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Achievement of the Critical View of Safety in Laparoscopic Cholecystectomy & Its Outcome in MGM Medical College, Aurangabad

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Abstract: ***Laparoscopic cholecystectomy (LC), a gold standard in treatment of Cholelithiasis is a common procedure in general surgery. However, when this was introduced as an alternative to conventional cholecystectomy, incidences of biliary injuries began to rise. Strasberg et al, in 1995 introduced the concept of "critical view of safety" (CVS)- a method for ductal identification. It is a concept based on extended dissection and delineation of all structures in the hepatocytic triangle. It was formulated after reviewing the injuries occurring in Laparoscopic cholecystectomy. CVS should be achieved every time, by clearing the hepato-cystic triangle of all fat and fibrous tissues both in its ventral and dorsal aspects and by dissecting the entire infundibulum off the liver bed till only two structures are seen entering the Gall Bladder. Recent evidence emerging from case studies suggest that in large numbers of patients in whom the CVS was used had no biliary injuries due to misidentification. Hence is being used as standard of care in laparoscopic cholecystectomies***

Keywords: CVS, Cholelithiasis, Laparoscopic cholecystectomy, Gall bladder

1. Introduction

Gallbladder removal (Cholecystectomy) is performed for most of the gallbladder diseases. First cholecystectomy was performed in 1882. In the year 1985, the first laparoscopic cholecystectomy (LC) was performed. Since then, the procedure has evolved with the invention of laparoscopic procedure, single port laparoscopic cholecystectomy and robot assisted cholecystectomy. Laparoscopic cholecystectomy (LC), a gold standard in treatment of Cholelithiasis is a common procedure in general surgery. However, when this was introduced as an alternative to conventional cholecystectomy, incidences of biliary injuries began to rise. [1,2] The true incidence is still unknown, but, considering that this procedure is very commonly performed, the impact of these injuries on patients and healthcare costs is significant. [3,4] Commonest cause of serious biliary injury is misidentification/misperception of the anatomical structures while dissecting the Calot's triangle. The common bile duct (CBD) is usually mistaken to be the cystic duct and, sometimes, it is the aberrant duct mistaken as the cystic duct. [5] Such biliary injuries need to be managed by experienced hepatobiliary centers. With advent of increasing bile duct injuries, strategies to correctly identify ductal anatomy, human psychological factors, and improving technique and utilizing better technology is being sought. Several studies have utilized intraoperative imaging such as cholangiography and laparoscopic ultrasound to correctly identify ductal anatomy. [6–8] However, this isn't helpful in all patients and feasible too. It is now clear that, variability in the ductal anatomy is a major risk factor which includes sub-vesical ducts, accessory ducts, right hepatic duct with low entry into the common hepatic duct, a cystic artery that courses lateral to the cystic duct etc. The extent of surgical dissection should cover these structures to avoid inadvertent injuries. [6,9] Therefore, a safe dissection identifying relevant structures irrespective of their normal or abnormal anatomy is the best strategy. The most commonly misidentified structure is common bile duct usually mistaken as cystic duct. Strasberg et al, in 1995 introduced the concept of "critical view of safety" (CVS)- a method for ductal identification. [5,10] It is a concept based on extended dissection and delineation of all structures in the hepatocytic triangle. It was formulated after reviewing the injuries occurring in Laparoscopic cholecystectomy. [5] 18 CVS should be achieved every time, by clearing the hepato-cystic triangle of all fat and fibrous tissues both in its ventral and dorsal aspects and by dissecting the entire infundibulum off the liver bed till only two structures are seen entering the Gall Bladder. Conceptually, it is a method of target identification, where the target is two cystic structures (cystic duct and the cystic artery). [10] This enables anatomy be visualized through a 360-degree viewpoint. It can thus alert the surgeon about the presence of variable or unpredictable anatomy and difficult dissection in cases of acute or chronic inflammation. Recent evidence emerging from case studies suggest that in large numbers of patients in whom the CVS was used had no biliary injuries due to misidentification. [11,12] Also, studies in which the mechanism of biliary injuries was analyzed have not described the use of CVS. CVS also reiterates the proven technique of ductal identification in open surgery. If there is any difficulty in identification of CVS, it should indicate potential danger and approach can be changed. Although, CVS is the most rigorous method available for ductal identification, it has not been uniformly carried out due to incomplete understanding of the requirements. However, the technique is well described now and assessment techniques are available. The present study aims to evaluate

the achievement of CVS in laparoscopic cholecystectomy and its outcome in our institute

2. Methodology

The present study is a double arm cross section prospective study done after obtaining approval of institutional ethics committee was taken prior to commencement of this study. The study was undertaken in the Department of Surgery at tertiary care hospital that is MGM medical college and hospital, Aurangabad. The study was conducted from December 2018 to December 2021. All patients presented to the surgical outpatient department with symptoms of gallbladder disease who were electively admitted for an ambulatory laparoscopic cholecystectomy after preanesthetic check-up and routine investigations. The inclusion criteria were all the planned and emergency laparoscopic cholecystectomies with exclusion being malignancy and liver cell failure patients. All patients were informed about the nature of the study and written informed consent were obtained from all. Detailed history, Clinical examination, liver function profile and abdominal ultrasound was performed in all patients. Data on patient demographics, type of admission, clinical presentation, duration of symptoms, radiological findings, diagnosis, interval from admission to surgery, operative difficulty grade, achievement of CVS, operative time, conversion to open, intra - operative time, intra - operative blood loss, perioperative complications, post-operative stay and follow up after 1week and 3 weeks were recorded in a case proforma. The operative difficulty grade was based on the Nassar Scale. All patients underwent laparoscopic cholecystectomy under general anaesthesia. The operative timing was noted from the first port site incision till the last port closure.

Laparoscopic cholecystectomy was performed using a standard four port technique with the patient in American position. Standard approach was to routinely pursue and display a CVS wherever possible. Operative difficulty grade was defined as early as possible. Blunt dissection with a "duckbill" forceps was used to clear fat and fibrous tissue over the cystic pedicle, maintaining the dissection lateral to the cystic lymph node. Diathermy hook was not used. After the cystic artery was encircled as it entered the gallbladder wall and gallbladder neck was positively identified attention was directed to separating the proximal third of the gallbladder from the liver, exposing the cholecystohepatic plate and confirming the presence of a window. Intraoperative cholangiography (IOC) was routinely attempted. When a difficult cholecystectomy was encountered and an area of significant risk was approached, dissection stopped short of any suspected arterial or ductal structures allowing for a time- out pause to consider appropriate strategies. The following difficulty cues and recoveries were observed 1. A tense gallbladder (acute cholecystitis, empyema, mucocele) was decompressed. 2. Hartmann's Pouch stones (HPS) were either pushed back into the gallbladder or occasionally removed after opening the Hartman Pouch to facilitate the dissection of the cystic plate. 60 3. The cystic lymph node was identified as it is a reliable marker of the underlying cystic artery. 4. The presence of the duodenum in the view of the operative field was considered a risk factor for BDI and a new target area was chosen further laterally. 5. A thick-walled gallbladder could be adherent to the duodenum or the lateral wall of the bile duct so subserosal dissection was preferred 6. A contracted gallbladder (e.g. contracted fundus has caused notching of the liver edge) may suggest the common bile duct being drawn laterally. Dissection around the body of the gallbladder or fundus first dissection (FFD) was considered.

If CVS could not be obtained, a transvesical IOC through the body or infundibulum of the gallbladder was performed If Intraoperative cholangiography (IOC) could not be obtained, gallbladder body was divided horizontally creating a "funnel- shaped remnant" with the whole contour of the Hartman's pouch becoming visible, allowing safe blunt posterior dissection.

