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Comparative Evaluation Of Derangement Of Hepatic Functions In Cholelithiasis Patients In The Postoperative Period As Compared To Preoperative Status Of Patients Undergoing Different Forms Of Cholecystectomy

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Abstract:

Introduction: Cholelithiasis or gallstones are hardened deposits of digestive fluid that is formed in the gall bladder. Open cholecystectomy and laparoscopic cholecystectomy are the surgical interventions done to remove gall bladder in these cases. During investigations of these cases of cholelithiasis it is often found that there is significant alteration in liver function test depending upon different forms of cholecystectomy i.e, open and laparoscopic cholecystectomy which produces sometimes symptomatic and sometimes asymptomatic biochemical changes in the body.

Aim: To compare the effect of different forms of cholecystectomies (conventional and laparoscopic cholecystectomy) on derangement of hepatic functions in postoperative period as compared to preoperative status in cholelithiasis patients.

Material and method: The study was conducted with a series of 100 cases of chronic calculus cholecystitis with or without choledocholithiasis. Patients were selected from surgical outpatient department of RIMS, Ranchi. The tenure of study was from October 2019 to September 2021. Liver function tests was conducted preoperatively, at deflation, on the 1st postoperative day and on the 7th postoperative day of all the patients. All the patients had their preoperative liver function test values within normal limits. 50 patient went under conventional cholecystectomy and 50 under laparoscopic cholecystectomy.

Result: In this study in Conventional cholecystectomy elevation of bilirubin was about 16% and 8% at deflation and on 1st postoperative day respectively. Elevation in AST was 20% and 40% at deflation and on 1st postoperative day respectively. Elevation in ALT was 40% and 32% at deflation and on 1st postoperative day respectively. There was no change in levels of alkaline phosphatase and albumin. In Laparoscopic cholecystectomy elevation in level of bilirubin was 36% and 20% at deflation and on 1st postoperative day respectively. Elevation in level of AST was 80% and 84% at deflation and on 1st postoperative day respectively. Elevation in level of ALT was 60% and 70% at deflation and on 1st postoperative day respectively. Elevation in alkaline phosphatase was 10% each at deflation and on 1st postoperative day. There was no change in levels of albumin. All the cases with abnormal values returned to baseline on 7th postoperative day.

Conclusion: This study showed that postoperative serum bilirubin, AST and ALT levels were raised significantly in laparoscopic cholecystectomy as comparison to in conventional cholecystectomy. Elevation in level of serum alkaline phosphatase in laparoscopic cholecystectomy was relatively less with no elevation in level albumin. Levels of alkaline phosphatase and albumin remain same in conventional cholecystectomy. All the deranged parameters normalized within 7 days of operation. The reason of this derangement in laparoscopic cholecystectomy is the pneumoperitonium related intrabdominal hypertension .

Keywords: Cholecystectomy, laparoscopic, pneumoperitonium, liver function tests.

