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OPTIMIZING GALLSTONE CARE: UNLOCKING THE POWER OF ICHBS(INTRAOPERATIVE CLINICAL HEPATO-BILIARY SCORE)

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ABSTRACT

Background:

Management of cholecystitis and its complications has evolved dramatically. The ICHBS scoring system aims to address difficult cholecystectomies and intraoperative complications by introducing an objective criteria which can standardize the difficulty levels for Laparoscopic Cholecystectomy.

Aim:

The present study aims at studying the role of pre-operative predictive factors along with intra-operative findings as per ICHBS scoring system and its role in decision making as per calculated difficulty level Ia, Ib, IIa, IIb, III and outcome for safe cholecystectomy procedure.

Material and Methods:

All the patients were operated in a single tertiary care hospital. Patients satisfying the inclusion and exclusion criteria were included in the study and they underwent laparoscopic cholecystectomy and proposed ICHBS scoring system was applied to analyse and co-relate the pre-operative factors and intra operative findings to decide the operating difficulty level (Level Ia , Ib, IIa, IIb, III) during laparoscopic cholecystectomy for gall bladder disease and comparison of the existing surgical management of gallbladder stone disease using ICHBS system versus without using any scoring criteria was done.

Statistical Analysis Used

Statistical analysis was performed using Chi- Square test via SPSS 25.0 software. The data was compiled in a tabulated manner and necessary statistical tests (frequencies, proportions, percentages and chi – square test) were applied to study for significance of findings and their correlation with other parameters.

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Results:
ICHBS Grade 1A, 1B, 2A, 2B and 3 was reported among 29.5%, 25.7%, 20.6%, 19.2% and 5.1% of the subjects, respectively. In our study, it was found that as the ICHBS grade increases, the difficulty level performing laparoscopic cholecystectomy also increases.
The selective incidence of open conversion in different difficulty levels increases with the ICHBS score as follows: Level 1A (1conversion, 3.12%; 1/32; due to anesthesia team request), Level 1B (0 conversion, 0%; 0/32), Level 2A (3 conversions, 9.38%; 3/32), Level 2B (20 conversions, 62.5%; 20/32) andLevel3 (8 conversions, 25%; 8/32) with statistically significant difference as $p<0.05$. Most common reason for conversion was the lack of skill to perform laparoscopic subtotal cholecystectomy type 1/type2 /type3 with 78.12% incidence in open conversion group.
Conclusion:
The ICHBS scoring is a very reliable system for safe LC and statistically significant outcome for safe cholecystectomy was observed following recommendations as per difficulty levels (Ia, Ib, IIa, IIb and III) for managing the gall stones. In conclusion, it can be said that this scoring system can be used clinically to predict and guide the surgeons regarding safe surgical practice and anticipate the outcomes beforehand , provided the surgeon has the required experience in laparoscopic procedures like LSC type1/type2/type3.
Keywords: Laparoscopic cholecystectomy (LC), Intraoperative Clinical Hepato-Biliary Score (ICHBS)

INTRODUCTION

Gall stone disease has become one of the most prevalent conditions in today's time and date, owing to high cholesterol fatty foods often thought to be an affliction to modern society [1]. This is especially found to be common in the North Indian region in India – the stone belt. These stones are believed to form when there is too much cholesterol in the gallbladder. Gallstones develop insidiously, and they may remain asymptomatic for decades. Migration of a gallstone into the opening of the cystic duct may block the outflow of bile during gallbladder contraction. The resulting increase in gallbladder wall tension produces a characteristic type of pain (biliary colic).Female sex, obesity, pregnancy, fatty foods, crohn‟s disease, terminal ileal resection, gastric surgery, hereditary spherocytosis, sickle cell disease and thalassemia are associated with an increased risk for developing gall stones[2]. Management of cholecystitis and its complications has evolved dramatically[1] and there have been significant paradigm shifts in the management of patients since the introduction of laparoscopic cholecystectomy in the mid 1990.[1-4]
The ICHBS scoring system aims to address difficult cholecystectomies and intraoperative complications by introducing an objective criteria which can standardize the difficulty levels for Laparoscopic Cholecystectomy and recommend the various surgical options for treatment of gallstone disease based on the difficulty levels which can be implemented universally.