Modified NASAAR scale for Operative difficulty grading [37] 1. Grade I a. Gallbladder—floppy, non-adherent b. Cystic pedicle—thin and clear c. Adhesions—simple up to the neck/Hartmann's pouch 2. Grade II a. Gallbladder— mucocele, packed with stones b. Cystic pedicle—fat laden c. Adhesions—simple up to the body 3. Grade III a. Gallbladder—deep fossa, acute cholecystitis, contracted, fibrosis, Hartmann's adherent to CBD, impaction b. Cystic pedicle—abnormal anatomy or cystic duct—short, dilated or obscured c. Adhesions—dense up to fundus; involving hepatic flexure or duodenum 4. Grade IV a. Gallbladder—completely obscured, empyema, gangrene, mass 61 b. Cystic pedicle— impossible to clarify c. Adhesions—dense, fibrosis, wrapping the gallbladder, duodenum or hepatic flexure difficult to separate 5. Grade V a. Mirizzi Syndrome type 2 or higher b. cholecysto-cutaneous, cholecysto-duodenal or cholecysto- colic fistula

Visual analog scale (VAS) (0 to 10) [38]: The VAS consists of a l0 cm horizontal line with the two end points labeled as 'no pain' and 'pain as bad it could be.' The patient is asked to mark the line at a point that corresponds to their level of pain intensity. The distance in centimeters from the low end is used as a numerical index for severity of pain.

Other important data was taken into consideration like:- Age of the patients, Sex of the patient, Distribution of cases according to the symptoms, USG findings, Diagnosis, operative difficulty (modified nassar scale), CVS Achievement, Operative time, Operative finding, Operative complication, Wound infection, VAS pain scale, Post operative recovery time, Follow up for pain, Follow up for jaundice.

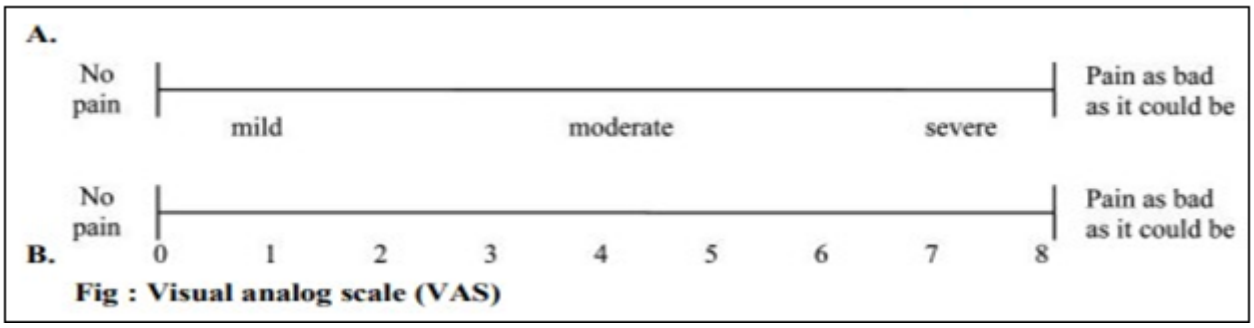

Fig : Visual analog scale (VAS)

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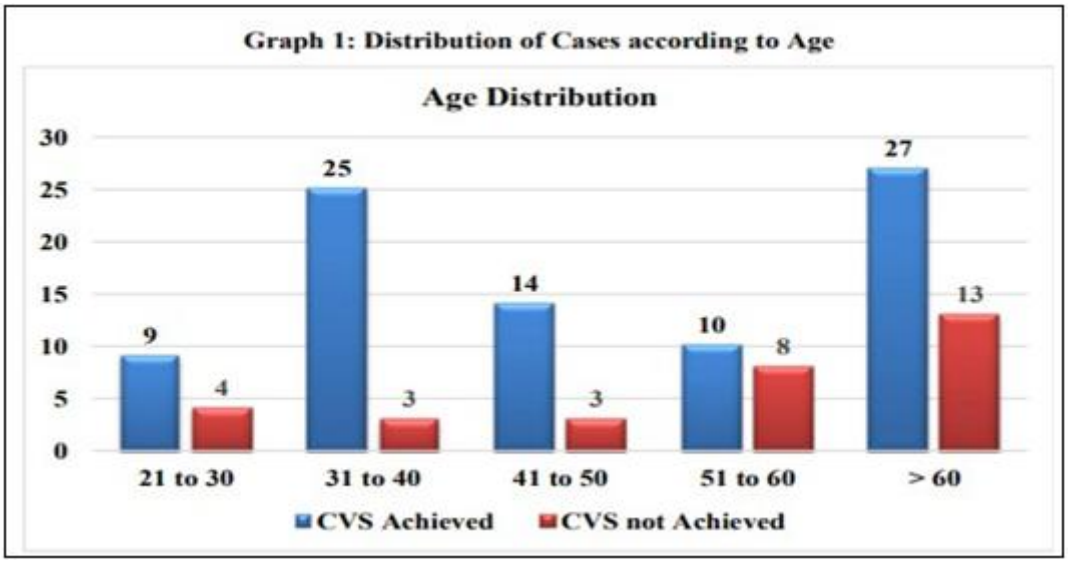
Statistical Analysis: Data collected compiled in MS EXCEL Sheet 2018. Analysis of Data is done by SPSS Software Version 2.0. Qualitative data tabulated in the frequency and percentage form. Quantitative data tabulated in the form of Mean, Median, Mode, Standard deviation. Chisquare test has been used to test the proportions in association. Both Qualitative and Quantitative data represented in the form of visual impression like Bar Diagram, Pie Diagram. Microsoft word and Excel have been used to generate graphs, tables etc,