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I.INTRODUCTION

Cholecystectomy is the most common major abdominal procedure performed in Western countries. Carl Langenbuch performed the first successful cholecystectomy in 1882 and for 100 years it was the standard treatment for symptomatic gallbladder stones. Open cholecystectomy was a safe and effective treatment for both acute and chronic cholecystitis. Minimally invasive surgery has rapidly evolved as a major speciality since laparoscopic cholecystectomy was first performed in March, 1987 by Mouret, in Lyon, France. Laparoscopic cholecystectomy has certainly revolutionised general surgery and in a very short span of time has become the gold standard in gall bladder surgery. Born in secrecy and developed under an atmosphere of scepticism and hostility, laparoscopic cholecystectomy triumphed and was quickly accepted (R. David Rosin 1997). The concept of minimally invasive surgery aims to "minimize the trauma of any interventional process but still achieve a satisfactory therapeutic result". The key feature of minimal access surgery is that it produces significantly less trauma than conventional procedures (Malley C and Cunningham A.J 2001). It not only supplanted open cholecystectomy, but also more or less ended attempts for non-invasive management of gallstones, such as extracorporeal shock wave and bile salt therapy. Minimally access surgery has changed the face of general surgery with a goal to perform standard, classical open surgical procedures via laparoscope to make the operative procedure more patient-friendly. Laparoscopic surgery allows a better access to coelomic cavity for both diagnostic and therapeutic surgical procedures which were previously possible through laparotomy alone. The procedure of laparoscopic cholecystectomy operation involves the creation of an artificial pneumoperitonium with the assistance of carbon dioxide insufflation to minimise visceral injury during trocar insertion, it also allows for the easy manoeuvrability of instruments and also to enable the use of diathermy. With growing surgical expertise and continuing improvements in technology, laparoscopic cholecystectomy is being performed on a much broader patient population like in elderly patients with multiple co morbid conditions, the very young, morbidly obese as well as on pregnant women. Serious complications are rare with mortality rate of about 0.1%. However, laparoscopic cholecystectomy is associated with a higher rate of injury to the bile ducts. When important anatomic structures cannot be clearly identified or when no progress is made over a set period of time, a conversion to an open procedure is usually indicated. In the elective setting, conversion to an open cholecystectomy is about 5% and in complicated gallstone the incidence of conversion is 10 to 30%.

The major benefits of minimally access cholecystectomy technique include: minimal tissue trauma, subsequent decreased incidence of intrabdominal adhesions, less post operative pain, decreased duration of stay in hospital, early resumption to work, improved cosmesis and quality of life. Today majority of gall bladder removal (>90%) are being performed by laparoscopic technique. A temporary rise in intra-peritoneal pressure following CO_2 insufflation during laparoscopic cholecystectomy is seen to be causing only the minimal detrimental effects. Numerous recent articles have shown that the level of serum liver enzymes rise significantly following laparoscopic procedures, which might be attributed to altered hepatic and splanchnic circulation, therefore explaining the intention of our study. The extent of rise in serum level of these liver enzymes has been demonstrated to be directly related to the pressure level created, thereby seen more in high-pressure pneumoperitonium. This temporary rise of liver enzymes during laparoscopic cholecystectomy is usually self-limiting and is generally not marker of any complication in patients having normal hepatic function. The clinical observation of significant change in serum level of certain hepatic enzymes in majority of patients with previous normal hepatic function raises several questions like if there is any clinical significance of these changes in liver function tests, mechanism responsible, is there any role of laparoscopic technical modifications to prevent these changes? Temporary rise of hepatic enzymes has shown no evident clinical implication in most patients however, in patients with preoperative poor liver functions, surgery via laparoscopic method might not be the optimal choice. Present prospective clinical study is being conducted to compare the derangement in serum hepatic enzymes in different types of cholecystectomy procedures.

II.MATERIALS AND METHODS

This prospective clinical study was conducted in a series of 100 cases of chronic calculus cholecystitis with or without choledocholithiasis. Patients were selected from the surgical outpatient department of Rajendra Institute of Medical Sciences, Ranchi. The tenure of this study was from October 2019 to September 2021. A

detailed clinical history was taken from each patient to ascertain the diagnosis of chronic calculus cholecystitis with or without choledocholithiasis without any past or present evidence of common bile duct obstruction. Particular features were noted-

1.Type of pain- Character, site, radiation, duration, relation with food and aggravating and relieving factors.

2.H/o jaundice.

3.H/o fever with chills and rigor (cholangitis).

Clinical examinations were done. After clinically confirming the case investigations were carried out (imaging and blood tests). Ultrasonography of full abdomen was done to confirm the diagnosis. It demonstrated the presence of calculi, size of gall bladder, pre cholecystectomy inflammation, thickness of the gall bladder wall, width of the common bile duct and if any stone/ sludge was present in it. It also gave information regarding the condition of the liver and the kidney. Routine blood tests were conducted that is haemoglobin percent, TLC, DLC, ESR and blood sugar. Liver function tests -serum bilirubin, AST, ALT, alkaline phosphatase and albumin were done of all the cases to exclude any liver disorder or CBD obstruction. Renal function tests- routine urine examination, serum urea, creatinine and creatinine clearance were done in all the patients to exclude any renal compromise. ECG and chest X-ray was also done as part of routine investigation.