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Aim-

This study aims to evaluate the role of a new objective scoring system known as "IntraoperativeClinical Hepato-Biliary Scoring" system (ICHBS scoring system) based on various preoperative factors (Part-A assessment) which include the patient's history, clinical examination findings, biochemical investigations and ultrasound findings and intraoperative first port findings (Part-B assessment) which include gallbladder and hepatic factors to allow grading of the findings and standardize the stages of difficulty levels (Level Ia , Ib, IIa, IIb, III)and applying its recommendations for safe outcome.

Material

The present prospective study was conducted in patients admitted through surgery outpatient department / Emergency /transferred from other departments for gallstone disease. We had selected patients according to following inclusion and exclusion criteria:

Inclusion Criteria:

a. Patient criteria:

Case of acute or chronic cholecystitis with cholelithiasis or without cholelithiasis

Patient giving informed consent for operative intervention

b. Surgeon criteria:

Operated by surgeon having minimum experience of >100 laparoscopic cholecystectomy performed successfully OR experience of performing regular laparoscopic procedures for > 2 years

Exclusion criteria:

Age below 10 years, viral marker positive patients (HBs Ag, HCV, HIV 1 &HIV2), Pregnancy, patients not fit for general anaesthesia due to various medical illnesses, bleeding disorders, and Patient not giving informed consent.

Methods

The patients were worked up thoroughly and subjected to detailed history and clinical examination. Routine haematological investigation CBC, KFT, LFT, Viral markers, USG abdomen for hepatobiliary region and ECG were done. Part A and Part BICHBS score calculation was done for every patient and recorded. (Fig 1,2)"All patients who fulfilled the inclusion criteria had their ICHBS score calculated either manually or from the 'GALLBLADDER WALK "Application available on android and iOSoperating system" (Fig.3)

Figure 1: Table demonstrating PART A and PART B calculation for ICHBS scoring.

LEVEL 1A	0-5	LC (ANY TECHNIQUE OF PERITONEAL ACCESS- SILS,TWO PORT , THREE PORT OR STANDARD FOUR PORT AS PER SURGEON'S CHOICE) ± ELECTRO-DISSECTION + CLIPS OR LIGATION + PATIENCE
LEVEL 1B	6-10	LC (ANY TECHNIQUE OF PERITONEAL ACCESS- SILS,TWO PORT , THREE PORT OR STANDARD FOUR PORT AS PER SURGEON'S CHOICE) **± EXTRA PORT** ± ELECTRO DISSECTION + CLIPS OR LIGATION ± PATIENCE
LEVEL 2A	11-20	LC (ANY TECHNIQUE OF PERITONEAL ACCESS- SILS,TWO PORT , THREE PORT OR STANDARD FOUR PORT AS PER SURGEON'S CHOICE) ± EXTRA PORT ± ELECTRO DISSECTION **± DISSECTION OF CALOT'S WITH SUCTION OR GAUZE ± CLIPS OR ENDO-LIGATURE ± DRAIN** ± PATIENCE
LEVEL 2B (GREY AREA)	21-30	LSC TYPE1 OR TYPE 2 OR TYPE 3 WITH FOUR PORT PREFERABLY ± EXTRA PORT ± DISSECTION OF CALOT'S WITH SUCTION OR GAUZE ± SHARP DISSECTION WITH ENDO SCISSORS ± ELECTRO DISSECTION ± HARMONIC SCALPEL USE ± GAUZE PRESSURE HEMOSTASIS ± ENDO LIGATURE OR ENDO SUTURING WITH ENDO KNOTTING ± CLIPS FOR SECURING KNOTS + DRAIN + PATIENCE
LEVEL 3	31-40	LSC TYPE1 OR TYPE 2 OR TYPE 3 WITH FUNDUS FIRST METHOD , WITH FOUR PORT PREFERABLY ± EXTRA PORT ± DISSECTION OF CALOT'S WITH SUCTION OR GAUZE ± SHARP DISSECTION WITH ENDO SCISSORS ± ELECTRO DISSECTION ± HARMONIC SCALPEL USE ± GAUZE PRESSURE HEMOSTASIS ± ENDO LIGATURE OR ENDO SUTURING WITH ENDO KNOTTING + DRAIN + PATIENCE **± OPEN CONVERSION**

