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Research Article

LIVER FUNCTION TEST CORRELATION WITH INSUFFLATION PRESSURE OF 12 TO 15mmHg OF CO2 PNEUMOPERITONEUM FOLLOWING LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Background: Although laparoscopy offered many advantages over laparotomy,some concerns arose over time regarding the effects of a pneumoperitoneum CO2 on liver function. The pressures of created pneumoperitoneum and its duration influences the degree of hepatic ischemia by causing elevations in liver enzymes. We aimed to investigate the effects of different insufflation pressures of CO2 pneumoperitoneum on Liver function tests following laparoscopic cholecystectomy.

Method: We randomly selected 100 patients with no other co –morbidities who were posted for laproscopic-cholecystectomy from ESIC MC PGIMSR, for this prospective study, with normal LFT preoperatively then divided into 3 groups,A,B,C where 3 different insufflation pressures used from 12 mmhg to 15mmhg. Further each group subdivided based on duration of surgery as subgroup1 with<30mins, subgroup2 with 30-90minutes, subgroup3 with 90-135 minutes and subgroup4 with>135mins.LFT(TB,DB,SGOT,SGPT) changes been studied and compared among all these groups pre and post operatively

Results: The study was based on paired t test with sig 2 tailed. The effect of Co2 on individual liver enzymes were studied in 100 Patients(n=100).Comparing Pre and post-operative TB in group 1 and subgroup 1,2,3 show p value (p=0.55),(p=0.66),(p=0.84) respectively and was insignificant.Similarly other groups and subgroups showed insignificant p value in other studied parameters as in DB, SGOT,SGPT.

Conclusion: Co2 insufflation pressure from 12-15 mmhg under studied duration has no significant effects on liver enzyme rise postoperatively. Thus CO2 is safe in creating pneumoperitoneum as in the studied pressures and duration for laparoscopic cholecystectomy

INTRODUCTION

Laparoscopic surgery is one of the most significant surgical advances of the twentieth century. This minimally invasive surgery has changed the face of General Surgery. Laparoscopy provides access to the peritoneal cavity for diagnosis and for many surgical interventions that were previously possible only by laparotomy. Its advantages are well recognized and include reduced post-operative pain, shorter length of hospital stay, more rapid recovery, reduction of complications and superior cosmetic results.[1,2,3,4]Although laparoscopy offered many advantages over laparotomy, some concerns arose regarding the effects of a pneumoperitoneum CO2 on cardiovascular and respiratory system.[5] One of the important hemodynamic changes is the transient reduction in the hepatic blood flow caused by a pneumoperitoneum[6-13]. The pressures of a created pneumoperitoneum and its duration was shown to influence the degree of hepatic ischemia by causing elevations in liver enzymes. Among other techniques for the assessment of biliary injuries, biochemical testing of liver enzymes is a common clinical practice .The sensitivity of Liver function tests in detecting obstruction in bile flow has been found to be greater than 90%[14].Any increase in their values is always a matter of concern for the clinicians and warrants further investigation to determine underlying pathology.AST and ALT are generally considered a measure of hepatocellular function. ALP levels are increased during obstruction of the biliary duct system; bilirubin levels can increase due to hemolysis or obstruction to the bile flow. Very high levels of serum transaminases can also be suggestive of CBD stone. It has been noticed that following laparoscopic surgery ,levels of certain liver enzymes rose markedly in patients who had shown normal preoperative liver function tests. This observation raised several questions----Are these changes of any clinical significance? what is the mechanism responsible?

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These changes might be attributed to hepatocellular dysfunction secondary to one or combination of CO2 pneumoperitoneum, diathermy extruding liver, branch of hepatic artery injured and general anesthesia. In this study we aimed to investigate the effects of different insufflation pressures of CO2 pneumoperitoneum on Liver function tests following laparoscopic cholecystectomy we evaluated the effect of different insufflation pressures of CO2 pneumoperitoneum on Liver function tests following laparoscopic cholecystectomy. So that, possible mechanisms and clinical significance of disturbances in liver function tests following laparoscopic cholecystectomy can be assessed. Also the occurrence and clinical significance of serial liver enzyme changes after uneventful laparoscopic cholecystectomy

