Section: General Surgery

Original Research Article

A COMPARISON STUDY ON EFFECT OF LOW PRESSURE VERSUS HIGH PRESSURE PNEUMO PERITONEUM ON LIVER FUNCTIONS AND OPERATIVE FIELD VISIBILITY IN LAPAROSCOPIC CHOLECYSTECTOMIES IN A TERTIARY CARE CENTRE

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Abstract

Background: We have compared low pressure versus high pressure pneumoperitoneum effects in laparoscopic cholecystectomy. **Materials and Methods:** 60 patients with gallstones admitted in Government Stanley medical College for laparoscopic cholecystectomy were divided into two groups of 30 each. Evaluation of outcome was based on postoperative liver enzymes levels, shoulder tip pain, abdomen pain, vomiting, operative field visibility. **Result:** Both groups had post-operative abdominal pain, shoulder tip pain, vomiting. **Conclusion:** Even though there is transient elevation of liver enzymes levels, high pressure pneumoperitoneum has better operative field visibility.

INTRODUCTION

The gall bladder is one of the accessory organs of the digestive tract, which helps in storing and concentrating bile in between the meals. The gall bladder undergoes contraction and causes release of bile into the small intestine, in response to feeding. The bile acids thus enter the lumen of intestine and facilitate the absorption of lipids. Normally, most of the bile acids (approximately 95%) are undergoes reabsorption from the intestine into portal vein, which are taken up by the hepatocytes and are re-excreted back into the bile. The gall bladder, through its motor function, greatly influences the inflow of bile into the intestine and thereby helps in enterohepatic circulation of the bile acids. The unique absorption and secretory capacities of the gall bladder helps in contribution to the composition of bile flowing into large bile ducts and then into the intestine. The gall bladder undergoes functional and structural changes in many pathological conditions, including gallstone disease. [1-8]

There are almost more than 50 different techniques of laparoscopic cholecystectomy available in the literature.[9] It is mainly due to modifications by the surgeons in view of improving the postoperative outcome of the patients and cosmesis. These modifications are the reduction in port size or/and number of ports than that is used in standard laparoscopic cholecystectomy. As there is no uniform nomenclature to explain these different techniques, it is impossible to compare the outcomes of these different techniques. [10-15]

Laparoscopic cholecystectomy was introduced in 1989. Now, it has become the gold standard treatment for gall stones. The technique of performing laparoscopic cholecystectomy has undergone several changes and variations. Most of the surgeons have tried to reduce the number and size of the ports in order to improve the cosmetic and postoperative outcomes. The most recent development in laparoscopic cholecystectomy technique is SILS (Single Incision Laparoscopic Surgery) or SSLC (Single Site Laparoscopic Cholecystectomy). [16-20]

Aim and Objectives

The purpose of the study is,

- To compare the postoperative abdomen pain
- To compare the postoperative liver function
- To compare the postoperative shoulder tip pain and vomiting
- To compare the visibility of the operative field between the two groups.

MATERIALS AND METHODS

A prospective comparative study was conducted on 60 patients who had underwent laparoscopic cholecystectomy for symptomatic cholelithiasis in

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Government Stanley medical college and hospital during the study period between April 2021 and August 2022. The patients were chronologically divided into two groups of intervention applying the inclusion and exclusion criteria.

Inclusion Criteria

- Patients giving informed consent for the procedure.
- Patients with or without co-morbidities.
- Patient aged more than 18 years of age for all the genders.

Exclusion Criteria

- Denial of consent
- Patients with acute severe pancreatitis.
- Patients with biliary tract surgery, post ERCP, gall stone related complications like cholangitis, Mirizzi syndrome, etc.
- Patients with per-op / post-op bile duct injury.
- Patients on chemotherapy, immunotherapy and long-term steroids
- Hepatic, renal and immunological insufficiencies
- Patients with hematological disorders.