Figure 2: Recommendation as per ICHBS scoring application used

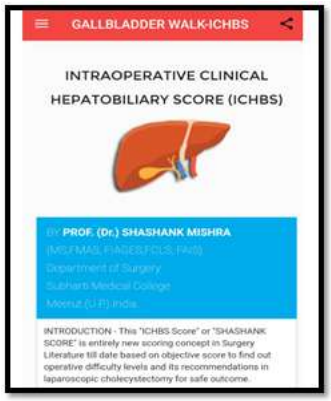


Figure 3: the 'GALLBLADDER WALK'scoring app used for calculation

Laparoscopic Subtotal Cholecystectomy (LSC) performed are of 3 types:
Type 1-Cystic Duct and Cystic Artery are dissected and clipped and cut. Anterior wall of the gallbladder is excised leaving behind the posterior wall of the gallbladder attached to liver.
Type 2 - Calot‟s triangle is not dissected. Cystic duct and Cystic Artery are not clipped. Incision over the infundibulum is taken circumferentially. Whole gallbladder is dissected from its liver bed.

Type 3 - Calot‟s triangle is not dissected. Cystic duct and Cystic Artery are not clipped. Incision on the infundibulum is taken anteriorly. The contents of gallbladder are removed. The anterior wall of the gallbladder is excised, leaving behind the posterior wall.

Gallbladder walk ICHBS scoring application available on android and ios systems, and hence attached to maintain authenticity of this study.For example, Case 1: The patient's calculated ICHBS score can be represented as Normal version – H4C0B1S0 – G2H0 . This score has 2 parts - H4C0B1S0 (Part A being 4+0+1+0= 5) i.e the preoperative assessment score and G2H0 (Part B being 2+0= 2) . So, total score being , 5 (part A) + 2 (part B) = 7.

Therefore, as per the scoring system in fig 1, 2 under materials and method score '7' will fall under difficulty level 1B .

