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**ORIGINAL RESEARCH**

# PRE-OPERATIVE ASSESSMENT TO PREDICT DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY

**Mandapati Mallikarjuna Reddy[1*], K.L. Narayana Rao[2]**

[1]Associate Professor, Department of General Surgery, NRI Medical College, Chinakakani, Guntur, Andhra Pradesh, India 522503

[2]Senior Resident, Department of General Surgery, NRI Medical College, Chinakakani, Guntur, Andhra Pradesh, India 522503

**Corresponding Author:**

Dr. Mandapati Mallikarjuna Reddy, Department of General Surgery, NRI Medical College, Chinakakani, Guntur, Andhra Pradesh, India 522503.

**ABSTRACT**

**Background: This research aimed to determine, prior to surgery, what factors, if any, could help a surgeon anticipate a "difficult cholecystectomy" using either laparoscopic or open surgery. Consecutive patients undergoing cholecystectomies (both open and laparoscopic) for gallstone-related disorders are analysed to see which factors best predict the presence or absence of surgical complications. The goal of this study is to determine which clinical, laboratory, and radiographic criteria are most indicative of difficult dissection during cholecystectomy. To develop a scoring system prior to surgery that can accurately predict the result during the procedure.**

**Results: A cholecystectomy is a common surgical procedure. Those who experience symptoms from gallstone disease are increasingly likely to opt for laparoscopic cholecystectomy. The incidence of both complications and conversions are higher in patients who are already at high risk, as well as in complex cases that provide technical challenges. The current study included 123 individuals with confirmed cases of cholelithiasis who were scheduled to have surgery. The results and discoveries were recorded and scored intraoperatively. The range of possible grades was 0–15. In this case, a score of 5 or below indicated an easy task, 6–10 indicated a moderately difficult task, and 11–15 indicated a very challenging task. Two categories, "Easy" (scores of 5) and "Difficult" (scores of >6), were made for the purpose of statistical analysis. Demographic, clinical, laboratory, and imaging parameters were collected before to surgery and compared to the two intra-operative groups to identify any possible correlations.**

**Conclusion: 123 patients with cholelithiasis were the subjects of a prospective study. Data from these patients' demographics, imaging, and metabolic profiles, as well as their intra-operative outcomes, were compared. All 123 patients used in the study underwent laparoscopic procedures. Of the 123 cholecystectomies performed laparoscopically, 113 were successful without having to resort to open surgery. In this**

**analysis, we find a conversion rate of 8%. It is 33.3% greater in cases of acute cholecystitis.**

**Keywords: Pre-operative, laparoscopy, cholecystectomy, cholelithiasis, radiographic.**

## INTRODUCTION

Gallstones are among one of the most common diseases affecting the digestive system requiring hospitalisation with a prevalence of 11% to 36% in autopsy report.[1] However most patients remain asymptomatic (>80%) and they have <20% chance of ever developing symptoms, in symptomatic patients there is >80% chance that they will continue to have the symptoms and develop disease related complications. Gallstone disease prevalence in general population is 3% to 20% of the total population worldwide.[2] In India it is estimated to be around 6%.[3] In 1992, the National Institute of Health (NIH) consensus development stated that laparoscopic cholecystectomy "provides a safe and effective treatment for most patients with symptomatic gallstones". Two decades since its introduction, laparoscopic cholecystectomy has now become widely accepted as the procedure of choice and with their growing experience surgeons have started taking up even more complex cases and high risk patients. Decreased post-operative pains, earlier feeding, shorter hospital stay, early resumption to normal activity and improved cosmesis have been well recognized after Laparoscopic cholecystectomy. A significant reduction in the incidence of wound complication and post-operative ileus has also been documented. But at times, the surgery becomes difficult, taking longer time. Difficulties in accessing the peritoneal cavity, creating a pneumoperitoneum, dissecting the gall bladder or extracting the excised gall bladder are other problems that render difficulty during laparoscopy. Conversion to an open cholecystectomy may be required. It is important to note that conversion is neither a failure nor a complication, but an attempt to avoid complication and ensure patient safety. It cannot be said with certainty pre-operatively whether the cholecystectomy is going to be easy or difficult. The degree of difficulty, to some extent is difficult to predict clinically and also with the available imaging techniques. This study has tried to look at various parameters pre-operatively that would help a surgeon predict a "difficult cholecystectomy" both in laparoscopy and open methods. Various variables are studied, in patients undergoing consecutive cholecystectomies (both open and laparoscopic) for gallstone related disorders, to predict the difficulties encountered during the surgery.

## AIM AND OBJECTIVES

### Aim

- To identify the predictability of difficult dissection by clinical, laboratory and radiological parameters in cholecystectomy**.**

### Objective

- To devise a pre-operative scoring system to predict the intra operative outcome.

## MATERIALS & METHODS

**Study Design:** This is a prospective, analytical, single centre study.

**Study Place:** Department of General Surgery, NRI General Hospital, chinakakani.

**Study Period:** The data collection was done in the period spanning from January 2021 to June 2022.

**Sample Size:** The sample size calculated is 123.

**Inclusion Criteria:** All patients undergoing consecutive cholecystectomy for cholelithiasis and its related complications in NRI General Hospital, chinakakani

**Exclusion Criteria:**

- Patients undergoing cholecystectomy for non-gallstone related diseases
- Patients undergoing open cholecystectomy directly without initial laparoscopic cholecystectomy for gall stones.
- ASA Grade IV not suitable for laparoscopic cholecystectomy.
- Incidental cholecystectomy for gallstone for patients undergoing surgery for other indications.

**Methodology:** All patients undergoing consecutive cholecystectomy were included in this study type regardless of the age. Patients meeting the exclusion criteria were not included in the study. Clinical, laboratory and radiological parameters were analysed for significant correlation with the outcome of the surgery (dependent variables) to predict difficult dissection during cholecystectomy.

**Clinical parameters:**

- Age- taken as a continuous variable and later grouped as <50yrs and >50yrs.
- Gender.
- BMI- taken as a continuous variable and then later grouped as normal (<25kg/m2), overweight (25-30kg/m2) and obese (>30kg/m2).
- Presence of concurrent medical illness like diabetes mellitus, hypertension, bronchial asthma, heart disease.
- History of any intra-abdominal surgery.
- History of symptoms namely- pain abdomen, fever, dyspepsia, vomiting. Pain is categorised as those patients with past history of pain but currently asymptomatic, patients with history of pain at the time of admission with or without past history of pain. Duration of pain has been documented for those patients complaining of pain.
- Patients with AC is defined as those patients with right upper quadrant pain showing evidence of Murphy's sign on physical examination and pericholecystic fluid collection on imaging with or without constitutional symptoms, requiring emergency admission.

