Methods. 1998; 40:227-234.