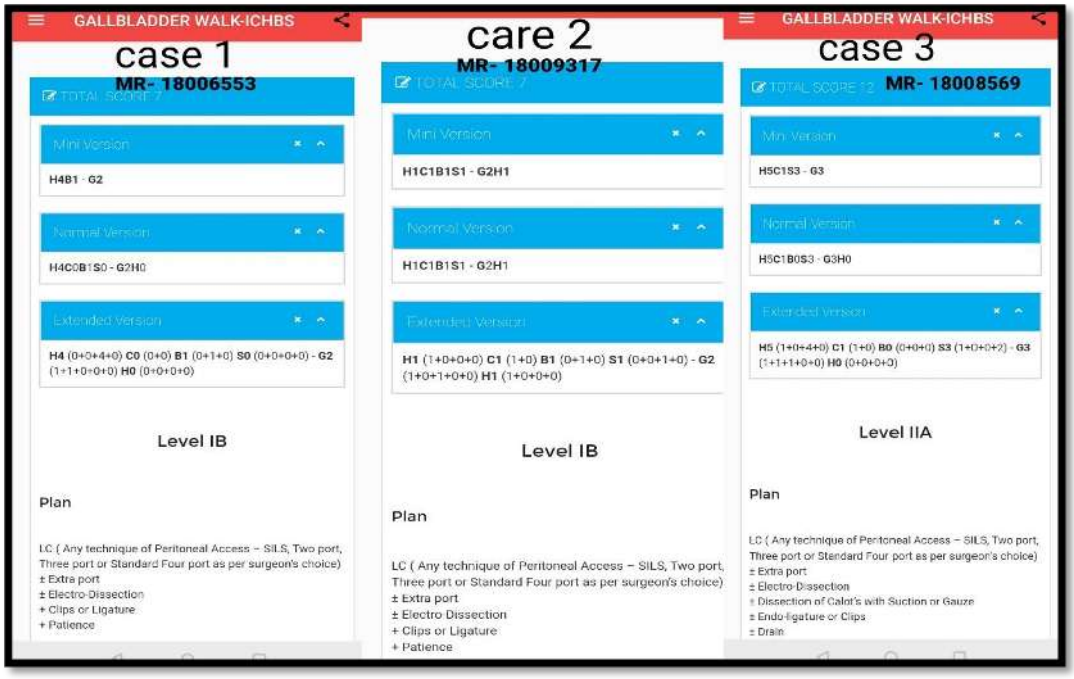


Figure 4:Gallbladder walk ICHBSscoringforfirst three cases of the 214 cases:

Case 2

Results

The present study was conducted on the patients attending surgery outpatient department/Emergency or transferred from other departments to the Department of surgery for gallstone disease in CSSH Hospital attached to Subharti Medical College, Meerut, U.P, INDIA.A total of 214 patients underwent the study out of which 165 (77.1%) were females and 49 (22.9%) were males. The 214 patients who underwent the study , were divided into 15-25, 25-35, 35-45, 45-55 , 55-65, 65-75 and >75years andthe distribution was as follows 10.74%, 20.09%, 29.43%, 21.96% , 12.61% , 4.20% and 0.93 % respectively. The maximum number of patients 63 (29.43%) were present in the age group of 35-45 years **.** Mean age of the study subjects was **43.42±9.86years .** Out of the 214 patients who

Abdominal Scar	N=50	%
Present (Infra-umbilical)	39	78
Present (Supra-umbilical)	11	22
Total	214	100.0

underwent the study , 86 (40.2%) participants had a history of prior hospitalization whereas 128 (59.8) had no history of prior admission to the hospital. Out of the 214 participants who underwent the study , 112 patients presented post ERCP out of which 23 (20.5%) presented with a CBD stent in situ whereas the remaining 89 (79.5%) were without the CBD stent . Out of 214 patients, majority participants who were operated, 164 (N=214,76.64%) were without any abdominal scar presentation and 50 (N=214, 23.36%) had abdominal scars present. Of these 50 subjects, 39 (78%) had infra umbilical scar and remaining 11(22%) had supra umbilical scar due to past surgeries.(Table 1a,b)

Table 1a: Abdominal scar among the study subjects (% of N=214)

Table 1b: Reasons for supraumbilical and infraumbilical scars seen in total N=50subject

Scar type	Reasons for scar	No. of cases	%
Supraumbilical (N= 11)	-Paramedian incision	6	54.54
	-Umbilical with anatomical repair	2	18.18
	-Exploratory laparotomy	3	27.27%
Infraumbilical (N=39)	-Hysterectomy & LSCS	19	48.71
	-Inguinal hernia repair	5	12.82
	-Exploratory laparotomy (infra - umbilical)/ Diagnostic laparoscopy	8	20.51
	-Tubal ligation	7	17.94

Of the 214 participants who underwent the study , majority of the participants 152 (71%) didn‟t have a palpable gall bladder , whereas 62 patients (29%) had a palpable gall bladder . Of the 214 participants who underwent the study , 71 participants (33.2%) had an elevated amylase/lipase or both in previous 2 weeks, whereas the rest 66.8% had normallevels and 135 participants (63.1%) had a deranged liver function test whereas the rest 36.9% didnot. A total of 74 (34.6%) showed elevated TLC of >11,000/cm^3 and the remaining 140 (65.4%) had TLC within the normal limits or <11,000/cm^3. The elevated TLC showed to have participants with GB wall thickness >3mm in USG findings. Out of the 214 patients who underwent the study , it was observed that 125 patients (58.4%) had Gall Bladder Wall thickness > 3mm whereas 89 patients (41.6%) did not. Out of the 214