**Laboratory parameters:**

- Total white cell count- is taken as a continuous variable and then categorised as normal or elevated. (Normal-<11,000/cumm and elevated- >11,000/cumm).

**Liver function test:**

Serum bilirubin- values above 1.3mg/dl is considered elevated.

Serum transaminases- SGOT>40U/L or SGPT>40U/L is considered as elevated.

Serum ALP/GGT- ALP>200U/L or GGT>50U/L is considered as elevated.

**Operative technique:** The standard four port technique was used for all laparoscopic cholecystectomies. All surgeries were performed by the one of three experienced surgeons (who has performed more than 500 cholecystectomies each). First, a 10-mm port was inserted

in the umbilical region using veress needle or under vision. Other ports included a 10-mm port to the epigastrium and two 5-mm lateral ports.

**Table No 1: Score For Intra-Operative Findings:**

Total score: 15; Easy: 0-5; Difficult: 6-10; Very Difficult: 11-15.

| **Findings** | **Score** | **Maximum score** |
|---|---|---|
| Duration | <60 min (0)<br>>60 min (1) | 1 |
| Pericholecystic fluid | No (0)<br>Yes (1) | 1 |
| Gallbladder wall thickness | <3 mm (0)<br>>3mm (1) | 1 |
| Adhesions | None (0)<br>Flimsy (1)<br>Dense (2) | 2 |
| Bile leak/ stone spill | No (0)<br>Yes (1) | 1 |
| Calot's triangle identification | Easy (0)<br>Difficult (1) | 1 |
| Gallbladder bed dissection | Easy (0)<br>Difficult (1) | 1 |
| Subtotal cholecystectomy or Fundus first technique | No (0)<br>Yes (1) | 1 |
| Conversion to open/ direct open cholecystectomy | No (0)<br>Yes (1) | 1 |
| Presence of complications | Mucocoel (1)<br>Empyema gallbladder (2)<br>Gallbladder perforation (3)<br>Gangrenous gallbladder (4)<br>Mirizzi's syndrome (5) | 5 |

**Table No 2: Scoring Factors- Clinical Parameters:**

| | **Score** | **Maximum** |
|---|---|---|
| Age (in years) | <50 (0)<br>>50 (1) | 1 |
| Gender | Female (0)<br>Male (1) | 1 |
| BMI ($kg/m^2$) | Normal (<25.5) (0)<br>Overweight (25-30) (1)<br>Obese (>30) (2) | 2 |

**Table No 3: Scoring Factors- Laboratory Parameters:**

| | **Score** | **Maximum score** |
|---|---|---|
| Total White Cell count (in cumm) | <11,000 (0)<br>>11,000 (1) | 1 |
| Serum bilirubin (in mg/dL) | <1.3 (0)<br>>=1.3 (1) | 1 |
| Serum transaminases (in IU/L) | Normal (0)<br>Elevated (1) | 1 |
| Serum ALP/ GGT (in IU/L) | Normal (0)<br>Elevated (1) | 1 |
| Total | | 4 |

**Table No 4: Scoring Factors- Imaging Parameters:**

| | **Score** | **Maximum score** |
|---|---|---|
| Number of stones | Single (0)<br>Multiple (1) | 1 |
| Size of stones (in cm) | <1 (0)<br>>1 (1) | 1 |
| GB wall thickness (in mm) | <3 (0)<br>>3 (1) | 1 |
| CBD diameter (in mm) | <8 (0)<br>>8 (1) | 1 |
| Stone impaction | No (0)<br>Yes (1) | 1 |
| Pericholecystic fluid | No (0)<br>Yes (1) | 1 |
| TOTAL | | 6 |

Scores were given based on history, clinical examination, laboratory investigations and imaging findings according to the [Tables 3-5]. Maximum score given was 12+4+6=22. Scores upto 8 was defined as easy, between 9 and 15 was defined as moderate and scores more than 16 was defined as difficult. For statistical analysis, only two groups were considered- easy (scores <8) and difficult (scores >9). Intra-operative outcomes were also scored as given in [Table No 1]. Maximum score was 15. Scores below 5 was considered easy, between 6 and 10 was considered as difficult, and scores above 11 was taken as very difficult. Similarly, for statistical reasons, only two groups were taken- easy (score <5) and difficult (score >6).

**Statistical Analysis:** Descriptive analysis of all the independent and dependent variables were done. All the parameters were described as categorical variables and were presented in frequencies and percentages. The association between the pre-operative parameters and the outcome parameters was assessed using chi-square test.

## RESULTS

**Table No 5: Demographic Data of the Study Population**

| | | Frequency | Percentage (%) |
|---|---|---|---|
| Age (in years) | <50 | 62 | 50 |
| | >50 | 61 | 50 |
| Gender | Male | 38 | 30.9 |
| | Female | 85 | 69.1 |
| Type of surgery | Elective | 102 | 82.1 |
| | Emergency | 21 | 17.9 |
| BMI ($kg/m^2$) | Normal | 46 | 37.4 |
| | Overweight | 54 | 43.9 |
| | Obese | 23 | 18.7 |

In this study, half of the population was below 50 years 62/123, and half of them were more than 50 years. Majority of the study population were females, 85/123 (67.4%) and 38/123 (32.6%) were males.

**Table No 6: Age and Gender Variation in the Study**

| | Males | Females | Total |
|---|---|---|---|
| < 30 years | 4 (10%) | 21 (24.5%) | 25 (21.6%) |
| 30 – 50 years | 18 (47.3%) | 40 (47.1%) | 58 (45.5%) |
| 50 – 65 years | 13 (34.2%) | 20 (21.8%) | 33 (31.9%) |
| >65 years | 3 (7.4%) | 4 (5.5%) | 7 (8%) |
| Total | 38 | 85 | 123 |

**Table No 7: Co-Morbidities and Past Surgical History of the Study Group**

| | | Frequency | Percentage (%) |
|---|---|---|---|
| Diabetes mellitus | Yes | 56 | 45.5 |
| | No | 67 | 54.5 |
| Hypertension | Yes | 43 | 35 |
| | No | 80 | 65 |
| IHD | Yes | 11 | 4.9 |
| | No | 112 | 95.1 |
| Asthma | Yes | 19 | 6.3 |
| | No | 104 | 93.8 |
| Intra-abdominal surgery | Yes | 51 | 41.5 |
| | No | 72 | 58.5 |

**Table No 8: Clinical Presentation of the Study Population**

| | | Frequency | Percentage (%) |
|---|---|---|---|
| Pain | Yes | 99 | 80.5 |
| | no | 24 | 19.5 |
| Fever | Yes | 48 | 39 |
| | No | 75 | 61 |
| Dyspepsia | Yes | 53 | 43 |
| | No | 70 | 57 |
| Vomiting | Yes | 38 | 30.9 |
| | No | 85 | 69.1 |
| Jaundice | Yes | 6 | 5 |
| | No | 117 | 95 |
| Murphy's sign | Yes | 25 | 20.8 |
| | No | 98 | 79.2 |

48/123 patients (39%) presented with complaints of fever; of which 16 were diagnosed to have AC. 25/123 patients (20.8%) had positive Murphy's sign on examination.