Inclusion criteria:

1.Symptomatic.

2.No history of jaundice.

3.No history of urinary trouble.

4.USG showed gall bladder with normal CBD diameter with or without presence of calculi in CBD.

5.Liver function tests reports were within normal range .i.e, Serum bilirubin <= 0.8 mg/dl, AST- upto 40 IU/L per at 37° Celsius, ALT- upto 40 IU/L at 37° degrees Celsius, Alkaline phosphatase- 65-306 U/L and Albumin- 3.5-5.5 gm/dl.

6.Renal function tests were within the normal limits.

III. Surgical methods

There were no specific criteria for the selection of the patients for laparoscopic cholecystectomy (50 cases) and conventional cholecystectomy (50cases). They were randomly chosen from the above groups patients. Liver function test was done prior to and after their line of management in order to facilitate the investigation. Patience with cholelithiasis as the main cause underwent cholecystectomy whereas cases associated with choledocholithiasis, a CBD exploration or an endoscopic retrograde cholangiopancreatography was carried out. Protectively prophylactic antibodies like ceftriaxone was given routinely. Every patient was catheterization under strict aseptic condition just before the starting of operation. Operations were conducted under general anaesthesia. No hepatotoxic drugs like halothane was used throughout the operation. Uniform rate and type of fluid was tried to be infused to the patient as far as possible. All laparoscopic cholecystectomy was done with four ports keeping intrabdominal pressure between 10-12mm/Hg. All open cholecystectomy was done by making right subcostal incision with incision length >10cm. Drain was placed. Post operative drugs used where ceftriaxone, metronidazole, diclofenac, ranitidine and pethidine. Blood for Bilirubin AST, ALT, Alkaline phosphatase and Albumin was sent for assay just at deflation in the laparoscopic cholecystectomy and after end of operation in conventional cholecystectomy and also on the 1st and 7th post operative day in all the patients. Disturbances were defined as increased by 50% of post operative values and or above the normal range. These values were compared to the preoperative values.

Exclusion criteria:

1. Individuals in which other pre-existing disease states dominated or the presence of which may adversely affect the outcome were excluded .

2. Medically unfit patients with co morbid conditions.

3. Suspected cases of carcinoma GB.

4. Patients with any preoperative abnormal liver function test or preoperative history of jaundice .

5. Patients with bilioenteric fistula and those who developed major complications after cholecystectomy requiring prolonged hospitalisation such as biliary leak requiring hepatic jejunostomy, pancreatitis and major collections requiring laparotomy were also excluded from this study.

IV.RESULT

This study comprises of 100 cases of cholelithiasis with or without choledocholithiasis, was carried out during the period of October 2019 to September 2021 in three units of department of surgery RIMS, RANCHI. 50 patients underwent open cholecystectomy and 50 laparoscopic cholecystectomy. Of these 100 cases 3 cases were associated with choledocholithiasis, 2 cases of which underwent endoscopic retrograde cholangiopancreatography and 1 case underwent conventional cholecystectomy with common bile duct exploration. The results and observation of this study of has been tabulated.

Table no.1 depicts in this study in conventional cholecystectomy elevation of bilirubin was about 16% and 8% (both within normal range) at deflation and on 1st postoperative day respectively. Elevation in AST was 20% (12% within normal range and 8% above normal range) and 40% (28% within normal range and 12% above normal range) at deflation and on 1st postoperative day respectively. Elevation in ALT was 40% (28% within normal range and 12% above normal range) and 32% (12% within normal range and 20% above normal range) at deflation and on 1st postoperative day respectively. There was no change in levels of alkaline phosphatase and albumin.

TABLE NO.1: Analysis of Data showing liver function test of conventional cholecystectomy.