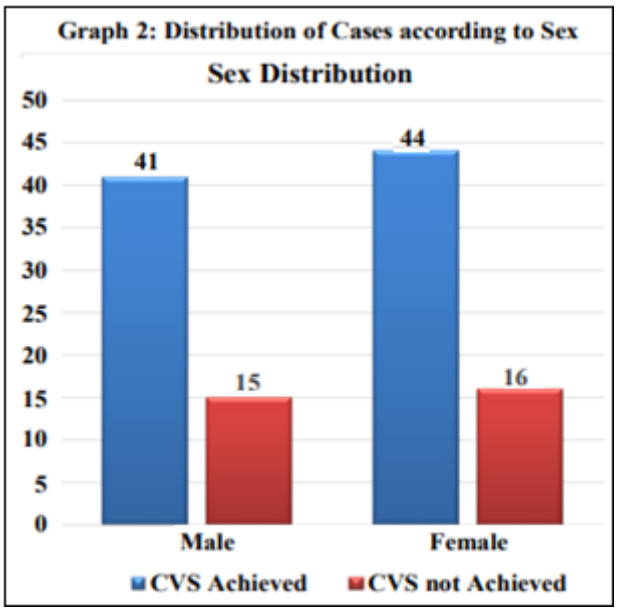
Chi-Square Test

$$\chi^2 = \frac{\Sigma (Oi - Ei)^2}{Ei}$$

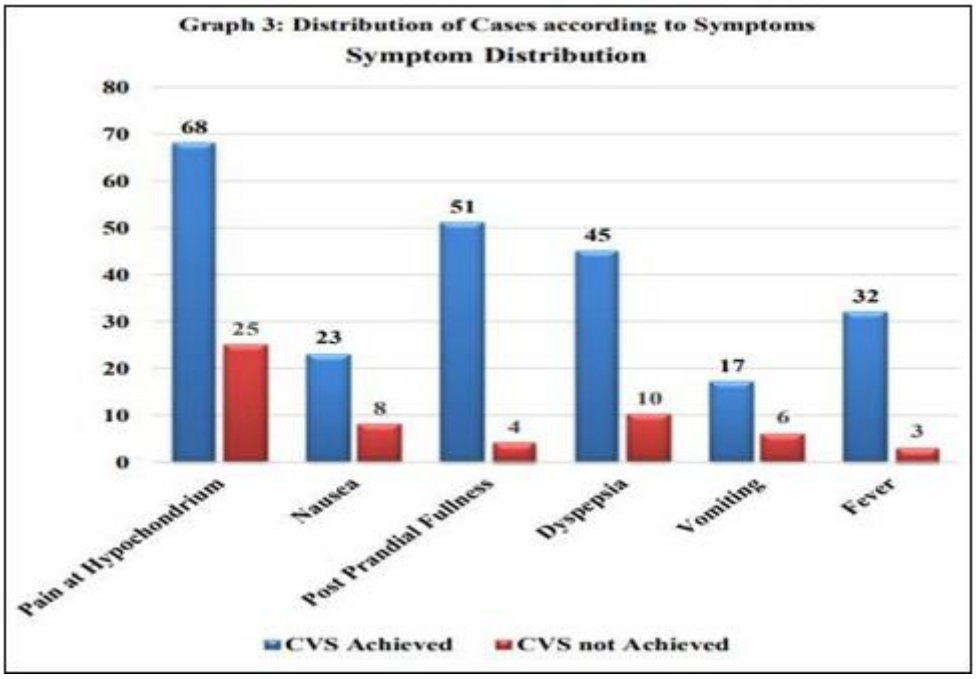
3. Observation & Results



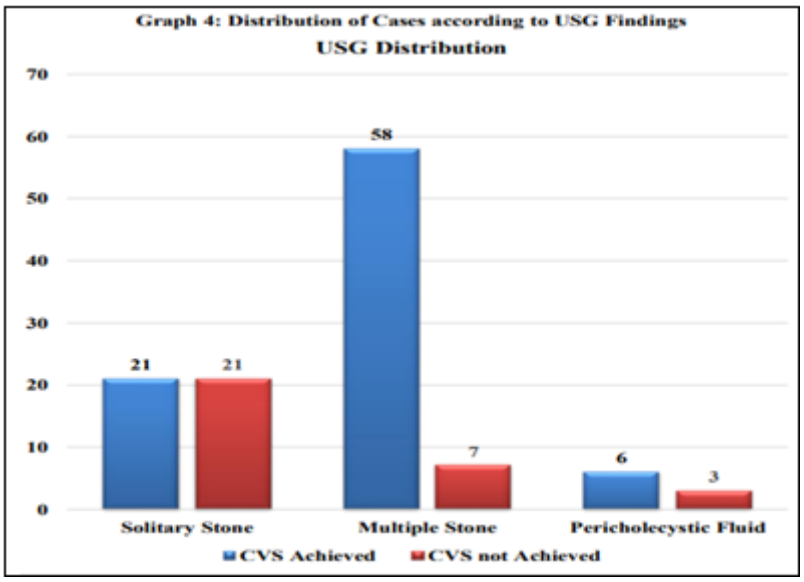
Graph 1: shows distribution of Cases according to Age. Amongst CVS achieved cases i.e. 85 (73.27 %) maximum patients i.e. 27 (23.27 %) were from age group > 60 years followed by 25 (21.55 %) in 31 to 40 years, 14 (12.06 %) in 41 to 50 years, 10 (8.62 %) in 51 to 60 years and 9 (7.75 %) in 21 to 30 years. Amongst CVS not achieved cases i.e. 31 (26.73 %) maximum patients i.e. 13 (11.2 %) were from age group > 60 years 64 followed by 3 (2.58 %) in 31 to 40 years, 3 (2.58 %) in 41 to 50 years, 8 (6.89 %) in 51 to 60 years and 4 (3.44 %) in 21 to 30 years



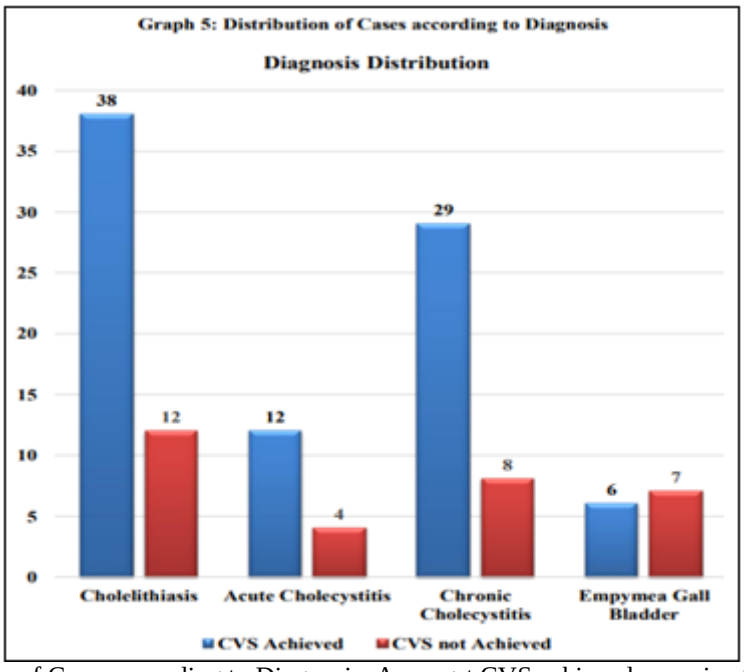
Graph 2: shows distribution of Cases according to Sex. Amongst CVS achieved cases i.e. 85 (73.27 %) males were 41 (35.34 %) and females were 44 (37.93 %). Amongst CVS not achieved cases i.e. 31 (26.73 %) males were 15 (12.93 %) and females were 16 (13.79 %).



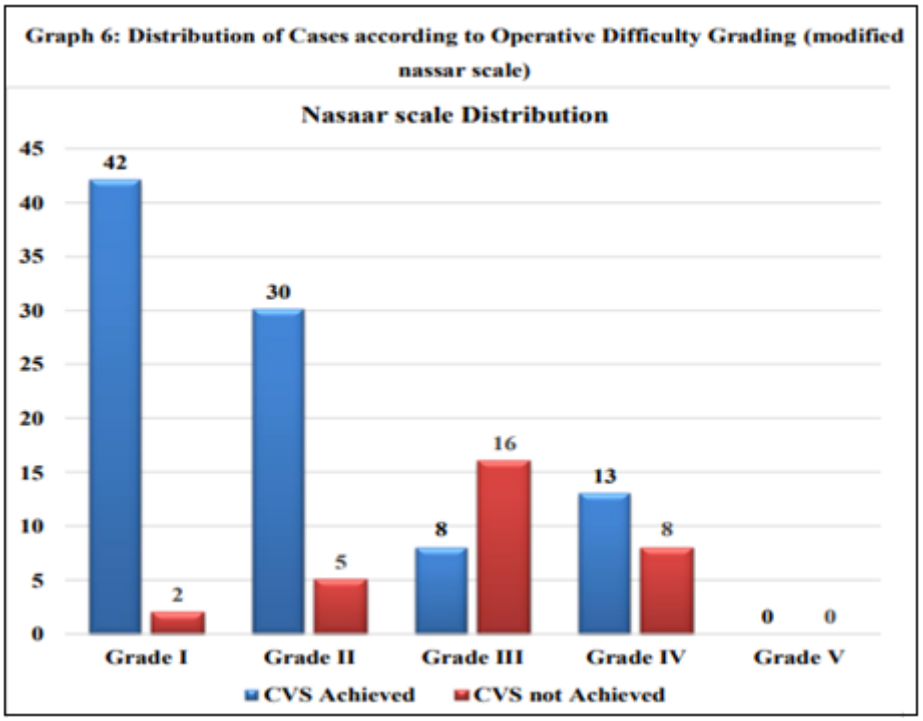
Graph 3: shows distribution of Cases according to Symptoms. Amongst CVS achieved cases i.e. 85 (73.27 %) pain at hypochondrium present in 68 (58.62 %) cases Nausea in 23 (19.82 %) cases, Post Prandial Fullness in 51 (43.96 %) cases, Dyspepsia in 45 (38.79 %) cases, Vomiting in 17 (14.65 %) cases and Fever in cases 32 (27.58 %). Amongst CVS not achieved cases i.e. 31 (26.73 %) pain at hypochondrium present in 25 (21.55 %) cases Nausea in 8 (6.89 %) cases, Post Prandial Fullness in 4 (3.44 %) cases, Dyspepsia in 10 (8.62 %) cases, Vomiting in 6 (5.17 %) cases and Fever in cases 3 (2.58 %)