Pre-operative assessment

History

- Onset and duration of symptoms.
- Location of symptoms.
- Character of symptoms
- Aggravating or reliving factors
- History of abdominal distension
- History of itching
- History of vomiting – quality and quantity
- History of yellowish discoloration of urine / eyes.
- History of black colored stools.
- History of weight loss / weight gain
- History of physical activity.

Past History

- History of similar illness in the past.
- History of co-morbidities such as type 2 diabetes mellitus, systemic hypertension, hypothyroidism, pulmonary tuberculosis, cardiac diseases.
- History of previous surgeries.

Personal History

- Type of diet
- sleep and appetite
- Bowel and bladder habits
- Alcohol or smoking
- Any other drug abuses

Family History

- History of similar illness in the family.

Treatment History

- History of intake of drugs such as oral contraceptive pills, or any other forms of estrogens and progestogens.

General Examination

After obtaining consent, the patients were examined in a well-lit room, for the following.

- Pallor
- Icterus
- Cyanosis
- Clubbing
- Pedal oedema
- Generalized lymphadenopathy
- Vital signs
    - Blood pressure
    - Pulse rate
    - Respiratory rate
    - Temperature
    - Oxygen saturation

Systemic Examination:

- CVS
- RS
- CNS

Per abdomen Examination

Inspection

- Umbilicus – number and position
- All quadrants movement with respiration
- Visible gastric / intestinal peristalsis
- Visible mass
- Visible dilated veins
- Scars, sinuses
- Hyper or hypo pigmentations
- Hernial orifices
- Flanks
- Left supraclavicular fossa fullness
- External genitalia

Palpation

- Warmth
- Tenderness
- Rebound tenderness
- Guarding
- Rigidity
- Palpable mass
- Organomegaly
- Other inspectory findings confirmation with palpation

Percussion

- Liver dullness- obliterated / not obliterated
- Evidence of free fluid

Auscultation

- Bowel sounds – present / absent

Digital Rectal Examination

- Fecal staining
- Rectal and anal mucosa
- Fissure / Fistula
- Hemorrhoids

Investigations

- Neither laboratory nor radiographic studies are recommended for patients without any abnormalities on history or physical examination.
- However, workup is essential for symptomatic patients.

The laboratory evaluation includes,

- Complete hemogram
- Liver function tests
- Thyroid function tests
- Serum amylase, lipase levels.

Radiological Investigations

- Abdominal USG – investigation of choice

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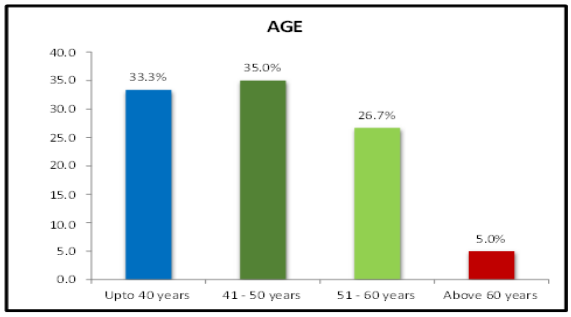
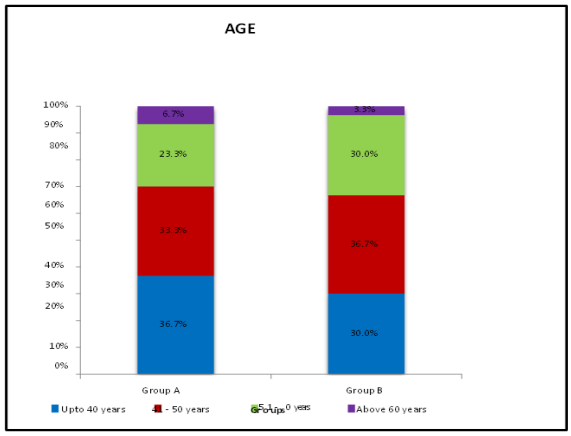
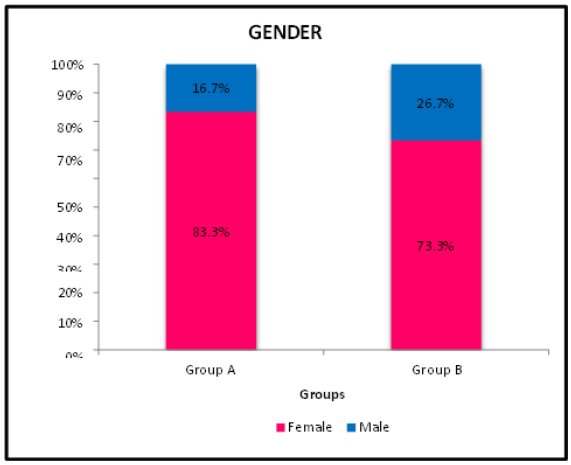
- CECT- abdomen
- MRCP – Gold standard

