

## Pre-operative and Intra-operative Predictive Factors for Conversion of Laparoscopic Cholecystectomy, Wad Madani Teaching Hospital, Gezira State, Sudan; (September 2020 - June 2021)

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### Abstract

**Background:** Laparoscopic cholecystectomy is gold standard for cholecystectomy.

**Objective:** to determine pre- and intra-operative predictive factors for conversion of laparoscopic cholecystectomy to open.

**Methods:** It was a comparative cross-sectional study performed in Wad Madani Teaching Hospital. Total coverage of patients (268 participants) admitted for elective laparoscopic cholecystectomy during (September 2020 - June 2021).

**Dependent variable:** open cholecystectomy; **independent:** socio-demographical characteristics, co-morbid illnesses, body mass index, drug and surgical history; ultrasound and intra-operative findings. Master sheet, SPSS version 25.0 and Chi square test was used.  $P \leq 0.05$  was considered statistically significant.

**Results:** Fifty six percent in age group (40-60 years); 87.3% females; 64.3% had normal body mass index; and 53% had history of abdominal surgery. Ultrasound findings: gall bladder wall thickness  $\geq 4$  in 91% and wasn't fibrosed in 63.6%. Intra-operative findings: gall bladder contracted in 54.5%, Twenty-two cases converted to open; 72.3% of them in age group (40-60 years); and 72.3% were female. No statistical association between (socio-demographic characteristics; co-morbid diseases and number of admissions) and conversion of laparoscopic cholecystectomy to open. Regarding ultrasound findings: gall bladder wall thickness  $< 4$  had significant statistical association with laparoscopic cholecystectomy; apart from that there was no significant statistical association with any ultrasound findings and that of both laparoscopic and open cholecystectomy. For intra-operative findings there was statistical association between contracted gall bladder and conversion of laparoscopic cholecystectomy to open surgery.

**Conclusion:** contracted gall bladder is the main factor for conversion of laparoscopic cholecystectomy to open surgery.

**Keywords:** Pre- and Intra-operative Predictive Factors; Conversion of Laparoscopic Cholecystectomy; Sudan

### 1. Introduction

About 120,000 cholecystectomies are performed for acute cholecystitis annually in the United States. However, the incidence of acute cholecystitis found to be regress due to the greater acceptance by patients of laparoscopic

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cholecystectomy as management plan. Women represented about 60% of patients with acute cholecystitis. However, acute cholecystitis develops in men more frequently than would be expected from the relative prevalence of gallstones (about half that in women), and cholecystitis tends to be more severe in men [1]. Patients with acute cholecystitis usually developed right upper quadrant abdominal pain that may radiate to the epigastrium, to the right flank and/or right shoulder, or to the back. They may also present with fever and a positive Murphy's sign. Laboratory investigations may show an increased white blood cell count and possibly mild increase in liver function tests (LFTs). Ultrasound is the gold standard imaging study and may demonstrate gallbladder wall thickening and pericholecystic fluid [2]. Laparoscopic cholecystectomy (LC) has become the gold standard for treatment of symptomatic gallstones, due to lower morbidity, shorter hospital stay, earlier return to regular daily activities, and less postoperative pain. When consenting the patients for laparoscopic cholecystectomy it is always important to mention the possibility of conversion to an open procedure (OC) which ranges between 0% and 20%. Although the conversion of the procedure from laparoscopic to open is associated with an increase in the operating time, hospital stay, and morbidity, it shouldn't be regarded as a failure but rather as a necessary measure to prevent complications such as biliary or vascular injuries. The identification of the predictor factors for conversion is essential to obtain a proper informed consent prior to surgery [3, 12-20]. It has been reported that converted cases are associated with increased numbers of infections and other postoperative complications, increased risk of additional procedures, and a higher 30-day readmission rate. Overall, conversion from laparoscopic to open operation results in longer postoperative stays also the morbidity and the mortality rates are higher in this group of patients. Identifying preoperative patient-related variables, predicting the need for conversion of laparoscopic cholecystectomy to open surgery may help to identify high-risk patients and redefine the surgical strategy in this group, for example, ensuring sufficient available expertise for complicated cases [4].

### **1.1. Predictive factors for conversion**

Many factors found to be associated with conversion of laparoscopic cholecystectomy to open one including: Male gender, older age more than 60 or 65 years, high BMI, thick gallbladder wall; with wall thickness of more than 4 mm as a cut-off, Previous abdominal surgery specifically upper abdominal surgery, choledocholithiasis, Impacted stone at the neck of gallbladder, Acute cholecystitis, Raised alkaline phosphatase (ALP), elevated total bilirubin, elevated white cell count (WCC) [4-8, 12, 15,18-20]. Other risk factors including: Elevated body temperature ,hypertension, hyponatremia, a haematocrit level less than or equal to 38%, and increased international normalized ratio (INR), less experienced surgeons in laparoscopic cholecystectomy, history of endoscopic retrograde cholangio-pancreatography (ERCP), delay of surgery of more than 72h from time of admission with concomitant acute symptoms of inflammation, diabetes mellitus, HbA1c level of more than 6 in a diabetic patient, chronic lung disease, positive result for Murphy's sign, , gallbladder adhesions, and scleroatrophic gallbladder [5-9,12,15,18-20]. The aim of this study is to identify predictive factors for conversion of laparoscopic cholecystectomy to open cholecystectomy in patients undergoing elective laparoscopic cholecystectomy in Wad Madani Teaching Hospital, Gezira State, Sudan; (September 2020 - June 2021).