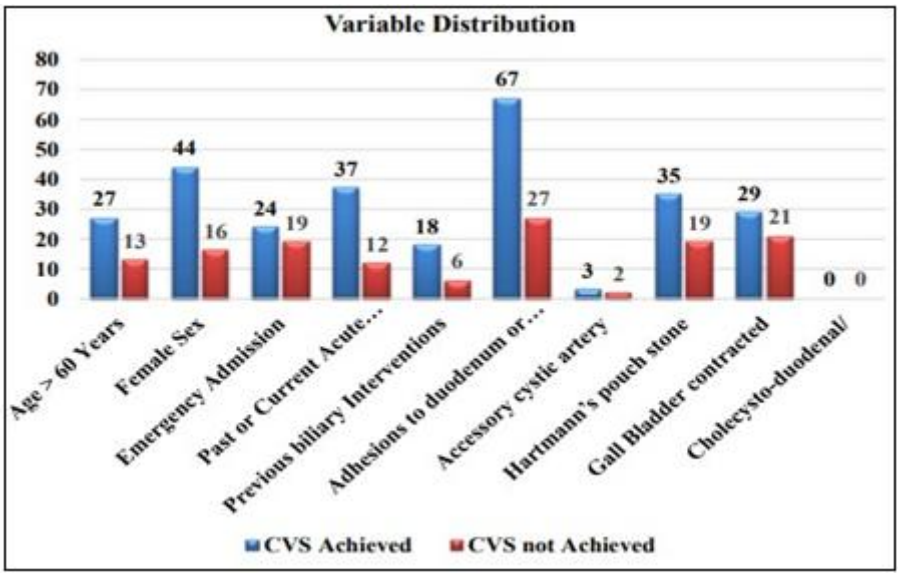
Graph 4: shows distribution of Cases according to USG Findings. Amongst CVS achieved cases i.e. 85 (73.27 %) Solitary Stone was found in 21 (18.10 %) cases, Multiple Stone was found in 58 (50 %) cases, Pericholecystic Fluid was found in 6 (5.17 %) cases. Amongst CVS not achieved cases i.e. 31 (26.73 %) Solitary Stone was found in 21 (18.10 %) cases, Multiple Stone was found in 7 (6.03 %) cases, Pericholecystic Fluid was found in 3 (2.58 %) cases.



Graph 5: shows distribution of Cases according to Diagnosis. Amongst CVS achieved cases i.e. 85 (73.27 %) Cholelithiasis was found in 38 (32.75 %) cases, Acute Cholecystitis was found in 12 (10.34 %) cases, Chronic Cholecystitis was found in 29 (25 71 %) cases and Empymea Gall Bladder was found in 6 (5.17 %) cases. Amongst CVS not achieved cases i.e. 31 (26.73%) Cholelithiasis was found in 12 (10.34 %) cases, Acute Cholecystitis was found in 4 (3.44 %) cases, Chronic Cholecystitis was found in 8 (6.89 %) cases and Empyma Gall Bladder was found in 7 (6.03 %) cases

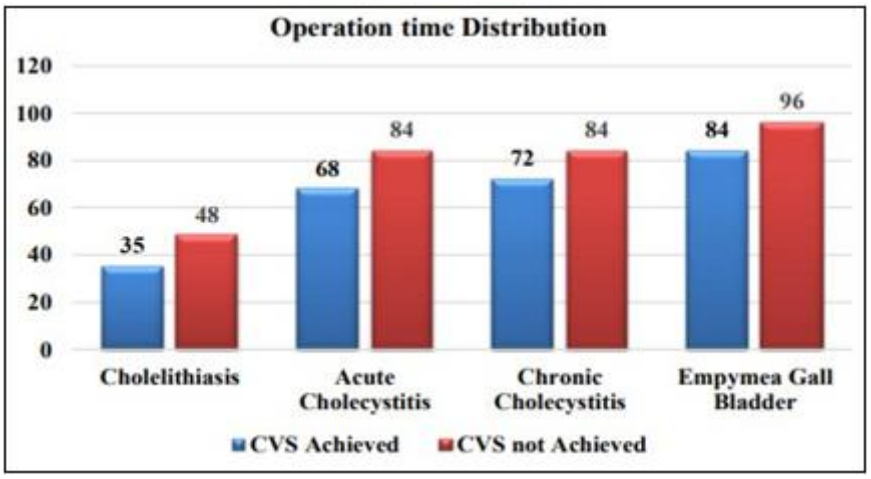


Graph 6: shows distribution of Cases according to Operative Difficulty Grading (modified nassar scale). Amongst CVS achieved cases i.e. 85 (73.27 %) Grade I was found in 42 (36.2 %) cases, Grade II was found in 30 (2.58 %) cases, Grade III was found in 8 (6.89 %) cases, Grade IV was found in 13 (11.20 %) cases, Grade V was found in 0 (0 %) cases. Amongst CVS not achieved cases i.e. 31 (26.73 %) Grade I was found in 2 (1.72 73 %) cases, Grade II was found in 5 (4.31 %) cases, Grade III was found in 16 (13.79 %) cases, Grade IV was found in 8 (6.89 %) cases, Grade V was found in 0 (0 %) cases.

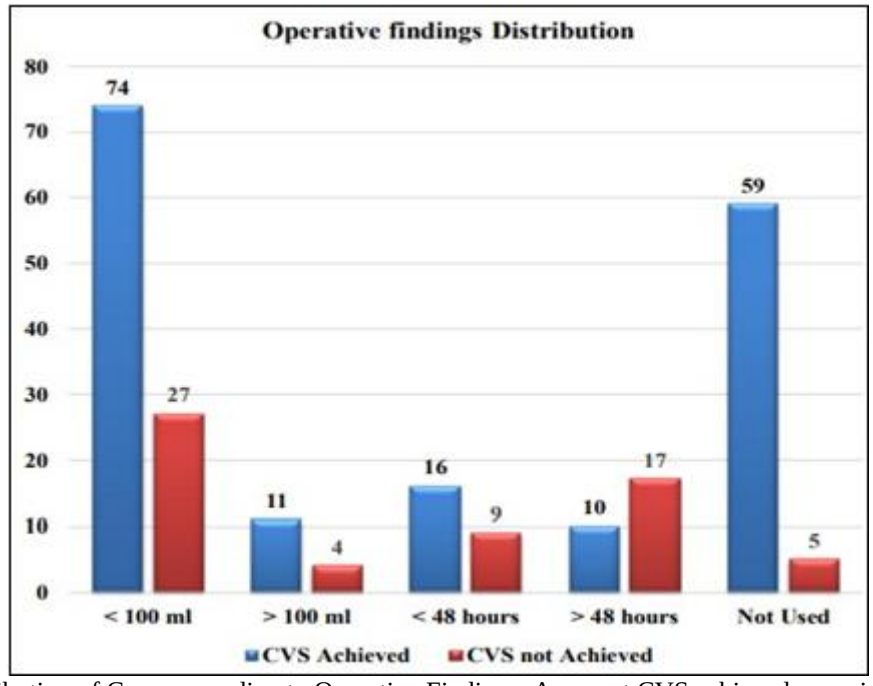


Graph 7: shows distribution of Cases according to variables for CVS Achievement. Amongst CVS achieved cases age > 60 Years cases were 27 (23.27 %) and CVS not achieved cases were 13 (11.20 %). Amongst CVS achieved cases Female cases were 44 (37.93 %) and CVS not achieved cases were 16 (13.79 %). Amongst CVS achieved cases Emergency Admission cases were 24 (20.68 %) and CVS not achieved cases were 19 (16.37 %). Amongst CVS achieved cases Past or Current Acute cholecystitis cases were 37 (31.89 %) and CVS not achieved cases were 12 (10.34 %). Amongst CVS achieved cases Previous biliary Interventions cases were 18 (15.51 %) and CVS not achieved cases were 6 (5.17 %). Amongst CVS achieved cases Adhesions to duodenum or Gall bladder cases were 67 (57.75 %) and CVS not achieved cases were 27 (23.27 %). Amongst CVS achieved cases Accessory cystic artery cases were 3 (2.58 %) and CVS not achieved cases were 2 (1.72 %). Amongst CVS achieved cases Hartmann's pouch stone cases were 35 (30.17 %) and CVS not achieved cases were 19 (16.37 %).