patients who underwent the study , 71 patients (33.18%) had pericholecystic fluid collection whereas 143 patients (66.82%) had no fluid collection. Out of the 214 patients who underwent the study , 25 patients (21%) had an impacted stones whereas 169 patients (79%) did not . Of the total of 214 participants, 42 of them (19.6%) had features of cirrhotic liver such as : nodular liver surface and hypoechoic nodules in liver parenchyma, present or even features of portal hypertension suggested by dilated portal vein presence; which made GB dissection difficult , especially with surgeons with lesser experience . The remaining 172 (80.4%) participants had normal liver presentation . In our study, gall bladder (GB) was visualized >3cm out of liver margins in 127(59.3%) of the subjects and not visualized out of liver margin in 87(40.7%) of them. Of the 214 subjects, adhesions were seen as follows (a)greater omentum , (b)colon/colon + (a), (c)duodenum/duodenum + (b) and (d)stomach/stomach+(c) with 54.76%(46) , 10.71%(9), 26.19%(22) and 8.33%(7) of the subjects respectively. (Table 2)

Table 2: Adhesion with various organ among the study subjects intraoperatively (84/214)

Adhesion (N=84)	**N**	**%**
(a) Greater omentum	n = 46	54.76
(b) Colon or colon + (a)	n = 9	10.71
(c) Duodenum or Duodenum + (b)	n = 22	26.19
(d) Stomach or Stomach + (c)	n = 7	8.33
TOTAL	84	100.0

Out of the 214 patients who underwent the study , 69 patients (32.2%) had gangrenous/empyema/mucocele/contracted /fibrosed gall bladder whereas the rest of 145 patients (67.8%) patients did not . Out of the 214 patients who underwent the study , 141 patients (65.88%) had a Rouvier‟ssulcuspresentintraoperativelywhereastherestof73patients(34.11%)did not . Outofthe214patientswhounderwentthestudy,141patientshadaRouvier‟ssulcus present intraoperatively . Among the 141 patients the various types of Rouvier‟sSulcus were as follows : 76 patients (53.9%) had Type 1(open type) ,17 patients (12.05%) had Type 2 (closed medially) , 13 patients (9.21%) had Type 3 (closed laterally) and 35 patients (24.82%) had Type 4 (scar type). (Table 3) Out of the 214 subjects, 68 of them had presence of : Peri hepatic fibrous bands, Pathogenic presence of GB neck (presence of large stone at neck, necrosis of wall, variation in anatomy) and anomalous presence of Hepatobiliary tree .

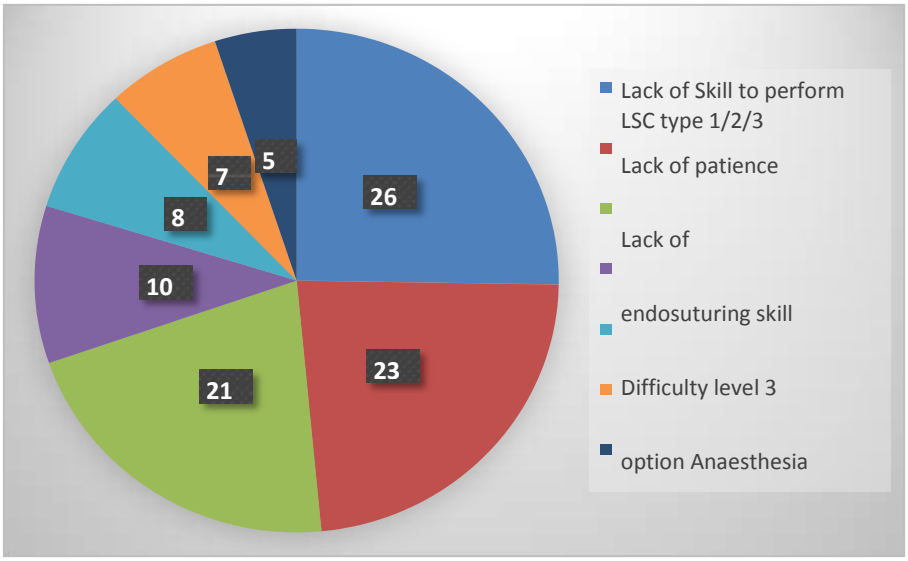
Out of the 214 patients who underwent the study , 155 patients (72.4%) had an easy gall bladder extraction whereas the rest of 59 patients (27.6%) had a difficult gall bladder extraction . (Table 3) Out of the 214 patients who underwent the study , 32 patients (15%) had a conversion to open cholecystectomy whereas the rest of 182 patients (85%) did not . (Table 4)