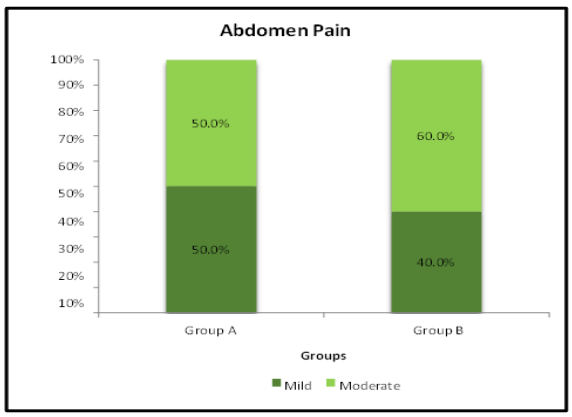
RESULTS

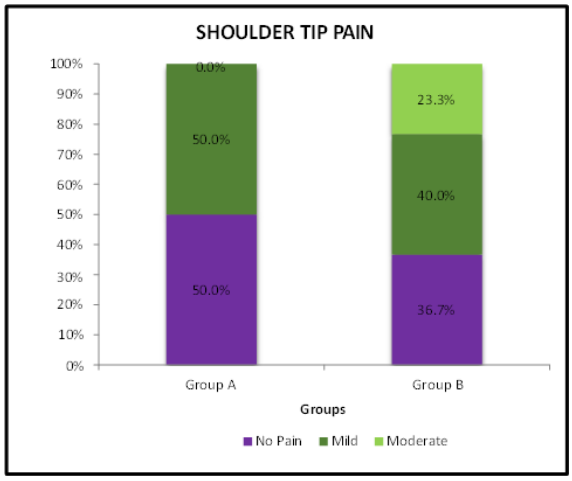
The collected data were analyzed with IBM SPSS Statistics for Windows, Version 23.0(Armonk, NY: IBM Corp), to describe about the data descriptive statistics frequency analysis, percentage analysis was used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in independent groups the independent sample t-test was used. To find the significance in qualitative categorical data Chi-Square test was used. In both the above statistical tools the probability value .05 is considered as significant level.