MATERIALS AND METHODS

This prospective study was conducted to evaluate different insufflations pressures of CO2 on liver function tests following laparoscopic cholecystectomy. The study population constituted 100 patients, selected by computer generated random sampling from those who undergoing laparoscopic cholecystectomy in ESIC MC &PGIMSR hospital, Bangalore. Prior to selection, they underwent routine history taking, physical examination and Investigations to exclude general disability and pre existing hepatic diseases. the patients The patients selected for the study had normal values of serum liver enzymes prior to surgery. This study conducted over period from 1ST Jan 2018 to June 2019. This prospective study carried out at ESIC MC PGIMSR BANGALORE. All patients, posted for laparoscopic cholecystectomy for symptomatic gall stone disease in the age group of 18-60 years without any other comorbid illness or deranged liver function test included in the study. After getting approval, every alternate patient will be grouped as either group A, group B and C. Group A as 12mmhg and Group B as 13mmhg and group C as 15mmhg.And further each group sub classified based on duration of surgery as subgroup1 with<30mins ,subgroup2 with 30-90mins,subgroup3 with 90-135 minutes and subgroup4 with>135mins. Informed consent was taken for the study and pre-operative workup done, including pre-operative liver function test (LFT).

LFT includes total bilirubin (TB) in mg/dl, Direct bilirubin (DB) in mg/dl, serum glutamic oxalo-acetic transaminase (SGOT) [aspartate aminotransferase (AST)] in IU/L, serum glutamic pyruvic transaminase (SGPT) [alanine aminotransferase (ALT)] in IU/L and alkaline phosphatase (ALP) in IU/Land Laparoscopic cholecystectomy performed under general anesthesia. All patients received standard pre-anesthetic medication, similar induction technique and general anesthetic medication and Same protocol. For prophylaxis, single dose of injection ceftriaxone one-gram given intravenously at the time of induction.

Pneumoperitoneum then created with open Hassons technique. Pneumoperitoneum pressure kept at 12 mmHg to 15mmhg in all group patients. Ports made, one 10mm epigastric port and another 5mm right subcostal mid-clavicular port. Dissection of Calots triangle done by Maryland dissector and gall bladder grasped by Babcock forceps through the right subcostal port at Hartmann's pouch. After clipping and dividing the cystic duct and artery, gall bladder dissected from the liver bed using monopolar hook diathermy. Gall bladder removed from the umbilical port. Local anesthetic instilled in the gall bladder fossa in all cases at the end of the surgery. The total time of pneumoperitoneum recorded. All patients in post-operative period been given intravenous fluid and intravenous paracetamol injection as analgesics. Liver function test done in all cases at 24 hour of surgery and discharged form hospital either at 24 hours or at 48 hours and asked to visit the outpatient clinic after 7 days for follow up. Patient parameters, preoperative, 24 hour post-operative liver function tests then recorded.

We included all patients undergoing laparoscopic surgery at our hospitals and the patients who had given written consent only become part of the study group then the patients who were willing to comply with study protocol. Age group of patients from 18-60 years of both gender. We excluded the patients with coexisting liver diseases/preoperative deranged liver function tests and also patients that developed complications such as bile duct injury, obstruction, infection, bleeding from liver bed and high grade fever during post operative period. also Patient who had underwent ERCP and endoscopic sphincterectomy in one week before surgery or who are positive for Hepatitis B or C viruses or patients on ATT for last 6 months were excluded from the study.

Method of sampling was non-random, purposive. After admission short history was taken and physical examination was conducted on each patient admitted in surgery department with features suggestive of extrahepatic biliarylithiasis. Baseline investigations, as routinely required, were done, followed by imaging studies. Patients were then explained about their disease process and the possible line of management. All the necessary information regarding the study was explained to the patients or their valid guardian. Informed written consent was taken from the patients or their guardian willing to participate in the study. Detailed history was taken from the study group to establish proper diagnosis. Thorough physical examination was done ineachcase. Data collection sheets were filled in by the investigator.

All of the preoperative factors related to the patient were noted down in the data sheet. After proper evaluation and preparation, patients who required surgical management were taken up for surgery. Strict aseptic precautions were followed during the operation. Meticulous techniques were practiced as far as possible. The operation procedure and related preoperative factors were observed directly and recorded in the data collection sheetinstantly. After completing the collection of data it was compiled in a systematic way.