Table 3: Types of Rouvier's sulcus seen (N=141) intraoperatively

Types of Rouvier's sulcus (N=141)	**Number of Patients**	**%**
Type 1 (Open type)	76	53.90
Type 2 (closed medially)	17	12.05
Type 3 (closed laterally)	13	9.21
Type 4 (Scar type)	35	24.82
Total	141	100.0

Table 4: Reasons for Open conversion during laparoscopic cholecystectomy in our hospital (N=32)

Reasons	N	%
Lack of skill to perform LSC Type1/type2/type3 (Types of LSC explained in table 26)	25	78.12
Lack of patience	23	71.90
Lack of endo suturing skill	21	65.62
Difficulty level 3 *(explained in Fig. 11 under material and methods)	10	31.25
On request of anesthesia team	8	25.00
Unclear anatomy	7	21.90
Inefficient endosuturing / endoknotting	5	15.62



Graph 1: Conversion to open cholecystectomy among thestudysubjects(% ofN=32)

According to our study , out of the 214 subjects in the study ICHBS difficulty level grading, 15%(32) were converted to open and 85%(182) underwent laparoscopic cholecystectomy.

Table 5: ICHBS grading among the study subjects

ICHBS Grade	N	%
1A	63	29.5
1B	55	25.7
2A	44	20.6
2B	41	19.2
3	11	5.1
Total	214	100.0

Table 6: Difficulty levels as per ICHBS score range that got converted to open cholecystectomy (N=32)

ICHBS Grade		Cholecystectomy		
	Lap	% of lap cases(n=182)	Open	% of open cases(n=32)
1A	62	34	1	3.12

1B	55	30.3	0	0
2A	41	22.52	3	9.38
2B	21	11.53	20	62.5
3	3	1.65	8	25
Total	182	100.00	32	100.00
Chi Square		21.77		
p value		<0.05*		

***: statistically significant**

Table 7: Reasons for laparoscopic conversion to open in different ICHBS grades for N= 32 cases.

Converted cases with ICHBS difficulty level	**Reasons for conversion to open**	**No of participants**	**Total %**
1A (N=1)	-Lack of patience	01	3.12
2A (N= 3)	- Lack of endosuturing skill -Lack of patience	02 01	9.40
2B **(N= 20)**	- Lack of skill to perform LSC type1 /type2/ type3 . -Lack of endosuturing skill - Inefficient endosuturing / endoknotting - Lack of patience and on request of anesthesia team	11 05 02 02	62.50
3 **(N= 8)**	-Lack of skill to perform LSC type1 /type2/ type3 - Inefficient endosuturing /	03 02	25.00

	endoknotting - Difficulty level 3 option - Unclear anatomy	 02 01	

Discussion

Laparoscopic cholecystectomy not only is the cornerstone of management of biliary disease and cholecystitis but is also one of the commonest operations in both elective and emergency surgery. The first Laparoscopic Cholecystectomy was performed by **Muhe** in 1985[2]. In Subharti Medical College, Meerut, UP, India, we have introduced first laparoscopic cholecystectomy in year2003. In our study subjects, there was female predominance (77.1%), indicating that more of the female patients had gallstones due to various factors like hormones, obesity, increaseBMI. **Mishra Shashank[3]** reported the same too in their study with female predominance at 72%. **Gupta G et al[4]** (2015) states male gender arisk factor for conversion, as male patients have more intense inflammation or fibrosis leads to difficult dissection where as **Selvi et al[5]** (2017) states that obesity is an important risk factor for the development of gallstone diseases hence females are more prone for gallstones. In our study (N= 214), mean age of the study subjects was 43.42 ± 9.86 yrs. **Mohammad et al[6]** (2008) states the mean age as 42 years **Gabriel R et al[7]** (2009) states the mean age as 48.3 years, **Ramlah Ghazanfar et al[8]** 2017 states the mean age as 43.67 ± 13.54 years as well. RS was present in 141(65.88%) and absent in 73(34.11%) out of which the most commonly seen was Type 1 with 53.90%(76/141) followed by Type 4 with 24.82% (35/141), Type 2 with 12.05%(17/141) and Type 3 with 9.21% (13/141) .