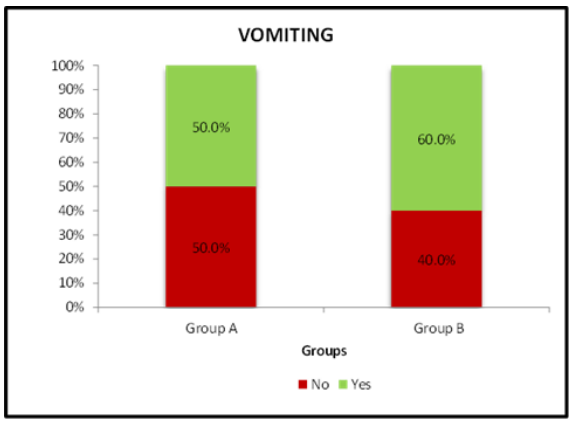


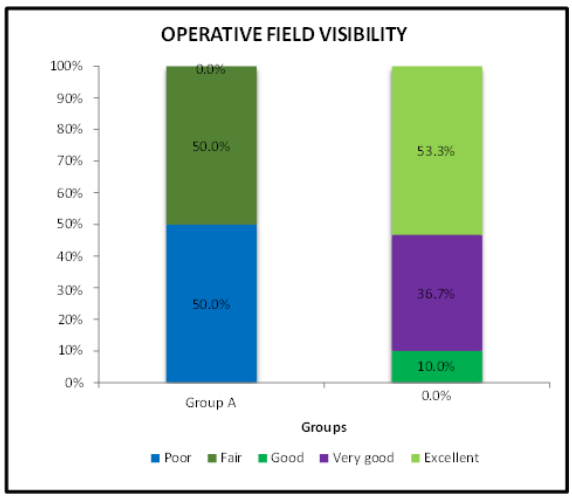












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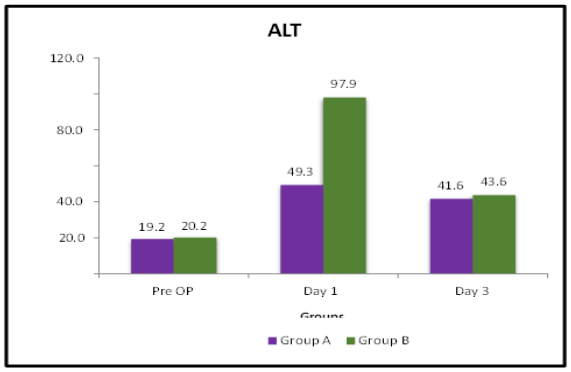

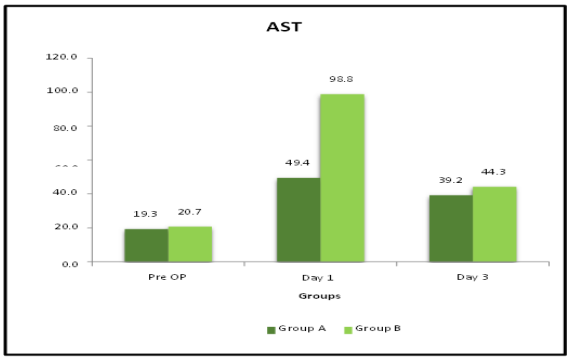

Table 1: Age distribution

Age		
	Frequency	**Percent**
Up to 40 years	20	33.3
41 - 50 years	21	35.0
51 - 60 years	16	26.7
Above 60 years	3	5.0
Total	60	100.0

The above table shows Age distribution were 33.3% is Up to 40 years, 35.0% is 41-50 years, 26.7% is 51-60 years and 5.0% above 60 years.

Table 2: Gender distribution

Gender		
	Frequency	**Percent**
Female	47	78.3
Male	13	21.7
Total	60	100.0

The above table shows Gender distribution were 78.3% are female, 21.7% are Male.

Table 3: Comparison between Age with Groups by Pearson's Chi-Square test

Age		**Groups**		**Total**	**χ 2 -value**	**p-value**
		Group A	**Group B**			
Up to 40 years	Count	11	9	20	0.831	0.842 #
	%	36.7%	30.0%	33.3%		
41 – 50 years	Count	10	11	21		
	%	33.3%	36.7%	35.0%		
51 – 60 years	Count	7	9	16		
	%	23.3%	30.0%	26.7%		
Above 60 years	Count	2	1	3		
	%	6.7%	3.3%	5.0%		
Total	Count	30	30	60		
	%	100.0%	100.0%	100.0%		
# No Statistical Significance at p > 0.05 level						

The above table shows comparison between Age with Groups by Pearson's Chi-Square test were $\chi 2=0.831$, $p=0.842>0.05$ which shows no statistical significance association between Age and Groups.