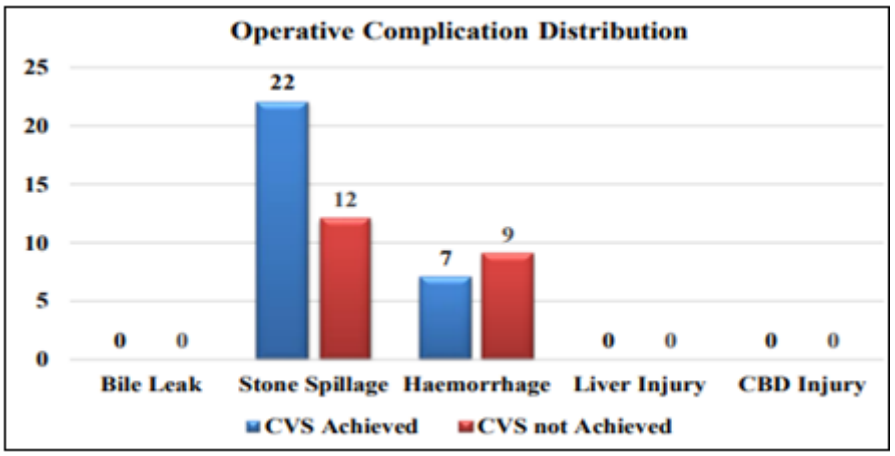
Amongst CVS achieved cases Gall Bladder contracted cases were 29 (25 %) and CVS not achieved cases were 21 (18.10 %). Amongst CVS achieved cases Cholecysto-duodenal/Cholecysto-colic fistula. cases were 0 (0 %) and CVS not achieved cases were 0 (0 %).



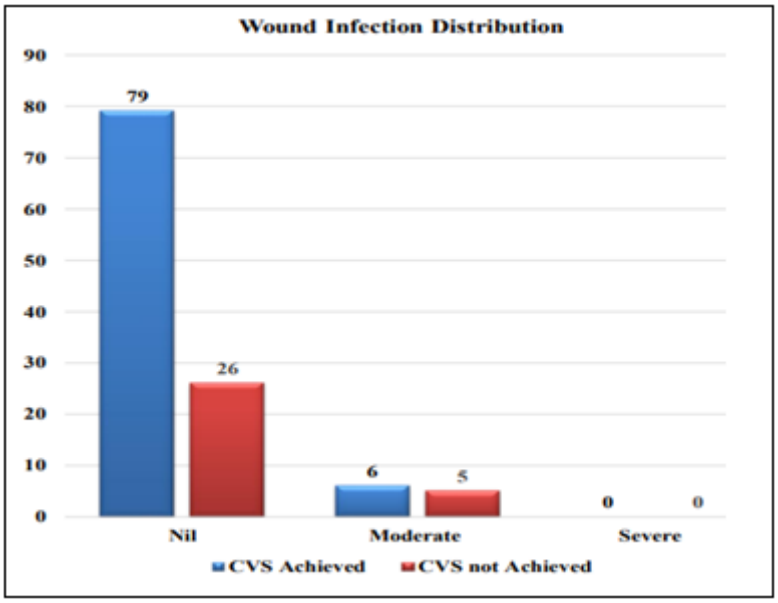
Graph 8: shows distribution of Cases according to Operation Time. Amongst CVS achieved cases i.e. 85 (73.27 %) median time for Cholelithiasis was 35 minutes, for Acute Cholecystitis was 68 minutes, for Chronic Cholecystitis was 72 minutes and for Empymea Gall Bladder was 84 minutes. Amongst CVS not achieved cases i.e. 31 (26.73 %) median time for Cholelithiasis was 48 minutes, for Acute Cholecystitis was 84 minutes, for Chronic Cholecystitis was 84 minutes and for Empymea Gall Bladder was 96 minutes.



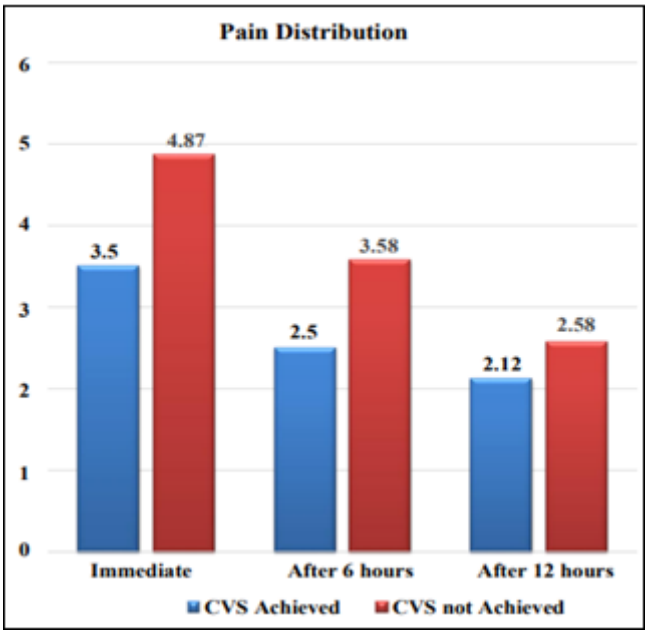
Graph 9: shows distribution of Cases according to Operative Findings. Amongst CVS achieved cases i.e. 85 (73.27 %) blood Loss < 100 ml was found in 74 (63.79 %) cases 35 68 72 84 48 84 84 96 0 20 40 60 80 100 120 Cholelithiasis Acute Cholecystitis Chronic Cholecystitis Empymea Gall Bladder Operation time Distribution CVS Achieved CVS not Achieved 79 and > 100 ml was found in 11 (9.48 %) cases. Drains for < 48 hours kept in 16 (13.79 %) cases, > 48 hours in 10 (8.62 %) cases whereas not used in 59 (50.86 %) cases. Amongst CVS not achieved cases i.e. 31 (26.73 %) blood Loss < 100 ml was found in 27 (23.27 %) cases and > 100 ml was found in 4 (3.44 %) cases. Drains for < 48 hours kept in 9 (7.75 %) cases, > 48 hours in 17 (14.65 %) cases whereas not used in 5 (4.31 %) cases.



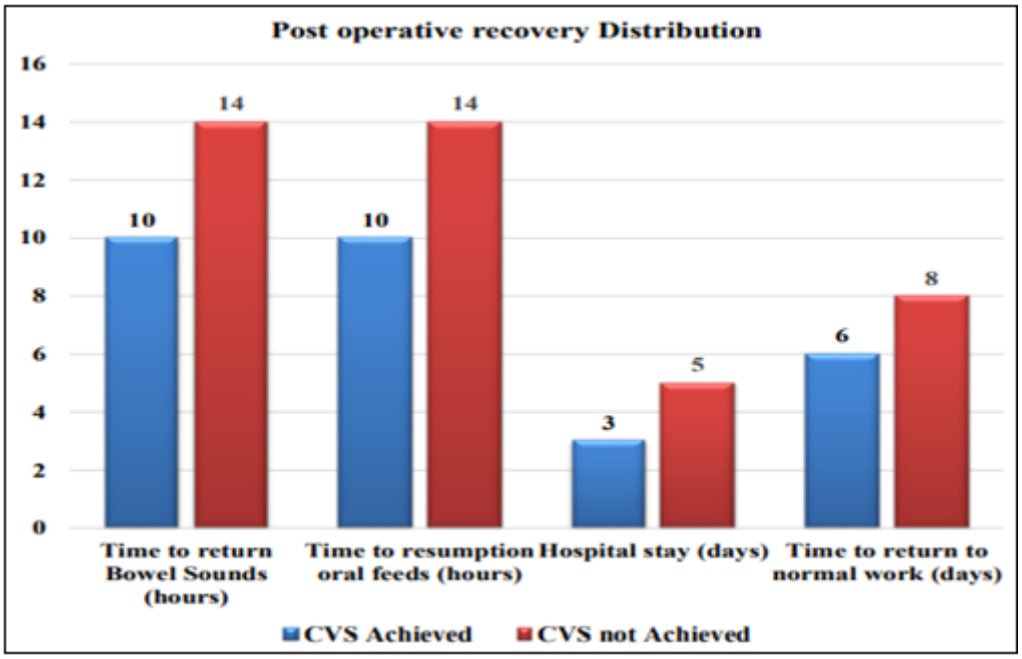
Graph 10: shows distribution of Cases according to operative complication. Amongst CVS achieved cases i.e. 85 (73.27 %) Bile Leak was found in 0 (0 %) cases, Stone Spillage was found in 22 (18.96 %) cases, Haemorrhage was found in 7 (6.03 %) cases, Liver Injury was found in cases 0 (0 %) and CBD Injury was found in 0 (0 %) cases. Amongst CVS not achieved cases i.e. 31 (26.73 %) Bile Leak was found in 0 (0 %) cases, Stone Spillage was found in 12 (10.34 %) cases, Haemorrhage was found in 9 (7.75 %) cases, Liver Injury was found in cases 0 (0 %) and CBD Injury was found in 0 (0 %) cases.