Test	Pre operative level (within normal range)	At deflation	At deflation	At deflation	Post operative day1	Post operative day1	Post operative day1	Post operative day7(within normal range)
		No change	Change (increase)	Change (increase)	No change	Change (increase)	Change (increase)	
			Within normal range	Above normal range		Within normal range	Above normal range	
Bilirubin	50 (100%)	42 (84%)	8 (16%)	0	46 (92%)	4 (8%)	0	50 (100%)
AST	50 (100%)	40 (80%)	6 (12%)	4 (8%)	40 (80%)	14 (28%)	6 (12%)	50 (100%)
ALT	50 (100%)	30 (60%0	14 (28%)	6 (12%)	34 (68%)	6 (12)	10 (20%)	50 (100%)

Alkaline phosphatase	50 (100%)	50 (100%)	0	0	50 (100%)	0	0	50 (100%)
Albumin	50 (100%	50 (100%)	0	0	50 (100%)	0	0	50 (100%)

Table no.2 depicts in this study in laparoscopic cholecystectomy elevation in level of bilirubin was 36% (24% within normal range and 12% above normal range) and 20% (14% within normal range and 6% above normal range) at deflation and on 1st postoperative day respectively. Elevation in level of AST was 80% (14% within normal range and 66% above normal range) and 84% (20% within normal range and 64% above normal range) at deflation and on 1st postoperative day respectively. Elevation in level of ALT was 60% (6%within normal range and 54% above normal range) and 70% (4% within normal range and 66% above normal range) at deflation and on 1st postoperative day respectively. Elevation in level of Alkaline phosphatase was 10% (6% within normal range and 4% above normal range) each at at deflation and on 1st postoperative day. There was no change in levels of albumin.

TABLE NO.2: Analysis of data showing liver function test of Laparoscopic cholecystectomy.

Test	Pre operative level (within normal range)	At deflation	At deflation	At deflation	Post operative day1	Post operative day1	Post operative day1	Post operative day7(within normal range)
		No change	Change (increase)	Change (increase)	No change	Change (increase)	Change (increase)	
			Within normal range	Above normal range		Within normal range	Above normal range	
Bilirubin	50 (100%)	32 (64%)	12 (24%)	6 (12%)	40 (80%)	7 (14%)	3 (6%)	50 (100%)
AST	50 (100%	10 (20%)	7 (14%)	33 (66%)	8 (16%)	10 (20%)	32 (64%)	50 (100%)
ALT	50 (100%)	20 (40%)	3 (6%)	27 (54%)	15 (30%)	2 (4%)	33 (66%)	50 (100%)
Alkaline phosphatase	50 (100%)	45 (90%)	3 (6%)	2 (4%)	45 (90%)	3 (6%)	2 (4%)	50 (100%)
Albumin	50 (100%)	50 (100%)	0	0	50 (100%)	0	0	50 (100%)

V.DISCUSSION

Presently laparoscopic cholecystectomy is considered as the gold standard procedure for removal of diseased gallbladder and one of the commonest surgeries performed globally; it is performed by insufflating abdominal cavity with CO_2 to get good lookout of the surgical field. Generally an IAP of 10-15mmHg is maintained for laparoscopic cholecystectomy. This increased intra-abdominal pressure is considered to be the main factor leading to the impairment of pulmonary, cardiovascular, metabolic, neurological, renal and hepatic