Table 4: Comparison between Gender with Groups by Pearson's Chi- Square test

Gender		**Groups**		**Total**	**χ 2 - value**	**p-value**
		Group A	**Group B**			
Female	Count	25	22	47	0.884	0.347 #
	%	83.3%	73.3%	78.3%		
Male	Count	5	8	13		
	%	16.7%	26.7%	21.7%		
Total	Count	30	30	60		
	%	100.0%	100.0%	100.0%		
# No Statistical Significance at p > 0.05 level						

The above table shows comparison between Gender with Groups by Pearson's Chi-Square test were $\chi 2=0.884$, $p=0.347>0.05$ which shows no statistical significance association between Gender and Groups.

Table 5: Comparison between Abdomen Pain with Groups by Pearson's Chi-Square test

Abdomen Pain		**Groups**		**Total**	**χ 2 - value**	**p-value**
		Group A	**Group B**			
Mild	Count	15	12	27	0.606	0.436 #
	%	50.0%	40.0%	45.0%		

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Moderate	Count	15	18	33		
	%	50.0%	60.0%	55.0%		
Total	Count	30	30	60		
	%	100.0%	100.0%	100.0%		
# No Statistical Significance at p > 0.05 level						

The above table shows comparison between Abdomen Pain with Groups by Pearson's Chi-Square test were $\chi 2=0.606$, $p=0.436>0.05$ which shows no statistical significance association between Abdomen Pain and Groups.

Table 6: Comparison between Shoulder Tip Pain with Groups by Pearson's. Chi-Square test.

Shoulder Tip Pain		**Groups**		**Total**	**χ 2 - value**	**p- value**
		Group A	**Group B**			
No Pain	Count	15	11	26	7.949	0.019 *
	%	50.0%	36.7%	43.3%		
Mild	Count	15	12	27		
	%	50.0%	40.0%	45.0%		
Moderate	Count	0	7	7		
	%	0.0%	23.3%	11.7%		
Total	Count	30	30	60		
	%	100.0%	100.0%	100.0%		
* Statistical Significance at p < 0.05 level						

The above table shows comparison between Shoulder Tip Pain with Groups by Pearson's Chi-Square test were $\chi 2=7.949$, $p=0.019<0.05$ which shows statistical significance association between Shoulder Tip Pain and Groups.

Table 7: Comparison between Vomiting with Groups by Pearson's Chi- Square test.

Vomiting		**Groups**		**Total**	**χ 2 - value**	**p- value**
		Group A	**Group B**			
No	Count	15	12	27	6.944	0.008**
	%	50.0%	40.0%	45.0%		
Yes	Count	15	18	33		
	%	50.0%	60.0%	55.0%		
Total	Count	30	30	60		
	%	100.0%	100.0%	100.0%		
** Highly Statistical Significance at p < 0.01 level						

The above table shows comparison between Vomiting with Groups by Pearson's Chi-Square test were $\chi 2=6.944$, $p=0.008<0.01$ which shows highly statistical significance association between Vomiting and Groups.

Table 8: Comparison between Operative Field Visibility with Groups by Pearson's Chi-Square test.

Operative Field Visibility		**Groups**		**Total**	**χ 2 - value**	**p-value**
		Group A	**Group B**			
Poor	Count	15	0	15	60.000	0.0005 **
	%	50.0%	0.0%	25.0%		
Fair	Count	15	0	15		
	%	50.0%	0.0%	25.0%		
Good	Count	0	3	3		
	%	0.0%	10.0%	5.0%		
Very good	Count	0	11	11		
	%	0.0%	36.7%	18.3%		
Excellent	Count	0	16	16		
	%	0.0%	53.3%	26.7%		
Total	Count	30	30	60		
	%	100.0%	100.0%	100.0%		
** Highly Statistical Significance at p < 0.01 level						

The above table shows comparison between Operative Field Visibility with Groups by Pearson's Chi-Square test were $\chi 2=60.000$, $p=0.0005<0.01$ which shows highly statistical significance association between Operative field Visibility and Groups.