**Table No 9: Distribution of Pain Duration**

| | Frequency | Percentage (%) |
|---|---|---|
| <3 days | 28 | 28.6 |
| 3 – 7 days | 21 | 21 |
| 1 week to 1 month | 27 | 26.9 |
| 1 month to 3 months | 14 | 14.3 |
| >3 months | 9 | 9.2 |

In the current study, 99 patients (82.6%) presented with chief complaint of abdomen pain (present or past). Of the 99 patients, 18 had positive Murphy's sign (18.2%). [Table No 9] shows the distribution of duration of pain among. Only 28.6% of patients (28/99) presented with pain of less than 3 days duration and >70% (71/99) had pain longer than 3 days.

**Table No 10: Descriptive Data of the Laboratory Investigations**

| | | Frequency | Percentage (%) |
|---|---|---|---|
| Total count (/cumm) | <11,000 | 92 | 70.8 |
| | >11,000 | 31 | 29.2 |
| ESR (mm/hr) | <25 | 56 | 38.9 |
| | >25 | 67 | 61.1 |
| Bilirubin (mg/dL) | <1.3 | 102 | 77.8 |
| | >1.3 | 21 | 22.2 |
| Transaminases | Normal | 91 | 63.2 |
| | Elevated | 32 | 36.8 |
| ALP/GGT | Normal | 90 | 62.5 |
| | Elevated | 33 | 37.5 |

Majority of the patients, 92/123 (70.8%) had normal values of total white cell count, and 31/123 (29.2%) had elevated total white cell counts.

**Table No 11: Imaging Findings of the Study Population (USG / MRCP)**

| | | **Frequency** | **Percentage (%)** |
|---|---|---|---|
| Number of stones | Single | 31 | 25 |
| | Multiple | 92 | 75 |
| Size of stones (in cm) | <1 | 77 | 62.5 |
| | >1 | 46 | 37.5 |
| GB wall thickness (in mm) | <3 | 71 | 57.6 |
| | >3 | 52 | 42.4 |
| CBD diameter (in mm) | <8 | 103 | 83.3 |
| | >8 | 20 | 16.7 |
| Impacted stone | Yes | 26 | 21.5 |
| | No | 97 | 78.5 |
| Pericholecystic fluid | Yes | 24 | 19.4 |
| | No | 99 | 80.6 |

The above table shows the distribution of the imaging findings among the study population. MRCP findings were taken for those patients who underwent MRCP after USG, and for those patients who did not undergo MRCP, USG findings were taken.

**Table No 12: Peroperative Outcome of the Study Population**

| | | **Frequency** | **Percentage (%)** |
|---|---|---|---|
| Duration (in min) | <60 | 48 | 39.6 |
| | >60 | 75 | 60.4 |
| Pericholecystic fluid | Yes | 23 | 18.8 |
| | No | 100 | 81.3 |
| GB wall thickness (in mm) | <3 | 64 | 52.8 |
| | >3 | 59 | 47.2 |
| Adhesions | None | 40 | 32.6 |
| | Flimsy | 44 | 36.1 |
| | Dense | 39 | 31.3 |
| Bile leak/ Stone spill | Yes | 30 | 24.3 |
| | No | 93 | 75.7 |
| Calot's triangle identification | Easy | 69 | 56.4 |
| | Difficult | 54 | 43.6 |
| GB bed dissection | Easy | 114 | 93.1 |
| | Difficult | 9 | 6.9 |
| Sub-total cholecystectomy | Yes | 12 | 9.7 |
| | No | 111 | 90.3 |
| Fundus first technique | Yes | 14 | 11.4 |
| | No | 109 | 88.6 |

The above table shows the distribution of the intraoperative findings among the study group in terms of frequency and percentage.

**Table No 13: Distribution of Patients in the Intraoperative Outcome Groups**

| Easy (0-5) | Difficult (6-10) | Very difficult (11-15) |
|---|---|---|
| 84 (68.3%) | 29 (23.7%) | 10 (8%) |

There were 84 patients (68.8%) in the easy group with a score ranging from 0 to 5. There were 29 patients (23.6%) in the difficult group with score ranging from 6 to 10. There were 10 patients (7.6%) in the very difficult group with scores between 11 to 15. For statistical analysis, difficult and very difficult groups were combined as one group with 39 patients.

**Table No 14: Association between Demographic Data and Peroperative Outcome**

| | | **Intraop** | | **Total** | **p- value** |
|---|---|---|---|---|---|
| | | **Easy** | **Difficult** | | |
| Age(in years) | <50 | 49 | 13 | 62 | 0.009 |
| | >50 | 35 | 26 | 61 | |
| Gender | Female | 62 | 23 | 85 | 0.097 |
| | Male | 22 | 16 | 38 | |
| BMI | <25 | 34 | 12 | 46 | 0.15 |
| | 25-30 | 32 | 22 | 54 | |
| | >30 | 18 | 5 | 23 | |
| Diabetes Mellitus | No | 44 | 23 | 67 | 0.494 |
| | Yes | 40 | 16 | 56 | |
| Intra-abdominal Surgery | No | 46 | 26 | 72 | 0.115 |
| | Yes | 38 | 13 | 51 | |

Chi-square test: P significant at 0.05 Of the 39 patients who had difficult cholecystectomy, only 13(33.3%) were in the age group of <50 years and 26(66.7%) were in the age group of >50 years.

Among the females patients, 23 out of 85 (27%) had difficult surgery whereas among the male patients, 16 out of 38 (42.1%) had difficult cholecystectomy.

Of all the 39 patients who had difficult surgery, 31% were with BMI of <25kg/$m^2$ and 69% had BMI >25kg/$m^2$. 22/39were in the overweight group between 25-30kg/$m^2$ and 5/39 were in the obese group >30kg/$m^2$.

Of the patients who had difficult surgery, only 16/39 (41%) had diabetes. And among diabetics, 40/56 patients (71%) had easy surgery and only 16/56 patients (29%) had difficult surgery.

Of the 39 patients with difficult surgeries, only 13/39 (33.3%) had previous surgeries. Among those patients with history of previous intra-abdominal surgery, only 13/51 (25.5%) had difficult cholecystectomy.