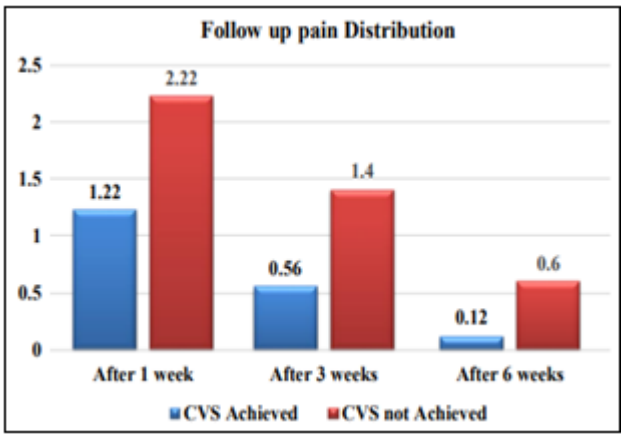
Graph 11: shows distribution of Cases according to Wound Infection. Amongst CVS achieved cases i.e. 85 (73.27 %) no wound infection was found in 79 (68.10 %) cases, 0 22 7 0 0 0 12 9 0 0 0 5 10 15 20 25 Bile Leak Stone Spillage Haemorrhage Liver Injury CBD Injury Operative Complication Distribution CVS Achieved CVS not Achieved 82 moderate wound infection in 6 (5.17 %) cases whereas no severe wound infection was found. Amongst CVS not achieved cases i.e. 31 (26.73 %) no wound infection was found in 26 (22.41 %) cases, moderate wound infection in 5 (4.31 %) cases whereas no severe wound infection was found.



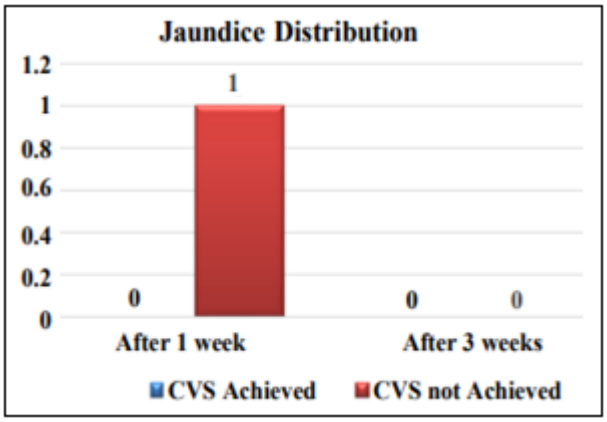
Graph 12: shows distribution of Cases according to VAS Pain scale. Amongst CVS achieved cases i.e. 85 (73.27 %) VAS Pain scale Mean ± SD immediate after surgery was 3.5 ± 0.50, after 6 hours was 2.5 ± 0.50 and after 12 hours was 2.12 ± 0.68. Amongst CVS not achieved cases i.e. 31 (26.73 %) VAS Pain scale Mean ± SD immediate after surgery was 4.88 ± 0.42, after 6 hours was 3.58 ± 0.50 and after 12 hours was 2.58 ± 0.50. Statistically significant difference was found between CVS achieved and CVS not achieved cases with less pain in CVS achieved cases



Graph 13: shows distribution of Cases according Post-Operative Recovery time. Amongst CVS achieved cases i.e. 85 (73.27 %) median time to return to Bowel Sounds was 10 hours and median time to resumption of oral feeds was 10 hours. Hospital stay median is 3 days and median duration to return to normal work is 6 days. Amongst CVS not achieved cases i.e. 31 (26.73%) median time to return to Bowel Sounds was 14 hours and median time to resumption of oral feeds was 14 hours. Hospital stay median is 5 days and median duration to return to normal work is 8 days.



Graph 14: shows distribution of Cases according to follow up for Pain. Amongst CVS achieved cases i.e. 85 (73.27 %) VAS Pain scale Mean ± SD after 1 week was 1.22 ± 0.41, after 2 weeks was 0.56 ± 0.52, after 3 weeks was 0.12 ± 0.33. Amongst CVS not achieved cases i.e. 31 (26.73 %) VAS Pain scale Mean ± SD after 1 week was 2.22 ± 0.66, after 2 weeks was 1.4 ± 0.50, after 3 weeks was 0.6 ± 0.49. Statistically significant difference was found between CVS achieved and CVS not achieved cases with less pain in CVS achieved cases.



Graph 15: shows distribution of Cases according to follow up for presence of Jaundice. Amongst CVS achieved cases i.e. 85 (73.27 %) no Jaundice was present in single case 1.22 0.56 0.12 2.22 1.4 0.6 0 0.5 1 1.5 2 2.5 After 1 week After 3 weeks After 6 weeks Follow up pain Distribution CVS Achieved CVS not Achieved 89 after 1 week and 3 week. Amongst CVS not achieved cases i.e. 31 (26.73 %) Jaundice was present in 1 (0.86 %) cases after 1 week which got corrected after 3 week.

Critical view of safety (CVS) which is characterized by blunt dissection of upper part of Calot's space, which usually does not contain arterial or biliary anomalies is ideal for safe dissection in comparison to age old "infundibular" technique for gallbladder hilar dissection. Even in less experienced hands. Present study with this objective included 116 patients of gallbladder disease undergoing laparoscopic cholecystectomy. In all demographic, clinical, operative and outcome factors were recorded and evaluated between CVS achieved and not achieved cases. Results of present study are summarised as Common complications found in both CVS achieved and not achieved cases were Stone Spillage and haemorrhage

- CBD Injury was not found in both CVS achieved and not achieved cases.
- Wound infection was found in 6 (5.17 %) CVS achieved cases and 5 (4.31 %) not achieved cases.
- Statistically significant difference (P<0.0001) was found between the CVS and not achieved cases for VAS pain scale immediately after surgery, 6hours and 12hours after surgery with overall less pain score in the CVS achieved cases.
- Median time to return to Bowel Sounds was 10 hours, resumption of oral feeds was 10 hours, Hospital stay was 3 days and return to normal work was 6 days in CVS achieved cases.
- Median time to return to Bowel Sounds was 14 hours, resumption of oral feeds was 14 hours, Hospital stay was 5 days and return to normal work was 8 days in CVS not achieved cases
- Statistically significant difference was found between CVS achieved and CVS not achieved cases with less pain in CVS achieved cases
- Statistically significant difference (P<0.0001) was found between CVS achieved and not achieved cases for VAS pain scale after 1 week, 3 week and 6 week of surgery with less pain score in the CVS achieved cases.