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## **2. Material and methods**

### **2.1. Study design**

Observational, comparative cross sectional, hospital-based study.

### **2.2. Study area**

Wad Madani Teaching Hospital, Department of General Surgery. It is a tertiary hospital that serves Gezira State and nearby states. It includes the departments of Medicine, Surgery, ENT, Orthopedics, Radiology, Blood Bank, ICU, Referred clinics, Medical Emergency Department, Surgical Emergency Department, Laboratory, Operation Theatres, and Radiology.

### **2.3. Study population**

Patients admitted for elective laparoscopic cholecystectomy during the period September 2020 - June 2021).

### **2.4. Study Variables**

#### *2.4.1. Dependent*

Open cholecystectomy

### 2.4.2. Independent

Socio-demographical characteristics, co-morbid illnesses, BMI, drug history and surgical history. US findings and intra-operative findings.

## 2.5. Surgical Procedure

The performed surgical procedure was laparoscopic cholecystectomy under general anesthesia with endotracheal intubation using a standard 30laparoscope and four operating ports (a 10mm umbilical port and three 5mm ports). The three 5mm ports were inserted in the right subcostal area. 5mm laparoscopic coagulation shears was used for Calot's triangle dissection and cystic artery and duct isolation. Cystic artery control and cystic duct section after isolation was achieved using 5mm laparoscopic clips. After cholecystectomy, absorbable suture (vicryle) was used for closure of the fascia to prevent umbilical hernia, finally the skin was closed using prolene or nylon 2\0.

## 2.6. Sampling and Data

### 2.6.1. Sampling and Sample size

Total coverage, (268 participants).

### 2.6.2. Data collection tools

Master sheet that covered the relevant variables from patient's files (secondary data) was used.

### 2.6.3. Data management and analysis

SPSS version 25.0 was used for data analysis; Chi square test was used.  $P$ -value  $\leq 0.05$  was considered statistically significant.

## 2.7. Ethical considerations

The study approval was obtained from the concerned bodies

## 3. Results

**Table 1** Socio-demographic characteristics cross tabulation among study participants, pre-and intra-operative predictive factors for conversion of laparoscopic cholecystectomy, Wad Madani Teaching Hospital, Gezira State, Sudan, (September 2020 - June 2021) (n=268)

Socio - demographic characteristics	None Converted cases	Converted cases	Total	P-value
	Frequency & percentage	Frequency & percentage	Frequency & percentage	
<b>Age</b>				
<40	98 (98.0%)	2 (2.0%)	100 (7.3%)	0.017
40-60	134 (89.3%)	16 (10.7%)	150 (56.0%)	0.033
>60	14 (77.7%)	4 (22.3%)	18 (6.7%)	0.001
<b>Gender</b>				
Male	28 (82.4%)	6 (17.6%)	34 (12.7%)	0.010
Female	218 (93.2%)	16 (6.8%)	234 (87.3%)	0.050
<b>BMI</b>				
Underweight	10 (100.0%)	00 (00.0%)	10 (3.7%)	0.022
Normal weight	154 (89.5%)	18 (10.5%)	172 (64.3%)	0.015
Overweight	74 (94.9%)	4 (5.1%)	78 (29.1%)	0.011
Obese	8 (100.0%)	00 (00.0%)	8 (2.9%)	0.000
Grand total	246 (91.8%)	22 (8.2%)	268 (100.0%)	

Two hundreds and sixty-eight participants were enrolled in this study. More than half (56%) of them were in the age group (40-60 years). Twenty-two cases (8.2%) were converted to open. About 72.3% of the converted cases was in this age group (40-60 years). Majority (87.3%) of the study participants were females. About 72.3% of converted cases were female. More than half (64.3%) of them were having normal BMI. More than third (36.9%) were known cases of hypertension. Almost third (32.1%) of them had history of jaundice. More than third (37.3%) were admitted once to hospital due to cholecystitis. More than half (53%) of them had history of abdominal surgery. Less than one third (21.6%) were using anticoagulants and antiplatelets. Upon examination: (7.8%) of them found to be jaundiced. US findings: majority (72.7%) had multiple stones, (91%) GB wall thickness was  $\geq 4$  and (63.6%) their GB wasn't fibrosed. Intraoperative findings: more than half (54.5%) had contracted GB, (90.9%) their GB was adherent to omentum and (54.5%) had fibrosis of Calot Triangle. Regarding admission with cholecystitis: more than third (36.4%) had admission of more than twice.