**Table No 15: Association between Pain and Operative Intra Operative Outcome**

| Pain score | Intra-op findings | | Total | P-value |
|---|---|---|---|---|
| | Easy | Difficult | | |
| 0 | 19 (90%) | 2 (10%) | 21 (17.3%) | 0.02 |
| 1 | 16 (80%) | 4 (20%) | 20 (16.7%) | |
| 2 | 33 (60%) | 22 (40%) | 55 (45%) | |
| 3 | 16 (59%) | 11(41%) | 27 (22%) | |
| Total | 84 | 39 | 123 | |

Chi-square test: P significant at 0.05.

The pain score given is as per [Table No 3] in materials and methods. As per [Table No 9], there were 21 patients (17.3%) with no complaints of pain and 102 (82.7%) came with complaints of pain (present or past). 20/123 (16.7%) had history of pain in the past for which they got evaluated and got admitted for elective surgery. 82/123 (>65%) had pain at the time of admission. Of the 82 patients, this was the first attack of pain for 55 of them and the other 27 patients had a past history of pain as well.

Of all the 39 difficult surgeries, 2 patients (5%) had pain score of zero, 4 patients (10.2%) had pain score of 1, 22 patients (56.5%) had a score of 2 and 11 patients (28.3%) had a pain score of 3. In the difficult group, 84.8% of the cases were accounted for by patients who had pain score >2. That is by patients who came with symptoms of pain at the time of admission.

**Table No 16: Association of Clinical Signs of Inflammation with Intraoperative Findings**

| | | Intra-op findings | | Total | P value |
|---|---|---|---|---|---|
| | | Easy | Difficult | | |
| Fever | No | 64 | 11 | 75 | 0.000 |
| | Yes | 20 | 28 | 48 | |
| Murphy's sign | No | 77 | 20 | 98 | 0.000 |
| | Yes | 6 | 19 | 25 | |

Of the 39 patients who had difficult surgeries, 28 patients had fever (71%). 25 patients in the current study had Murphy's sign positive on physical examination. 19 of them had difficult surgery (76%).

**Table No 17: Association between Laboratory Parameters and Intraoperative Outcome**

| | | Intra-op findings | | Total | P-value |
|---|---|---|---|---|---|
| | | Easy | Difficult | | |
| Total count (in cumm) | <= 11,000 | 75 | 20 | 95 | 0.0001 |
| | > 11,000 | 9 | 19 | 28 | |
| Serum bilirubin (in mg/dl) | <1.3 | 71 | 29 | 100 | 0.178 |
| | >=1.3 | 13 | 10 | 23 | |
| Serum transaminases | Normal | 62 | 22 | 84 | 0.053 |
| | Elevated | 22 | 17 | 39 | |

| | | | | | |
|---|---|---|---|---|---|
| Serum ALP/GGT | Normal | 60 | 23 | 83 | 0.17 |
| | Elevated | 24 | 16 | 40 | |

Of all the 39 difficult surgeries, 19 patients (48.7%) had elevated white cell counts (>11,000/cu.mm) and of the 85 patients in the easy group, only 9 patients (10.7%) had counts more than 11,000/cu.mm.
Of all the 39 difficult surgeries, 74.3% had a Serum bilirubin of <1.3 and 25.7% had a Serum bilirubin of >=1.3.
In the difficult surgery group, 22/39 (56.4%) patients had normal SGOT score and 17/39 (43.6%) had elevated score.
Of all the 39 patients with difficult surgeries, 23/39 (57.6%) patients had normal ALP score and 16/39 (42.4%) patients had an elevated score.

**Table No 18: Association between Imaging Findings and Peroperative Outcome**

| | | **Intra-op findings** | | **Total** | **P-value** |
|---|---|---|---|---|---|
| | | **Easy** | **Difficult** | | |
| Number of stones | Single | 19 | 9 | 28 | 0.9551 |
| | Multiple | 65 | 30 | 95 | |
| Stone size (in cm) | <1 | 59 | 21 | 80 | 0.076 |
| | >1 | 25 | 18 | 43 | |
| GB wall thickness (in mm) | <3 | 67 | 4 | 71 | 0.0001 |
| | >3 | 17 | 35 | 52 | |
| CBD diameter (in mm) | <8 | 76 | 29 | 105 | 0.016 |
| | >8 | 8 | 10 | 18 | |
| Impacted stones | No | 80 | 20 | 100 | 0.0001 |
| | Yes | 4 | 19 | 23 | |
| Pericholecystic fluid | No | 82 | 22 | 104 | 0.0001 |
| | Yes | 2 | 17 | 19 | |

Majority of the patients had multiple stones on imaging, 95/123 (77%). However, there was no statistical significance between the number of stones and the intra-operative outcome. Of the 95, 65 (69.2%) had easy surgery and 30(30.8%) had difficult surgery. 28/123 (23%) patients had a single stone on imaging; of which 19 (66.7%) fell in the easy group and 9 (33.3%) was in the difficult group.
Of all the 39 difficult surgeries, 53.3% had stone size <1cm and 46.7% had size >1cm.52 patients (42.4%) in this study had gallbladder wall thickness (>3mm), 17 of them (36.1%) had easy surgery and 35 patients (63.9%) had difficult surgery. Of all the 39 difficult surgeries, 4/39 patients (11.3%) had gall bladder thickness of <3mm and 35/39 patients (89.7%) had thickness >3mm.
18 patients had dilated CBD on imaging, of which 8 had easy surgery (44.2%) while 10 had difficult surgery (55.8%). Among difficult surgeries, 74.3% of patients (29/39) had CBD diameter less than 8mm and 25.7% patients (10/39) had CBD diameter >8mm.

23 patients had stone impaction, 4 (17.4%) among them had easy surgery and 19 (82.6%) had difficult surgery.
28 patients had pericholecystic fluid, 5 (17.9%) among them had easy surgery and 23 (82.1%) had difficult surgery.

**Table No 19: Correlation of Pre-Operative Score With the Intraoperative Score**

| Pre-Operative score | Intra Operative score | | Sensitivity % | Specificity % | PPV % | NPV % |
|---|---|---|---|---|---|---|
| | Easy | Difficult | | | | |
| <=8 | 58 | 13 | 69 | 59 | 81 | 47 |
| >8 | 26 | 23 | | | | |
| Total | 84 | 39 | | | | |