functions depending on intraperitoneal pressure grade and ischemia. This resulting hepatic ischemia leads to elevation of liver enzymes level: the raised intraperitoneal pressure leads to the compression of intra abdominal organs, potentially affecting the hepatic microcirculation leading to hepatocellular dysfunction. One study concluded that an increase of IAP from 10mm Hg to 15 mm Hg resulted in fall of hepatic blood flow by 39%, 60% to peritoneum, 40% to stomach, 32% to jejunum and by 44% to colon. Further it was also demonstrated that, splanchnic circulation was also decreased with increase in operating time at a constant IAP. The other potential mechanism leading to change in serum level of hepatic enzymes after laparoscopic cholecystectomy is squeeze pressure effect on liver during gallbladder retraction which release the hepatic enzymes in blood stream. Additionally the use of diathermy and general anaesthesia might be reason for the transient variation occurring. These variations are seen to be occurring in approximately 80% cases of cholecystectomies; in some studies the changes are significantly higher by laparoscopic technique than by open cholecystectomy. In the last decade many studies have demonstrated unexplained changes in level of post operative liver enzymes in patients undergoing laparoscopic procedures. CO_2 pneumoperitonium can be considered as one of the dominant factor leading to change in serum hepatic enzymes level, as this is the only main difference laparoscopic surgeries have when compared with open surgeries. It has been observed that most of laparoscopic operations can lead to transient elevation of liver enzymes and bilirubin level for which CO_2 pneumoperitonium is the leading factor.

In our study there was rise in the levels of bilirubin, AST, ALT and alkaline phosphatase (only in laparoscopic cholecystectomy) in both the case of laparoscopic cholecystectomy and open cholecystectomy but only in LC group the rise was statistically significant. Subsequently enzymes level in both groups returned to normal preoperative levels on 7th day. There was no change in level of serum albumin in both the cases. Further high intra-abdominal pressure (12-14 mmHg) of CO_2 which is much higher than portal blood pressure (7-10 mmHg) can lead to decreased portal blood flow, altering hepatic function. Few modifications during laparoscopic surgeries i.e, gasless techniques, minimal diathermy use, use of harmonic scalpel, ligatures might be having less alteration in hepatic enzymes. Hence the transient rise in level of liver enzymes tests after uncomplicated laparoscopic cholecystectomy might be a normal phenomenon without any obvious clinical implication since all values generally touches to normal within a week. A series of important studies in our literature have shown transient alterations in liver enzymes in immediate post operative period after laparoscopic cholecystectomy with hardly anyone showing effect on outcome. Clinician must be aware of these physiological changes and sound interpretation of investigations can avoid missing any bile duct injury and simultaneously not to worry for these minor changes.

TABLE NO.3: Regional circulatory changes associated with pneumoperitonium (Catherine O'Malley,2018)

REGION	CIRCULATORY CHANGES AND EFFECTS
BRAIN	Increased cerebral blood flow Increased intracranial pressure Normal cerebral perfusion pressure
BOWEL	Decreased gastric pH Decreased gastric,duodenal, jejunal, colonic microcirculation Decreased superior mesenteric artery flow
LIVER	Normal hepatic artery flow Decreased portal vein flow Decreased hepatic vein flow Decreased hepatic blood flow Decreased hepatic microcirculation

KIDNEY	Decreased renal artery blood flow Decreased renal vein flow Decreased renal cortical perforation Decreased renal medullary perforation
LOWER LIMB	Decreased femoral vein blood flow

VI.CONCLUSION

There occurred a significant temporary unexplained disturbance in liver function test in laparoscopic cholecystectomy as compared to conventional cholecystectomy. It is suggested that most probably the reason for this phenomenon is the pneumoperitonium related intrabdominal hypertension causing fall in hepatoportal blood flow, the only variable not present in conventional cholecystectomy. No apparent clinical changes are seen in patients as a result of this alteration. As benefits of the procedure overcome its limitations, laparoscopic surgery is now emerging to be the gold standard for various other surgical procedures as for cholecystectomy. Clinicians need to be conscious in presence of serious liver disorder and decide the operative modality accordingly. A comparative study using laparoscopy without gas would further be a pointer to pneumoperitonium being the cause for alteration in liver function test. Many studies also suggest that the duration and level of intrabdominal pressure is responsible for changes in hepatic function during laparoscopic procedures because the operating time and level of intrabdominal pressure is more. Thus intrabdominal pressure should be kept at the lowest possible limit and insufflation time should be kept as short as positive in hepatic and renal compromised patients.

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