Statistical analysis

Data analysed using appropriate descriptive and inferential; statistics. The categorical type data expressed in terms of frequencies whereas the numeric continuous data as mean ±SD. All the bio- chemical markers like LFT values; total bilirubin, direct bilirubin, AST,ALT,ALP expressed as mean ±SD .in order to compare the various markers in two different groups , students paired t- test used, whereas within groups at 3 serially. For all statistical evaluations, a p- value < 0.05 was considered as statistically significant. Qualitative data also summarised using tables. Data analysed using statistical package SPSS-2.0

RESULTS

This prospective and observational study was carried out to determine the effect of co2 at different pressures and considering the duration of the surgery as well on liver

function test was studied.100 patients fulfilling the inclusion criteria from Surgery department of ESIC PGIMSR, Bangalore during the period of 1 Jan 2018 to June2019.were randomly allocated in 3 groups with A ,12mmhg (n=33) B,13mmhg (n=34),C,15 mmhg (n=33). These we have subdivided according to the pressures we have used.ref (table1)

Table 1 The gender distribution and age frequency is shown in the pie chart. In our study more than half of the patients (38%) belonging to the 26-35 age group. The male to female ratio was 1 : 4. fig1.

A n(33)12 mmhg				B n(34) 13 mmhg				C n(33) 15 mmhg			
n=15 <30 min	n=10 (30-90)min	n=8 (90-135)min	n=0 -	n=11 <30 min	n=18 (30-90)min	n=5 (90-135)min	n=0	n=7 <30 min	n=8 (30-90)min	n=10 (90-135)min	n=8 >135 min

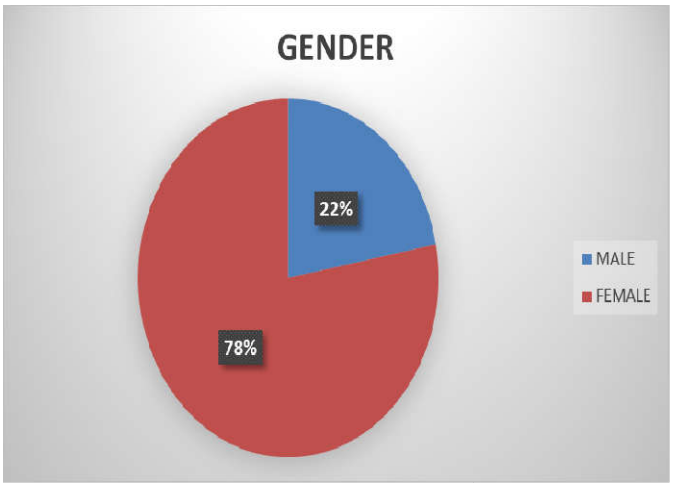

Fig 1

The post operative liver function parameters studied to be within the normal limits in all the subgroups studied and the study was insignificant, when compared to the liver function tests preoperatively.

Group A1-liver function parameters

Group =12mmhg of CO2 <30 min		Mean	Std. Deviation	p-value
Group	Pre-Total bilirubin	1.000	.7118	0.55
	Post-Total bilirubin	.786	.2911	
Pair 2	Pre-Direct bilirubin	.500	.1291	0.06
	Post-Direct bilirubin	.257	.1718	
Pair 3	Pre-Sgot	42.00	28.213	0.40
	Post-Sgot	44.86	20.812	
Pair 4	Pre-Sgpt	30.86	5.014	1.00
	Post-Sgpt	37.00	4.726	
Pair 5	Pre-ALP	48.14	15.115	0.33
	Post-ALP	54.00	26.255	

Table 2 (above) Paired t test,sig 2 tailed,p<0.05.
Group A2

12mmHg of CO2, 30-90 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.050	.4416	0.66
	Post-Total bilirubin	1.055	.3826	
Pair 2	Pre-Direct bilirubin	.268	.1359	0.89
	Post-Direct bilirubin	.227	.1352	
Pair 3	Pre-Sgot	27.86	10.025	0.14
	Post-Sgot	31.05	10.926	
Pair 4	Pre-Sgpt	28.18	8.964	0.96
	Post-Sgpt	31.86	9.135	
Pair 5	Pre-ALP	46.50	29.560	0.77
	Post-ALP	56.32	36.461	

Table 3 Paired t test ,sig.2 tailed,p<0.05
Group A3 liver function parameters

12mmHg of CO2, 90-135 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	.883	.2041	0.84
	Post-Total bilirubin	1.050	.1871	
Pair 2	Pre-Direct bilirubin	.200	.1095	0.74
	Post-Direct bilirubin	.250	.2074	
Pair 3	Pre-Sgot	22.00	8.649	0.09
	Post-Sgot	28.33	11.843	
Pair 4	Pre-Sgpt	31.33	12.323	0.73
	Post-Sgpt	34.67	12.675	
Pair 5	Pre-ALP	41.00	8.295	0.07
	Post-ALP	36.33	11.639	