## DISCUSSION

Cholecystectomy is one of the most commonly performed operations. Laparoscopic cholecystectomy is now widely accepted as the procedure of choice for symptomatic gallstone disease. In high risk patients and in complex cases having technical difficulty, the complication rates and the conversion rates increases. The accepted conversion rate worldwide is 2% - 15%,[22,23] and the incidence of bile duct injury is 0 - 0.6%.[20] Irrespective of the morbidity involved, statistics still favor laparoscopic cholecystectomy over open cholecystectomy.
It is important to identify and predict a difficult cholecystectomy pre-operatively which is essentially the same in laparoscopy as well as in open method increasing the complexity of a conventional surgery. Pre-operative prediction of a difficult cholecystectomy not only helps patient counselling but also helps the surgeon to prepare better for the intraoperative risk and the technical difficulties expected to be encountered. Moreover, the patient safety may further be improved by involving an experienced surgeon both pre-operatively and also during surgery in the decision making.
Present study consists of 123 patients who are known case of cholelithiasis admitted for surgery. Intraoperatively, the outcome/ findings were noted and scored as per [Table No 1]. Minimum score given was 0 and maximum score given was 15. Scores less than 5 was considered easy, 6 to 10 considered as difficult and 11 to 15 was taken as very difficult. For analysis, 2 groups were created- Easy (scores <5) and Difficult (scores >6). Various pre-operative factors including demographic, clinical, laboratory and imaging parameters were taken and compared with the two intra-operative groups to look for association.
[Table No 5 and 6] and Chart 1 shows age and gender variations in the present study. The incidence of cholelithiasis in the present study was most common in the age group of 30 to 50, which was 45%. Randhawa et al,[12] in their study also reported highest incidence in the age group between 30 and 50, which was 54%. Gabriel et al,[17] had largest number in the age group 41 – 50 (n=69, 29.5%) followed by next highest number in the group 31 – 40 (n=42, 17.9%) making their total number comparable to the present study. (n=111, 47%). Kumar et

al,[22] also noted similar findings. Gholipur et al,[23] noted in their study, the mean age was 50 (15.7).

**Table: 20. Comparision of Age Group Incedence**

| | **Age group (30-50 yr)** |
|---|---|
| Randhawa et al,[12] | 54% |
| Gabriel et al,[17] | 47% |
| Present study | 45% |

Thus, 50 years was selected as the cut off to assess the implication of advancing age in predicting difficult cholecystectomy. There was equal distribution of patients in the two groups in the current study.69.1% (85/123) were females and 30.9% (38/123) were males in the current study. Oymaci et al,[9] had incidence of 68% of females which was comparable to this study. Other authors reported incidence ranging from 55% to 90%.[3,12,13,15,18,25] Among males, 18/38 (47.3%) were in the age between 30 to 50, whereas among females, 40/85 (47.1%) were in the age group between 30 to 50. This shows that men and women are effected most at younger age.

[Table No 5] shows that total 37.4% were with normal BMI, 43.8% were overweight and 18.7% were obese. Majority of the patients in the study were in the overweight category which is in contrast to a study by Gabriel et al,[17] who reported that most of the patients (58%) had normal BMI and 42% had abnormal BMI which included 38% in the overweight group and 4% in the obese group. Randhawa et al,[12] also had similar findings.

[Table No 7] show the distribution of co-morbidities in the study population. A total of 74 (51.4%) had associated medical illness of which diabetes was the commonest- 56/123 (45.5%). Whereas Randhawa et al,[12] found that 22.6% had associated medical illness of which hypertension was the most common.

There were a total of 56 patients (45.5%) with diabetes in the present study. There is no proof that diabetic patients have more gallstones or that gallstones is a risk factor for diabetes. However, the prevalence of gallstones among diabetic patients is 17.5%.[7] The principal gallbladder pathologic feature in diabetic patients is a functional deficit of uncertain etiologic factors, creating a large, flaccid, poorly emptying organ. Also, bile acid and lipid composition are usually increased in diabetic patients causing supersaturation of bile with cholesterol, consequent sedimentation, crystallization, and stone formation. In the current study, there were 51/123 (41.5%) patients with history of previous abdominal surgery. The number of patients with previous history of laparotomy in Nachnani et al,[13] were 18% and Gholipur et al,[23] were 26.1%

[Table No 8] shows the distribution of clinical presentation in the study population. The most common complaint was upper abdominal pain in 99 patients (80.5%) followed by fatty dyspepsia and fever in 43% and 39% respectively. 38 patients had vomiting (30.9%) and 6 patients (5%) had clinical jaundice. Abdel baki et al,[15] in their study of 40 subjects, had the chief complaint as dyspepsia at 90%. Four patients had a history of jaundice (10%), 17 patients gave history of AC.

[Table No 8, 9 and 15] shows the details of pain. Of the 99 patients with complaints of pain, 79 patients had pain at the time of presentation. In the study by Gabriel et al,[17] there were 209 patients with complaints of biliary colic (89%) and 102 patients had right upper quadrant pain at the time of presentation which is comparable to the present study. When patients were divided into different groups according to the duration of onset of pain, as per [Table No 9], the highest number of patients (n=28, 28.6%) had pain within the last 3 days and only 9 patients (9.2%) had long standing pain >3 months. This shows that pain was the most alarming factor for which most patients decided to seek medical attention. However, Gabriel et al,[17] showed that most of the patients in their study had pain in the last 2 months (n=87) followed by those who had pain in the last 2 to 4 months.

Of the 79 patients presenting with right upper quadrant pain, 25 of them had positive Murphy's sign. 24 patients (19.4%) fit the criteria of AC (patients with right upper quadrant pain showing evidence of positive Murphy's sign on physical examination and pericholecystic fluid collection on imaging, requiring emergency admission). Only 15 of these patients with AC had fever and 19 had elevated total white cell counts.

Most patients with gallstones are asymptomatic. Of such patients, biliary colic develops in 1 to 4% annually and AC eventually develops in about 20% of these symptomatic patients if they are not treated.[26] This is comparable to the present study wherein, 19.4% of the study population had AC. Cwik et al,[10] identified 14.8% to have AC using percutaneous ultrasound. Other studies reported lower incidences. Rattner et al,[8] identified 20 out 281 patients (7.14%) undergoing laparoscopic cholecystectomy to have AC. Syed amjadalirizvi et al,[2] found 34 out 298 patients (11.5%) to have AC.

[Table No 11] shows the imaging findings of the study population. Majority of the patients had multiple stones (75%) and small (<1cm) sized stones (62.5%). This is comparable to Abdel baki,[15] and Nachnani et al.[13] Abdel baki et al,[15] study showed 57.5% multiple stones and 58% small sized stones. Similarly, Nachnani et al,[13] study showed 63.8% multiple stones 59.1% small sized stones.

Gallbladder wall thickness was an important factor. In the present study, 52/123 patients (42.4%) had wall thickness >3mm. Syed amjadalirizvi et al,[2] and Nachnani et al,[13] found similar proportion of patients, (98/298, 32.8%) and (32/105, 30.5%) respectively, with thickened gallbladder wall. Lal et al,[16] took 4 mm as the upper limit and had 10 patients (13.6%) with thickened gallbladder wall.

Common bile duct diameter >8mm on imaging was taken as cut off to define dilated common bile duct. In this study, there were 20 patients (16.7%) with dilated common bile duct. Lakatos et al,[27] found 53 patients (25.7%) to have common bile duct diameter >8mm. Lal et al,[16] took 6 mm as the cut off and had only 3 patients (4.1%) with dilated common bile duct.