In our study, GB visualized out of liver margin >3cm was found among 127 (59.3%) subjects. Intraoperative findings of adhesions with surrounding structures were seen in a total of 84 (39.25%) subjects out of 214. **Mishra Shashank[3]** in their study discussed similar findings regarding adhesions and GB wall thickness with following findings showing that out of total 172 patients 42(24%) patient with contracted GB,33(19%)with distended GB,9(5%) with normal GB,70(40%) patient have >3mm of GB wall thickness patient with GB wall thickness>3mm were difficult to dissect and operate butpossible.

In a study by **Veeranki N et al[9]**, 2(6.67%) had abdominal scar, 3(10%) had palpable gall bladder, 8(26.67%) had thick gallbladder wall, 6(20%) had pericholecystic fluid collection, and 3(10%) had impacted stone. **Ramlah Ghazanfar et al[7] (**2017) showed the conversion rate from lap to open cholecystectomy was higher in patients who had an elevated alanine aminotransferase before the operation. Reason for the conversions were difficulty in the dissection of the triangle of Calot, dissecting the gallbladder fossa, bleeding in gallbladder fossa, presence of duodenal fistula, and autolyzed gangrenous gallbladder. Similarly, SV **Ramamohan Reddy et al[10]** (2016) states co-morbidity like previous surgery also increases the risk of conversion because of the presence of adhesions and acute cholecystitis.

Relationship of Gallbladder wall thickness, gallbladder stone size, impacted stone with difficult laparoscopic cholecystectomy and conversion, was proved by Gupta G et al4 (2015). Single large stone, gall bladder wall thickness >3mm had prolonged operative time

due to difficulty grasping of gallbladder and gallbladder dissection as proved by Nabil A. **Abdel Baki1**[11] (2006). In our study, cases under ICHBS Grading : 1A, 1B, 2A, 2B and 3 were reported as 29.5%(63), 25.7%(55), 20.6%(44), 19.2%(41) and 5.1%(11) of the subjects respectively of the total 214 participants. In our study, conversion to open cholecystectomy was done in total 15% (32). In our present study, we observed that in difficulty level 2B there were 21 cases out of 41 i.e. 51.21% and in grade 3 there were 3 cases out of 11 i.e. 27.3% that underwent successful laparoscopic cholecystectomy (n=24). As per the ICHBS recommendation, Laparoscopic subtotal cholecystectomy (LSC) type 1/type2/type 3 is an option for tackling difficult gall bladder in level 2B and 3. Lack of skill to perform (78.12%) laparoscopic subtotal cholecystectomy type 1/type2 /type3 was the main reason for laparoscopic cholecystectomy to be converted to open (15%, total conversion rate).

CONCLUSION

The ICHBS scoring is a very reliable system for safe LC and statistically significant outcome for safe cholecystectomy was observed following recommendations as per difficulty levels (Ia, Ib, IIa, IIb and III) for managing the gall stones. In conclusion, it can be said that this scoring system can be used clinically to predict and guide the surgeons regarding safe surgical practice and anticipate the outcomes beforehand , provided the surgeon has the required experience in laparoscopic procedures like LSC type1/type2/type3. So, if we can utilize ICHBS scoring system in patients with GB stone disease in the decision making related to surgical technique leading to minimal open conversion (as the last resort). This would be a great mind shift for the surgeons in management of GB stone disease for benefitting the patients with a saferoutcome.

LIMITATIONS

These are some limitations in this study i.e.

1. This is a single center study, although the results of ICHBS scoring system used for safer outcome of GB stone disease may be generalized/ projected for other centers but need to be validated in different centers and set up.
2. Although the operating surgeons were blinded from the pre-operative score and prediction, performance bias cannot be ruled out based on each surgeon‟s laparoscopic experience.

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