Table 9: Comparison of ALT with Groups by Unpaired t-test

ALT	**Groups**	**N**	**Mean**	**S. D**	**t-value**	**p-value**
Pre- OP	Group A	30	19.2	4.3	0.918	0.362 #
	Group B	30	20.2	3.5		
Day 1	Group A	30	49.3	5.6	16.205	0.0005**
	Group B	30	97.9	15.5		
Day 3	Group A	30	41.6	5.4	1.459	0.150 #
	Group B	30	43.6	5.2		
# No Statistical Significance at p > 0.05, ** Highly Statistical Significance at p < 0.01						

The above table shows comparison of ALT with Groups by Unpaired t- test. In comparison of Day 1 with Groups were t-value=16.205, p- value=0.0005<0.01 which shows highly statistically significant difference at p <0.01 level whereas all the other time durations show no statistically significant difference at p>0.05 level.

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Table: 10 Comparison of AST with Groups by Unpaired t-test

AST	Groups	N	Mean	S. D	t-value	p-value
Pre-op	Group A	30	19.3	3.8	1.590	0.117 #
	Group B	30	20.7	2.9		
Day 1	Group A	30	49.4	5.5	26.268	0.0005**
	Group B	30	98.8	8.7		
Day 3	Group A	30	39.2	5.1	4.100	0.0001**
	Group B	30	44.3	4.4		
# No Statistical Significance at p > 0.05, ** Highly Statistical Significance at p < 0.01						

The above table shows comparison of AST with Groups by Unpaired t- test. In comparison of Day 1 with Groups were t-value=26.268, p- value=0.0005<0.01 which shows highly statistically significant difference at p <0.01 level. Similarly, in comparison of Day 3 with Groups were t-value= 4.100, p=0.0001<0.01 which shows highly statistically significant difference at p < 0.01 level whereas all the other time durations show no statistically significant difference at p>0.05 level.

Summary

Age distribution was 33.3% in up to 40 years, 35.0% in 41-50 years, 26.7% in 51-60 years and 5.0% in above 60 years.

Gender distribution was 78.3% are Female, 21.7% are Male.

Age with Groups by Pearson's Chi-Square test was $\chi 2$=0.831, p=0.842>0.05 which shows no statistical significance association between Age and Groups.

Gender with Groups by Pearson's Chi-Square test was $\chi 2$=0.884, p=0.347>0.05 which shows no statistical significance association between Gender and Groups.

Abdomen Pain with Groups by Pearson's Chi-Square test was $\chi 2$=0.606, p=0.436>0.05 which shows no statistical significance association between Abdomen Pain and Groups.

Shoulder Tip Pain with Groups by Pearson's Chi-Square test was $\chi 2$=7.949, p=0.019<0.05 which shows statistical significance association between Shoulder Tip Pain and Groups.

Vomiting with Groups by Pearson's Chi-Square test were $\chi 2$=6.944, p=0.008<0.01 which shows highly statistical significance association between Vomiting and Groups.

Operative Field Visibility with Groups by Pearson's Chi-Square test was $\chi 2$=60.000, p=0.0005<0.01 which shows highly statistical significance association between Operative field Visibility and Groups.

ALT with Groups by Unpaired t-test. In comparison of Day 1 with Groups were t-value=16.205, p-value=0.0005<0.01 which shows highly statistically significant difference at p <0.01 level whereas all the other time durations show no statistically significant difference at p>0.05 level.

AST with Groups by Unpaired t-test. In comparison of Day 1 with Groups were t-value=26.268, p-value=0.0005<0.01 which shows highly statistically significant difference at p <0.01 level. Similarly, in comparison of Day 3 with Groups were t-value= 4.100, p=0.0001<0.01 which shows highly statistically significant difference at p < 0.01 level whereas all the other time durations show no statistically significant difference at p>0.05 level.