This study had 26 patients (21.5%) with stone impaction and 24 patients (19.4%) with presence of pericholecystic fluid. Syed amjadalirizvi et al,[2] had 40 patients (13.4%) with impacted stone and 118 patients (39.5%) with pericholecystic fluid and of the 118, only 34 patients (28.8%) were diagnosed as AC. In a study by Cwik et al,[10] percutaneous ultrasound revealed signs of AC in 829 patients. Laparoscopic cholecystectomy was undertaken in 542 patients (65.4%) and the remaining 287 patients (34.6%) were referred directly for open cholecystectomy. In this study, of the 129 laparoscopic cholecystectomies, 113 were completed successfully by laparoscopic method and 10 cases required conversion to open

method. The conversion rate of the current study was 8%. The accepted conversion rate worldwide is around 2% to 15%.[2,13,15,17,22,25,28,29]

In Randhawa et al,[12] study, there were only 3 conversions out of 228 patients (1.3%), which was exceptionally low. However, in a study by Gabriel et al,[17] the conversion rate was very high at 26% (61/234 patients) and it was attributed it to the learning phase of the operating surgeons. Lal et al,[16] also noted similar conversion results, 23.3%.

In AC, the conversion rate is higher, ranging between 20% to 40%.[8-11,30] This is probably because of several reasons- difficulty in holding the gallbladder due to inflammation and friability of the gallbladder wall; dense inflammatory adhesions to the surrounding structures like duodenum, colon; inflammatory infiltrate into the components of the Calot's triangle thereby making identification of cystic duct and its junction with common bile duct difficult.

In view of patient safety and to avoid complications, surgeons prefer to convert to open method in case of any doubt in identification of structures or if they encounter difficulty in dissection. In the present study, 9 out of the 24 patients (33.3%) with AC had to be converted which is comparable with the reported rates.

If proper precautions are not ensured, there is a higher risk for bile duct injuries manifested as bile leak. In the present study, there were 2 patients with post-operative bile leak. Both the cases were started laparoscopically and were converted to open. They were managed with ERCP and stenting. Both the patients recovered completely without further intervention.

[Table No 12] show the distribution of the intra operative findings in the study population. The average time duration taken was 80 min. The minimum time taken was 25 min and the maximum time taken was 210 min. 40% had duration <60 min and 60% had duration >60 min. 18.8% of the patients had pericholecystic fluid as an intraoperative finding. Adhesions to the gallbladder were noted in 67.4% of the patients, which was graded as flimsy in 44 patients and dense in 39 patients. 40 patients (32.6%) had no adhesions. Intraoperative bile leak from the gallbladder or spillage of stone into the peritoneal cavity were noted in 30 patients (24.3%). All the stones spilled out were extracted using forceps. In cases of mucocoele or empyema, with hugely distended gallbladder, bile/pus was aspirated collapsing the gallbladder before commencing dissection. In certain difficult cases, gall bladder was opened up electively for ease of dissection. Difficult identification of Calot's triangle intraoperatively was encountered in 54 patients (43.6%). Difficulty in identification of cystic duct was the most common reason for conversion in this study [Table No 20]. Difficulty could be due to inflammatory infiltrate, anatomical variation or dense adhesion in the Calot's. Difficulty in gallbladder dissection from liver bed was seen in 9 patients (6.9%). 2 patients had continuous oozing from liver surface during gallbladder bed dissection prolonging the dissection time. However, both the cases were completed laparoscopically and bleeding was arrested by compression. 12 patients (9.7%) required subtotal cholecystectomy and 14 patients (11.4%) required fundus first technique. This was employed when there was frozen Calot's so as to prevent injury to common bile duct and ensure patient safety.

[Table No 13 and Chart No 2] show the number of patients in each group of the intraoperative outcome. 84 patients (68.3%) were in the easy group, 29 patients (23.7%) had difficult surgery and 10 patients (8%) were in the very difficult group.

[Tables No 14 to 18] show the association of the various pre-operative parameters with the intra-operative outcome and their significance.

**Demographic Parameters:**

Age is recognized as a risk factor for difficult cholecystectomy and conversion.[14,20,31] This is probably because of the longer duration of the gallbladder disease with more episodes of acute attack causing fibrotic adhesions. Kama et al,[28] found age >60years and Kauvar et al,[24] found age >65 years to be strongly associated with difficult cholecystectomy. Brodsky et al,[11] identified age >60years to be associated with conversion in AC. In the present study, 50 years was taken as the cut off and was found to be significantly associated with difficult cholecystectomy (p=0.009) which is shown in [Table No 16]. However, Randhawa et al,[12] and Bhar et al,[100] did not find any association with age > 50 and difficult surgery. Several other studies did not find any correlation with age.[22,23,25,29] This varied opinion could be attributed to the surgeon's experience and expertise. Also, in a study by Gabriel et al,[18] the highest conversion rate was seen in the age group between 31-40 years (n= 42, 43%) exceptionally. Various studies have reported male sex to be a risk factor for difficult cholecystectomy.[13,18,20,25,31] The exact reason for male patients to be associated with higher risk is not very well known. Male patients usually are found to have more intense inflammation and fibrosis, resulting in more difficult dissection in the Calot's triangle and through the plane between gallbladder and the liver. A possible explanation for this is that males have a higher threshold for pain, and it is probable that they have experienced many recurrent silent attacks of acute cholecysytitis which predisposes them to a more severe form of inflammation at the time of presentation. Another reason could be that male patients are generally older at the time of presentation just as in the present study.

[Table No 16] in the present study shows that males were found to be significantly associated with difficult surgery (p=0.005).

In the present study, among the 25 patients with AC, 14 patients (53.6%) were males and 11 patients (46.4%) were females. Proportion of males of the total study having AC was 14/38 (36.7%) and proportion of females of the total study having AC was 11/85 (12.9%). Thesbjerg et al,[33] also showed higher proportion of males experiencing AC. (odds ratio 1.94; 95% confidence interval 1.66-2.27).

The conversion rate in AC was 9/28 (32%) of which only 2 were females (2/13, 15.4%) and remaining 7 were male patients (7/15, 46.7%). In a study of 165 patients with AC, Oymaci et al,[9] reported the conversion rate among females to be 18.7% and among males to be 47.1% which is similar to the present study's findings.