Hence safe dissection of Calot`s triangle in laparoscopic cholecystectomy (LC) is important in successful outcome of surgery with less complications. Following laparoscopic cholecystectomy demonstration of critical view of safety (CVS) helps to standardize the 100 approach to the cystic artery and duct which effectively avoids the area of aberrant ductal and arterial anatomy. Therefore, it is essential to implement these evidence-based protocols in laparoscopic cholecystectomy (LC) with achievement of critical view of safety (CVS) for safe laparoscopic cholecystectomy using validated anatomical landmarks.

4. Discussion

Nowadays its become mandatory to achieve ***"CRITICAL VIEW OF SAFETY"*** in all laparoscopic cholecystectomies regardless of the difficulty of the operation.

Concept of Critical View of Safety Critical view of Safety is - "Unambiguous identification of the cystic duct and artery by creation of an infundibular window, in order to minimise bile duct lesions and conversion rate." Criteria for fulfilling CVS: [10]

- Hepato-cystic triangle cleared of all fat and fibrous tissues.
- Lower 1/3rd of the gallbladder dissected off the liver where the gallbladder is attached to the liver (cystic plate).
- Only two structures are seen to enter the gallbladder: cystic duct and the cystic artery.

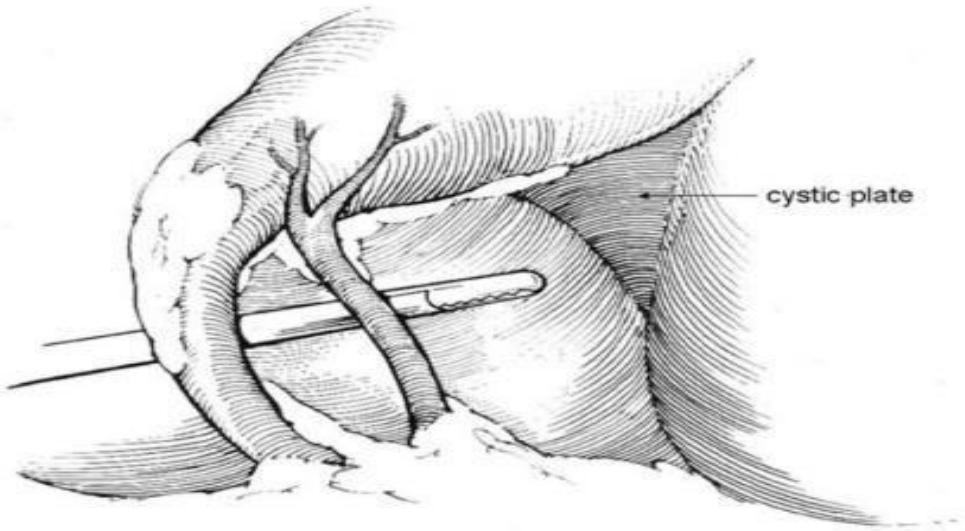


Figure 1. The critical view of safety. The triangle of Calot has been dissected free of fat and fibrous tissue, however, the common bile duct has not been displayed. The base of the gallbladder has been dissected off the cystic plate and the cystic plate can be clearly seen. Two and only 2 structures enter the gallbladder and these can be seen circumferentially.

Figure1: Critical View of Safety

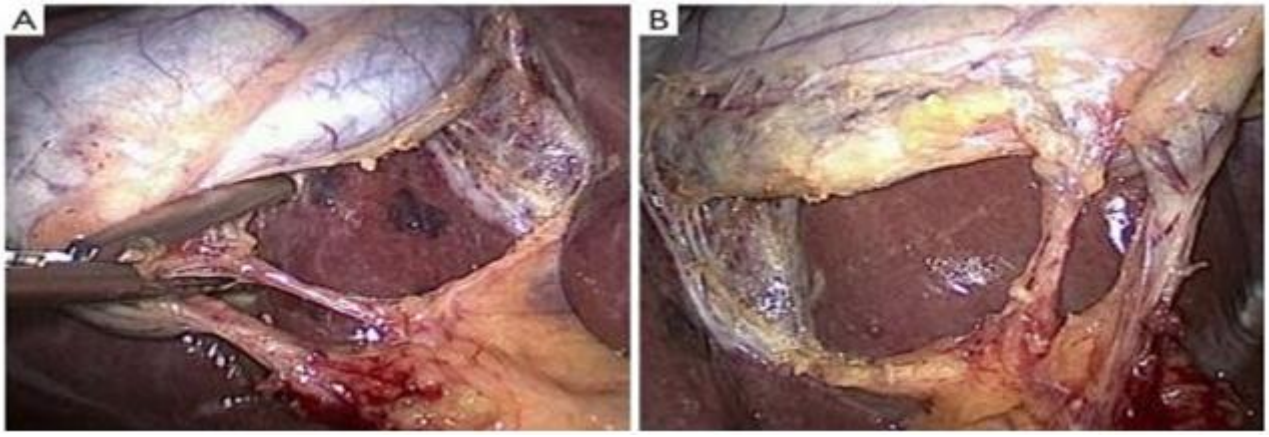


Figure 2: Showing the doublet view: A: anterior view B: posterior view Dissection:

- LC is carried out with four ports using a 30° laparoscope.
- The GB is held at the fundus and retracted.
- Infundibulum is retracted Infero-laterally to open up the hepato-cystic triangle.

Figure 3: Traction on the infundibulum directed laterally and inferiorly to avoid tenting the CBD

- Combination of blunt and electrosurgical dissection used to open the 50 peritoneum at the neck of GB and dissect the hepato-cystic triangle.
- Energy should be used in 2–3-second intervals to limit thermal spread beyond the area of dissection.

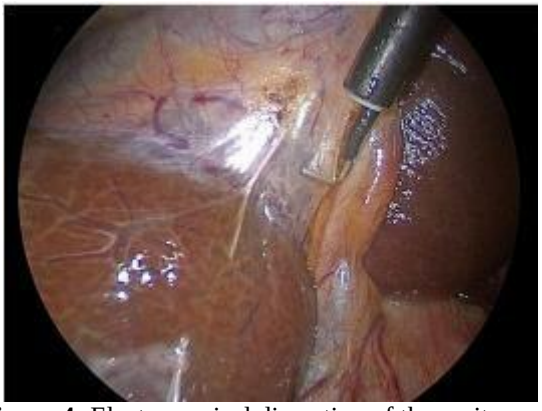


Figure 4: Electrosurgical dissection of the peritoneum overlying the neck of GB Assessment of CVS

Figure 5: Incomplete CVS- residual fat and fibrous tissue in the hepato-cystic triangle and the lower third of the cystic plate is not exposed.

Operating team should pause and verify that all three components of CVS are achieved. It can be verified by performing intraoperative cholangiography too. Documentation of 51 attainment of CVC is done in form of videos or photographs. CVS should be confirmed in both anterior and dorsal view.

In case CVS cannot be not achieved, following can be considered,[28]

- Intraoperative Cholangiogram
- Conversion to open cholecystectomy
- Get help from a colleague
- Exit strategies: terminate the procedure and refer to an advanced centre or insert a cholecystostomy tube into the GB and perform cholecystectomy 2–3 months later after the inflammation settled.