Table 4 Paired t test, sig.2 tailed,p<0.05
Group B1 liver parameters

13mmHg of CO2, <30 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.100	.2404	0.11
	Post-Total bilirubin	1.000	.5164	
Pair 2	Pre-Direct bilirubin	.210	.1287	0.73
	Post-Direct bilirubin	.190	.0738	
Pair 3	Pre-Sgot	41.70	14.338	0.09
	Post-Sgot	45.70	18.827	
Pair 4	Pre-Sgpt	24.70	7.103	0.79
	Post-Sgpt	30.50	8.960	
Pair 5	Pre-ALP	38.80	21.514	0.33
	Post-ALP	34.00	21.187	

Table 5 Paired t test ,sig.2 tailed,p<0.05
Group B2 liver parameters

13mmHg of CO2, 30-90 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.244	.6643	0.44
	Post-Total bilirubin	1.150	.4033	
Pair 2	Pre-Direct bilirubin	.425	.2817	0.16
	Post-Direct bilirubin	.219	.1109	
Pair 3	Pre-Sgot	29.56	10.462	0.98
	Post-Sgot	29.94	8.675	
Pair 4	Pre-Sgpt	31.38	10.494	0.09
	Post-Sgpt	35.69	10.378	
Pair 5	Pre-ALP	73.56	83.820	0.07
	Post-ALP	63.06	41.000	

Table 6 Paired t test, sig.2 tailed, p<0.05
Group B3 liver parametrs

13mmHg of CO2, 90-135min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.100	.1000	0.22
	Post-Total bilirubin	1.067	.1528	
Pair 2	Pre-Direct bilirubin	.300	.2000	0.57
	Post-Direct bilirubin	.233	.1528	
Pair 3	Pre-Sgot	24.67	15.535	0.66
	Post-Sgot	27.67	13.650	
Pair 4	Pre-Sgpt	21.33	8.083	0.74
	Post-Sgpt	24.00	10.583	
Pair 5	Pre-ALP	43.67	11.060	0.33
	Post-ALP	36.33	17.616	

Table 7 Paired t test, sig.2 tailed,p<0.05
Group C1 liver parameters

15 mmHg CO2, <30 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.300	.1897	0.47
	Post-Total bilirubin	1.350	.2168	
Pair 2	Pre-Direct bilirubin	.467	.1506	0.55
	Post-Direct bilirubin	.383	.1722	
Pair 3	Pre-Sgot	29.83	12.368	0.67
	Post-Sgot	30.33	10.614	
Pair 4	Pre-Sgpt	31.83	6.940	0.87
	Post-Sgpt	31.00	10.237	
Pair 5	Pre-ALP	63.17	44.969	0.90
	Post-ALP	66.67	25.256	

Table 8 Paired t test, sig.2 tailed, p<0.05
Group C2 liver parameters

15mmHg of CO2, 30-90 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.095	.2609	0.77
	Post-Total bilirubin	1.055	.4183	
Pair 2	Pre-Direct bilirubin	.418	.2302	0.88
	Post-Direct bilirubin	.291	.1797	
Pair 3	Pre-Sgot	33.59	17.676	0.63
	Post-Sgot	30.23	12.459	
Pair 4	Pre-Sgpt	35.50	18.436	0.56
	Post-Sgpt	33.50	14.172	
Pair 5	Pre-ALP	48.50	30.588	0.73
	Post-ALP	51.05	19.692	

Table 9 Paired t test, sig.2 tailed,p<0.05
Group C3, liver parameters

15mmHg of CO2, 90-135 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	1.250	.5196	0.33
	Post-Total bilirubin	1.050	.3317	
Pair 2	Pre-Direct bilirubin	.375	.2217	0.24
	Post-Direct bilirubin	.375	.2872	
Pair 3	Pre-Sgot	44.25	24.088	0.13
	Post-Sgot	41.50	20.551	
Pair 4	Pre-Sgpt	28.75	11.117	0.84
	Post-Sgpt	34.75	22.824	
Pair 5	Pre-ALP	30.25	13.074	0.66
	Post-ALP	32.75	16.681	

Table 10 Paired t test, sig.2 tailed,p<0.05
Group C4

15mm of CO2, >135 min		Mean	Std. Deviation	p-value
Pair 1	Pre-Total bilirubin	.867	.1155	0.77
	Post-Total bilirubin	.967	.4619	
Pair 2	Pre-Direct bilirubin	.300	.2646	0.53
	Post-Direct bilirubin	.167	.0577	
Pair 3	Pre-Sgot	29.33	15.885	0.11
	Post-Sgot	31.67	17.559	
Pair 4	Pre-Sgpt	25.67	18.175	0.08
	Post-Sgpt	18.00	7.000	
Pair 5	Pre-ALP	24.67	13.614	0.12
	Post-ALP	24.00	15.100	