**Table No 21: Gender Distribution among AC and Conversion Cases**

| | **AC** | **Gender associated conversion rates in AC** | **Oymaci et al,[9]** |
|---|---|---|---|
| Males | 14 (53.6%) | 7 (46.7%) | 47.1% |
| Females | 11 (46.4%) | 2 (15.4%) | 18.7% |
| Total | 25 | 9 | |

Ambe et al,[34] after controlling age and other comorbidities, found that male gender was an independent risk factor for severe gallbladder inflammation (43/69 vs 21/69, p=0.002). However, there was no statistical significance between the 2 groups in terms of conversion

(p=0.62), post-operative complication (p=0.82) or length of post-operative stay (p=0.25). Similarly, several other studies did not find any association between gender and difficult cholecystectomy.[12,22,23]

Obesity as a risk factor for difficult cholecystectomy is ambiguous. Obese patients can have technical difficulties like thick abdominal wall, cannula displacement, difficulty in obtaining pneumoperitoneum, fat laden falciform ligament and omentum, heavy fatty liver which will be difficult to elevate. Few studies have reported significance between higher BMI and conversion.[13,14,18,20]

Rosen et al,[4] reported that BMI >30kg/$m^2$ independently predicted conversion in patients with AC. Kumar et al,[22] also found a significant association between high BMI and conversion (p=0.003). Conversion among patients with low BMI <30kg/$m^2$ was 4.8% and among patients with BMI >30kg/$m^2$ was 14.63%.

However, some studies have also shown that obese patients have the same level of difficulty as that of non-obese patients.[12,15] In a study by Phillips et al,[35] there were 2 groups, group 1- obese patients and group 2- non obese. They found that the operative time, ability to perform cholangiography, conversion rate (1. %1 vs 1.5%) or post-operative complications (4.5% vs 3.8%) had no statistically significant differences between the two groups. Tiong et al,[36] also reported similar results even among the morbidly obese and super obese patients. In the present study, there was no statistical significance between higher BMI and difficult surgery (p=0.15) as shown in [Table No 14].

**Comorbid Conditions:**

Previous intra-abdominal surgery has been reported to be associated with difficult cholecystectomy as it can cause formation of intra-peritoneal adhesions that lead to difficulty in port entry, creating pneumoperitoneum and may require adhesiolysis before reaching the gallbladder thus increasing the operative time. These adhesions, especially after upper abdominal surgeries, can cause distortion of biliary anatomy. Poor visualisation of the Calot's triangle and dense adhesions can increase the risk of bile duct injury and bleeding.

The present study did not finding any association between previous abdominal surgery and difficult cholecystectomy, p=0.097 as per [Table No 16]. However, the current study included both upper abdominal and lower abdominal surgeries. Only one case in this study had difficulty in umbilical port entry due to peritoneal adhesions following puerperal sterilisation. Bhar et al,[32] and Dhanke et al,[37] also did not find past surgical abdominal history statistically significant. It is known that diabetic patients have flaccid, poorly emptying gallbladders referred to as diabetic neurogenic gallbladder. In diabetic patients, there will be stasis of bile, and also there may be several attacks of subacute inflammation not perceived by the patient due to diabetic autonomic neuropathy. This will cause more scarring making cholecystectomy more difficult. Bhar et al,[32] found diabetes to have positive correlation with difficult cholecystectomy (p=0.025).

However Kanaan et al,[38] did not find any association between diabetic patients and difficult cholecystectomy or conversion. Similarly, this study also did not find any similar correlation between patients with diabetes mellitus and difficult cholecystectomy, p=0.494. refer [Table No 14].

**Clinical Parameters:**

Pain is an important factor indicating the severity of the gallbladder disease. Pain could be as a result of stone obstructing the cystic duct or neck of gallbladder or due to the inflammatory process. Longstanding pain indicates recurrent attacks of infection/obstruction thereby increasing the fibrosis and gallbladder thickness.

In the present study, [Table No 15] shows the association between pain and intra operative outcome to be statistically significant, p=0.02. 21 patients had no pain, of which 19 of them (90%) had easy surgery and only 2 patients (10%) had difficult surgery.

20 patients had one episode of pain in the past for which they got evaluated and came to the hospital for elective surgery. These patients had no pain at the time of presentation however. Of these, only 4 patients (20%) had difficult surgery.

55 patients came with first episode of pain, 25 of them had AC while the remaining 30 had only biliary colic. 40% of them had difficult surgery.

27 patients presenting with pain had previous history of pain as well. 42% of them had difficult surgery while 58% of them had easy surgery.

The present study shows that patients getting admitted with presenting complaints of pain (score 2 and 3), had a higher proportion of patients with difficult surgery. Also, patients with multiple (>1) attacks of pain in the past had higher risk for difficult cholecystectomy. This study however did not take into account the number of attacks each patient had in the past.

Sanabria et al,[39] reported that attacks more than 10 was significantly associated with conversion whereas Kumar et al,[22] found association with difficult surgery with more than 5 attacks of pain in the past, p=0.001. History of AC was also significantly associated with higher risk of conversion.[13,22,25,28]

[Table No 16] shows clinical signs of inflammation. Fever, tenderness in right hypochondrium indicates presence of ongoing/persisting inflammation with oedema of gallbladder making surgery difficult. Fever and right hypochondrium tenderness as a risk factor was identified in several series.[23] Kumar et al,[22] reported that conversion rate was also significantly higher in patients with history of fever (17.46% vs. 4.66%) and tenderness in the right hypochondrium at presentation (36% vs. 4.8%).

Similarly in the current study, fever and positive Murphy's sign was statistically significant and associated with difficult cholecystectomy, both p value=0.000.

However, Oymaci et al,[9] found no statistically significant difference between the two groups of conversion and non-conversion in terms of fever and Murphy's sign (p >0.05).

**Laboratory Parameters:**

Elevated total white cell count again indicates ongoing inflammation, and in patients with AC it indicates the extent of inflammation and is more likely to have complicated gallbladder. Several studies have identified total count to be significant in predicting difficult cholecystectomy.[8,10,22,23,31]

In the present study, the mean total white cell count was 9824/cumm. The least was 3200/cumm and the highest was 27,100/cumm. [Table No 17] shows that elevated total white cell count >11,000/cumm was found to be statistically significant, p=0.0001 and associated with difficult surgery.

Altered Liver function test indicates ongoing hepatitis, or cholangitis and pancreatitis secondary to common bile duct stones and this may cause difficulty during surgery due to the

presence of oedema. [Table No 17] shows that altered LFT, elevated serum bilirubin (p >0.178), elevated serum transaminases (p >0.053) and elevated ALP/GGT (p >0.17) has no correlation to the intraoperative outcome.

**Imaging Parameters:**

[Table No 18] shows the association of the various imaging parameters based on USG or MRCP with the intra-operative outcome and its associated p value.

In the current study, the number of stones (p >0.955) and size of stones (p >0.076) did not show any correlation with the intra operative outcome. None of the previous studies have discussed their p-value with these imaging parameters so far. Hence, this study's p-value could not be compared with previous studies.