DISCUSSION

Our study was conducted in 60 patients who presented to General Surgery OPD, Government Stanley medical college with gall bladder disorders. The significance of the study is to clarify which pressure to use whether high pressure or low pressure in creating pneumoperitoneum while performing laparoscopic cholecystectomies in terms of liver function tests, surgeon's operative field visibility score and patient's pain score. Only patients giving informed consent for the procedure, patients with or without co-morbidities, patients aged more than 18 years of age for all the genders were included in this study.[21]

These patients were allowed into two groups as, odd serial numbers into group A and even serial number patients to group B. Group A underwent laparoscopic cholecystectomy in low pressure pneumoperitoneum whereas Group B underwent the same in high pressure pneumoperitoneum.[22]

Evaluation of outcome was based on liver enzymes, postoperative shoulder tip pain, abdomen pain, vomiting, operative field visibility. The patients were evaluated preoperatively for liver enzymes and then compared post operatively taken on day 1 and day 3 of surgery in both the groups.[23]

The observations from the study are as follows. The most common age group being operated is between 41 and 50 years constituting for 35%. Out of 60 patients, 47 were female which accounts to about 78.3%. Post operatively all 60 patients had abdomen pain on day 1. Among Group A patients, 50% had mild and 50% had moderate severity in pain. Among Group B patients, 40% had mild and 60% had moderate severity in pain. The p-value between these two groups with respect to abdomen pain was found to be 0.436 and hence it was considered statistically insignificant. Next, the patients were evaluated for postoperative shoulder tip pain. In Group A, 50% had shoulder tip pain whereas 63.3% had shoulder tip pain among Group B patients. The p-value among these two groups with respect to shoulder tip pain was found to be 0.019, making it statistically significant. Next, the patients were evaluated for postoperative vomiting. In Group A, 50% had postoperative vomiting whereas 60% had vomiting among Group B

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patients. The p-value among these two groups with respect to postoperative vomiting was found to be 0.008, making it statistically highly significant. The operative field visibility in two groups were then compared based on experience with surgeons according to categorical grading scale as poor, fair, good, very good and excellent. Among Group A, 50% had poor and remaining 50% had fair operative field visibility, making it difficult for the surgeons during operative procedure. Whereas, 53.3%, 36.7% and 10% had excellent, very good and good operative field visibility respectively among Group B patients, thus making it comfortable for the surgeons. The p-value between these two groups with respect to operative field visibility was found to be 0.0005 and hence it was considered statistically highly significant. All the above comparisons were done using Pearson's Chi-Square test.[24]

Next, the liver enzymes Alanine Transaminase (ALT) and Aspartate Transaminase (AST) were evaluated preoperatively, day 1 and 3 of surgery among both the groups. The comparison between the two groups with respect to liver enzymes were done using Unpaired t-test. There was a significant rise in ALT levels in Group B patients but within normal limits. Similarly, there was significant rise in AST levels in Group B patients but found within normal limits.[25]

CONCLUSION

Laparoscopic cholecystectomy is the removal of gall bladder through minimally invasive ports, for the various indications. This can be done either at low pressure or at high pressure pneumoperitoneum. Accordingly, the patients were divided into two groups and analysed for various parameters that will affect the outcome of the surgery. Though the enzyme levels are raised in Group B, they are within the normal limits. Since the operative field visibility is better in Group B patients, it is concluded that high pressure pneumoperitoneum is safe while performing laparoscopic cholecystectomies in a tertiary care centre as it comforts the surgeon providing adequate visibility and thereby decreasing the chances of adjacent structures injury. However, patients from both the groups had vomiting, abdominal pain, shoulder tip pain which were statistically significant. This can be investigated in a study with more sample size and also in Multi Centre studies.

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