Table 11. Paired t test ,sig.2 tailed,p<0.05

DISCUSSION

This prospective study was conducted among 100 purposively selected patients with evidence of cholelithiasis in department of General Surgery, ESIC MC PGIMSR and Hospital. Since ages there were always concern regarding the effect of pneumoperitoneum on various systems of human body and one such important hemodynamic changes was its on liver functions .Changes in the serum liver enzymes in laparoscopic surgery rather than open surgery has been reported before[29-34]. This study was mainly carried out with a view to determine the effect of CO2 as pneumoperitoneum on liver functions during laparoscopic cholecystectomy. In view of determining its importance as it have no such role in raising the liver enzymes in our study. Age of 100 patients who were part of study group ranged from 26-77 years. Most of the patients were in between 26-35 years; with mean age 30years . 22% of the patients were males while 78% of the patients were females. The male to female ratio was ~ 1: 4.females are predominating in our study.

The study is based on paired t test with sig 2 tailed. The effect of Co2 on individual liver enzymes were studied. Patients were classified based on insufflation pressure used as group1 with 12mmhg ,group 2 with 13mmhg and group 3 with 15mmhg and further they were subclassified .Based on duration of surgery again each groups were classified as subgroup 1<30min,subgroup 2:30-90 min, subgroup 3:90-135 min, sub group 4:>135 min.

In our study ;Preoperative T.B.in group A and A 1 shows mean value of 1.000 and standard deviation of 0.7118 and post op T.B. mean value of 0.786 and SD of 0.2911 with P-value 0.55. Pre operative T B in group B and B 2 with mean 1.050 and SD 0.4416 and post operative T B with mean 1.055 and SD 0.3826 with P value 0.66.

Preoperative T B in group A and A 3 with mean 0.883 and SD 0.2041 and post operative T B with mean 1.050and SD 0.1871and P value 0.84 similarly in group B with subgroup 1,2,3 showed P value of 0.11 , 0.44and 0.22 respectively. Preoperative DB in group A,B,C and subgroup 1,2,3 all the parameters showed the insignificant P value .and however even the other parameters like SGOT,SGPT and ALP in all the groups and subgroups showed insignificant P value as described in the tables.

This study was intended to assess the presence and clinical significance of unexplained disturbances in the liverenzymes following uneventful laparoscopic cholecystectomy. In our study with sample size of 100,was found that no significant postoperative rise in the liver enzymes were noted both with respect to the insufflation pressure as well as with respect to the duration of surgery. But however in some of the previous studies ,significant transient rise in the liver enzymes were noted and the postulated mechanisms for the same includes:

The ‘squeeze pressure effect on the liver by the traction of gallbladder may free these enzymes into the blood stream. however this should be studied using animal model to determine the response

Prolonged use of diathermy to the liver surface and spread of heat to the liver parenchyma.[35-41]Pulling on gall bladder creates a transient kink in the extra hepatic ducts ,which could induce an increase in the endoluminal pressure. After general anesthesia due to changes in splanchnic blood flow and oxygen consumption[42-50]Combination of more than one causes. But however in our study we could not arrive at the possible mechanism as we did not notice any significant change in the liver enzymes in a postoperative period in a patient who underwent laparoscopic cholecystectomy. Thus it requires study to be conducted in a large series of patients to determine the clinical implication of effect of co2 pneumoperitoneum on liver function test to be of any precision.

Limitations of Our Study

1. As our study has been carried out over a limited period of time with a limited number of patients,it could not have been large enough to be of reasonable precision.
2. All the facts and figures mentioned here may considerably vary from those of large series covering wide range of time, but still then, as the cases of our study were collected from a tertiary level hospital.
3. Emergency cases were not included in our study.
4. The amount of litres of CO2 consumed were not taken into consideration

CONCLUSION

This prospective type of study was conducted in department of General Surgery, ESIC MC PGIMSR Hospital, Bangalore,. It can be concluded from the findings of the study that usage of CO2 as pneumoperitoneum in laparoscopic cholecystectomy has no significant effect on post operative liver enzymes. It can also be concluded from our study that variation in insufflation pressure from 12 to 15 mmhg has no effect on enzyme rise significantly.

It can be observed from our study that duration of surgery as in this study with co2 pneumoperitoneum also has no effect on postoperative LFT level. Thus co2 is safe in creating pneumoperitoneum and thus can be safely used in laparoscopic surgeries

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