Multiple stones can cause difficulty in grasping the gallbladder or in extracting the specimen requiring extension of the port site incision.[14] Gabriel et al,[18] reported that in patients with multiple calculi, spillage of calculi in the peritoneum due to perforation of gallbladder was a leading factor for conversion. But, Nachnani et al,[13] found no correlation with number of stones and difficult gallbladder extraction.

Large size stones have a possibility to get impacted at the neck of gallbladder or cystic duct causing distension of the gallbladder. This hinders dissection due to difficulty in grasping the gallbladder.[13] yet few studies have found no significance between size and conversion.[22]

The gallbladder thickness has been identified as a risk factor for conversion in almost all studies.[2,5,6,12,16,18,20,25,28,29] The critical thickness of gallbladder associated with conversion varies from study to study. It was 3mm,[13,15,18] 4 mm,[22,23] 5mm,[10] and 6 mm,[40] in different studies. In the present study, gallbladder wall thickness (>3mm) was statistically significant, both in univariate analysis and logistic regression analysis, p=0.0001. The gallbladder wall thickness is contributed by fibrosis in patients with previous attacks of pain, and by the oedema in acute cases. Gallbladder wall thickness is associated with difficult surgery mainly due to difficulty in grasping the gallbladder.

In Gabriel et al,[18] the rate of conversion was 60% (n=41) in case of thickened gallbladder whereas it was 12% (n=20) in case of normal gallbladder wall. Abdel baki et al,[15] found gallbladder wall thickness to be strongly associated with increased operative time (p=0.03) and increased conversion rate (p=0.07). Thick walled gallbladder was one of the predictors of difficult cholecystectomy in Randhawa et al,[12] with p value 0.038.

However, certain studies did not find any correlation between gallbladder wall thickness and intra-operative outcome.[8,17]

Impacted stones, as already discussed, contribute to difficult surgery. In the present study, there was a statistical significance between impacted stones and intraoperative outcome. (p=0.0001) An impacted stone as documented by a preoperative ultrasound has been reported as a good predictor of difficult cholecystectomy in a few studies,[16,29] which is in contrary to the findings in other studies in which stone impaction has no correlation with conversion.[12]

Pericholecystic edema or fluid collection indicates ongoing inflammation of the gallbladder. There will be difficulty in holding the gallbladder wall due to the friability of the structures. There will be inflammatory ooze during dissection making visualisation of structures difficult. Dhanke et al,[39] found presence of pericholecystic fluid as a significant predictor of difficult cholecystectomy (p=0.001). Similarly, Syed amjadalirizvi et al,[2] found that

sonographic presence of pericholecystic fluid should alert the surgeon of a possible conversion (OR=4.396, CI= 1.212 - 15.947).

In the present study, pericholecystic fluid was found to be significant in predicting a difficult intraoperative outcome with p value 0.0001. But several studies have reported no strong association between pericholecystic fluid on imaging and conversion.[19,74] Randhawa et al,[21] obtained a p value of 0.999 for the same. Dilated common bile duct on imaging generally indicates biliary obstruction. Choledocholithiasis can cause inflammation of the hepatoduodenal ligament making Calot's triangle dissection difficult. Common bile duct size was found to have a good correlation with difficulty in surgery in Lal et al.[23] They had a total of 3 patients with dilated common bile duct, surgeries for all 3 were difficult and 2 were converted to open procedure.In the current study also, there was significant correlation between common bile duct diameter (>8mm) and intra operative difficulty, p=0.016.

Of all the variables analysed, only gallbladder wall thickness and age was found to be statistically significant. Gall bladder wall thickness (>3mm) was highly significant, p=0.000 followed by impacted stone (p=0.0001) and age (>50 years), p=0.038.

[Table No 19] shows the correlation of preoperative score and the outcome. Taking 8 as the cut off value for pre-operative score, the sensitivity and specificity for predicting the intra operative outcome was at 80% and 70% respectively. The positive predictive value for easy prediction was 88% and for difficult prediction was 55%.

**Table No 22: Comparison of Sensitivity and Specificity of Pre-Operative Score with Previous Papers**

| | **PPV easy %** | **PPV difficult %** | **Sensitivity %** | **Specificity %** | **Cut off score** |
|---|---|---|---|---|---|
| Randhawa et al,[12] | 88 | 92.2 | 75 | 90 | 5 |
| Gupta et al,[29] | 90 | 88 | 95.74 | 73.68 | - |
| Dhanke et al,[37] | 94 | 100 | - | - | - |
| Vivek et al,[14] | | | 85 | 97.8 | 9 |
| Present study | 81 | 47 | 69 | 59 | 8 |

The above table shows previous studies comparison of sensitivity, specificity, positive predictive value for easy and difficult prediction with the present study. As the score increases, the difficulty level increases. Kama et al,[41] reported that patients who required conversion had significantly higher scores (mean=6.9) and increasing scores resulted with significant increases in conversion rates and probabilities (p <0.001).

## CONCLUSION

A prospective study of 123 cholelithiasis patients was carried out. These patients were analyzed with demographic findings, radiological and biochemical parameters and were compared to the intra-operative outcome. Cholelithiasis was most commonly found in the age group of 30 to 50 years (45.5%). There were 7 patients in the age group >65 years (8%).Taking 50 years as the cut off, there was equal distribution of patients in the two groups of the study. Age >50 years was found to be significantly associated with difficult

cholecystectomy, p=0.000. Of the 39 difficult surgeries, 66.7% of the patients were in the age group >50 years. There were more females (69%) than males (31%) in the present study. Male gender had a strong statistically significant association with difficult surgery, p=0.005. The clinical profile of the study population showed that the most common complaint was upper abdominal pain in 99 patients (80.5%) followed by fatty dyspepsia and fever in 43% and 39% respectively. There was strong statistical association between pain groups and the intra operative outcome, p=0.012. Of the 99 patients, 18 had positive Murphy's sign (18.2%). On USG imaging 25% of population had single stone whereas 75% of population had multiple stones on imaging. Only 37.5% had large stones (>1 cm). 42.2% of the study population had a documented gallbladder wall thickness of 3mm or more. 24 patients (19.4%) had pericholecystic fluid, pericholecystic oedema or fat stranding. Of all the 39 difficult surgeries, 84.8% of the cases were accounted for by patients who had pain score >2. That is by patients who came with symptoms of pain at the time of admission. Of the 39 patients who had difficult surgeries, 28 patients had fever (71%) and 19 patients (48.7%) had elevated white cell counts (>11,000/cu.mm). All the 123 cases employed in the study, were operated by laparoscopic method. Of the 123 laparoscopic cholecystectomies, 113 were completed successfully by laparoscopic method and 10 cases required conversion to open method. The conversion rate in the current study is 8%. In acute cholecystitis, the conversion rate is higher at 33.3%.

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