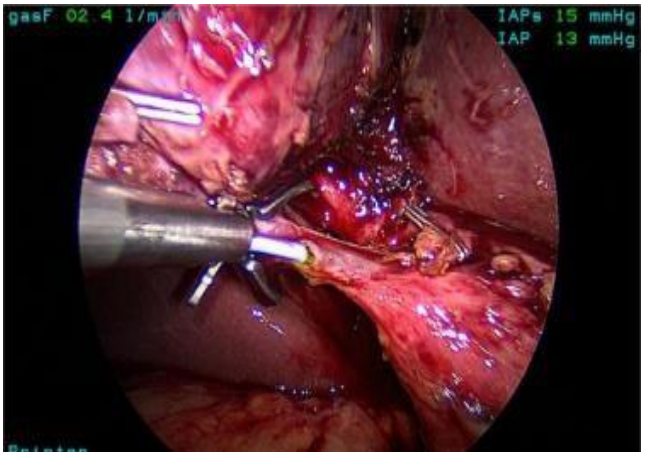


Figure 6: Cannulation of CBD for intraop cholangiogam

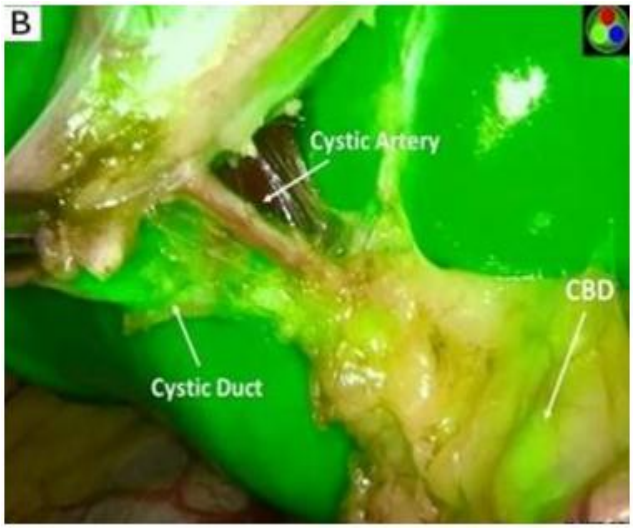


Figure 7: Infrared cholangiography during LC- infrared view.

Despite the advantages it is not used routinely because, [28]

- Achieving CVS is somewhat difficult and time consuming
- Incomplete understanding of CVS
- Comfort with infundibular technique

The SAGES Safe Cholecystectomy Program

SAGES 6-step program for prevention of bile duct injury during laparoscopic cholecystectomy

Steps	Strategies
1	Use the CVS method of identification of the cystic duct and cystic artery during laparoscopic cholecystectomy
2	Understand the potential for aberrant anatomy in all cases
3	Make liberal use of cholangiography (IOC) or other methods to image the biliary tree intraoperatively
4	Consider an intraoperative time-out during laparoscopic cholecystectomy prior to clipping, cutting or transecting any ductal structures
5	Recognize when the dissection is approaching significant risk and stop the dissection before entering the risk zone. Finish the operation by a safe method other than cholecystectomy if conditions around the GB is dangerous
6	Get help from another surgeon when the dissection or conditions are difficult

TOKYO GUIDELINES 2018 [21]

A flowchart for the management of acute cholecystitis was developed in 2018 where a more than 60 experts worldwide came to a consensus. Severity grading for acute cholecystitis according to the Tokyo guidelines.

Grade	Criteria
Mild	Acute cholecystitis that does not meet the criteria for a more severe grade. Mild GB inflammation, no organ dysfunctio
Moderate	The presence of one or more of the following: Elevated WBC count ([18,000 cells/mm3) Palpable, tender mass in the right upper quadrant Duration (72 h) Marked local inflammation including biliary peritonitis, pericholecystic abscess, hepatic abscess, gangrenous cholecystitis, emphysematous cholecystitis
Severe	The presence of one or more of the following: Cardiovascular dysfunction (hypotension requiring treatment with dopamine at ≥5 µg/kg body weight per minute or any dose of dobutamine) Neurologic dysfunction (decreased level of consciousness) Respiratory dysfunction (ratio of partial pressure of arterial oxygen to the fraction of inspired oxygen < 300) Renal dysfunction (oliguria; creatinine level, >2 mg/dl) Hepatic dysfunction (PT-INR >1.5) Hematologic dysfunction (platelet count

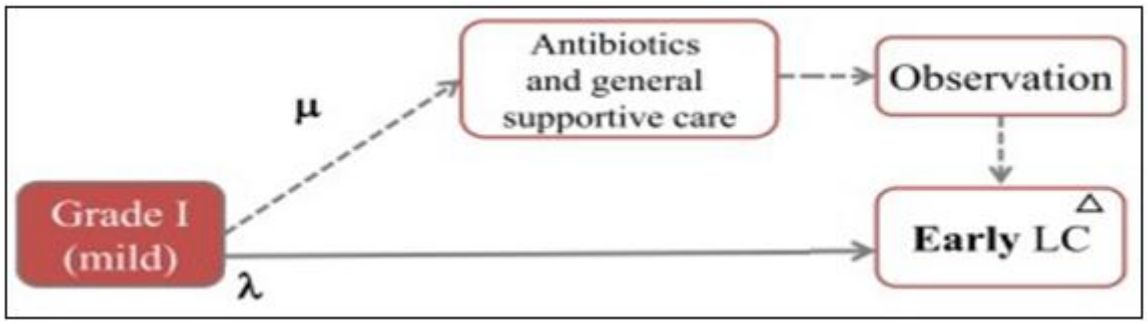


Figure 8: Grade 1 management

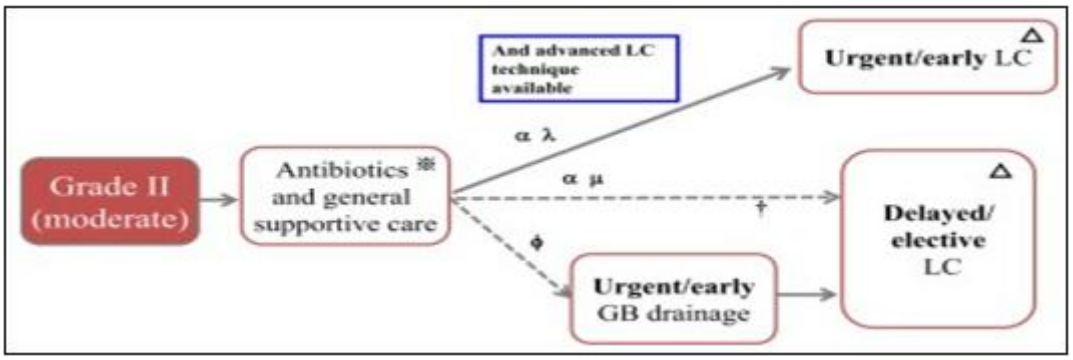


Figure 9: Grade 2 management

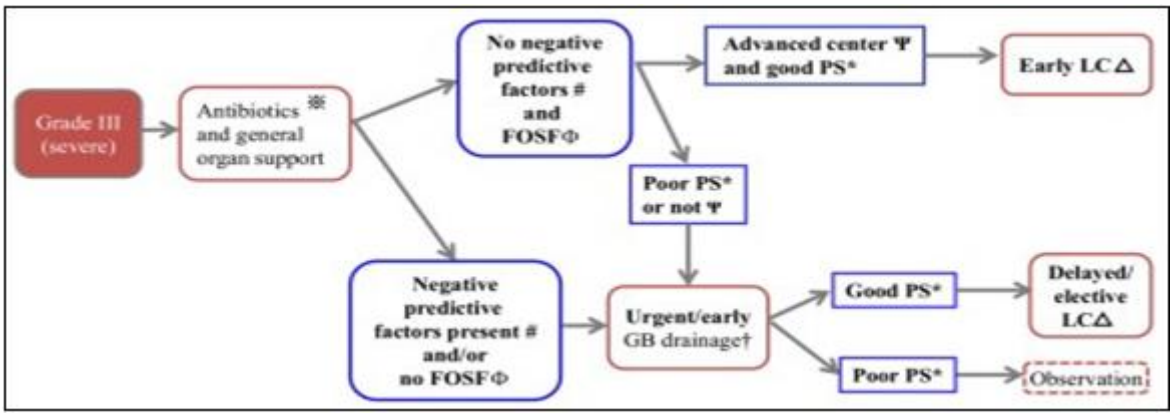


Figure 10: Grade 3 management.

5. Conclusion

Achieving the critical view of safety is a good standard of practice for completing safe laparoscopic cholecystectomy which avoids bile duct injuries which inturn reduces the morbidity and mortality significantly and also enhances the post operative recovery and helps us to to practice risk free surgery making laparoscopic cholecystectomy a safe and standard procedure for gall bladder pathologies. Hence it should be achieved in all the cholecystectomies regardless the difficulty level.

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