There was no statistical association between any of socio-demographic characteristics and conversion of laparoscopic cholecystectomy to open surgery (Table 1).

**Table 2** Co-morbid diseases cross tabulation among study participants, pre- and intra-operative predictive factors for conversion of laparoscopic cholecystectomy, Wad Madani Teaching Hospital, Gezira State, Sudan, (September 2020 - June 2021) (n=268)

Co-morbid diseases	None Converted cases	Converted cases	Total	P-value
	Frequency & percentage	Frequency & percentage	Frequency & percentage	
DM	52 (83.9%)	10 (16.1%)	62 (23.1%)	>0.05
HTN	163 (97.6%)	4 (2.4%)	167 (36.9%)	>0.05
IHD	7 (100.0%)	00 (00.0%)	7 (2.6%)	>0.05
Chronic lung disease	8 (80.0%)	2 (20.0%)	10 (3.7%)	>0.05
Smoking	10 (62.5%)	6 (37.5%)	16 (5.9%)	>0.05
None	00 (00.0%)	6 (100.0%)	6 (2.2%)	>0.05
Total	246 (91.8%)	22 (8.2%)	268 (100.0%)	

There was no statistical association between co-morbid diseases and conversion of laparoscopic cholecystectomy to open surgery (P value > 0.05). (Table 2)

**Table 3** Number of admissions cross tabulation distribution among study participants, pre- and intra-operative predictive factors for conversion of laparoscopic cholecystectomy, Wad Madani Teaching Hospital, Gezira State, Sudan, (September 2020 - June 2021) (n=268)

Number of admissions with cholecystitis	None Converted cases	Converted cases	Total	P-value
	Frequency & percentage	Frequency & percentage	Frequency & percentage	
None	52 (89.7%)	6 (10.3%)	58 (21.6%)	0.000
Once	98 (98.0%)	2 (2.0%)	100 (37.3%)	0.001
Twice	38 (86.4%)	6 (13.6%)	44 (16.4%)	0.021
>Twice	58 (87.9%)	8 (12.1%)	66 (24.7%)	0.000
Grand total	246 (91.8%)	22 (8.2%)	268 (100.0%)	

There was no statistical association between the number of admissions and conversion of laparoscopic cholecystectomy to open surgery (Table 3)

**Table 4** US findings among study participants, pre- and intra-operative predictive factors for conversion of laparoscopic cholecystectomy, Wad Madani Teaching Hospital, Gezira State, Sudan, (September 2020 - June 2021) (n=268)

US findings	None conversion cases	Conversion cases	Total	P value
	Frequency & percentage	Frequency & percentage	Frequency & percentage	
<b>Stones</b>				
Single	54 (90%)	6 (10.0%)	60 (22.4%)	>0.05
Multiple	192 (92.3%)	16 (7.7%)	208 (77.6%)	
<b>GB wall thickness</b>				
<4	52 (96.3%)	2 (3.7%)	54 (20.1%)	0.010
≥4	194 (90.7%)	20 (9.3%)	214 (79.9%)	
<b>GB</b>				
Fibrosed	24 (75.0%)	8 (25.0%)	32 (11.9%)	>0.05
Not fibrosed	222 (94.0%)	14 (6.0%)	236 (88.1%)	
<b>Pericholecystic fluids</b>				
Yes	4 (50.0%)	4 (50.0%)	8 (2.9%)	>0.05
No	242 (93.0%)	18 (7.0%)	260 (97.1%)	
<b>Dilated biliary system</b>				
Yes	60 (96.8%)	2 (3.2%)	62 (23.1%)	>0.05
No	186 (90.3%)	20 (9.7%)	206 (76.9%)	
<b>Impacted stone in GB</b>				
Yes	26 (86.7%)	4 (13.3%)	30 (11.2%)	>0.05
No	220 (92.4%)	18 (7.6%)	238 (88.8%)	
<b>Impacted stone in Hartman</b>				
Yes	2 (33.3%)	4 (66.7%)	6 (2.2%)	>0.05
No	244 (93.1%)	18 (6.9%)	262 (97.8%)	
Grand total	246 (91.8%)	22 (8.2%)	268 (100.0%)	

For US findings: GB wall thickness < 4 had significant statistical association with laparoscopic cholecystectomy and vice versa for open ( $P$  value = 0.010); apart from that there was no significant statistical association with any US findings and that of both laparoscopic and open surgical cholecystectomy ( $P$  value > 0.05). (Table 4)

**Table 5** Intraoperative findings among participants, pre- and intra-operative predictive factors for conversion of laparoscopic cholecystectomy, Wad Madani Teaching Hospital, Gezira State, Sudan, (September 2020 - June 2021) (n=268)

Intraoperative findings	None converted cases	Converted cases	Total	P-value
	Frequency & percentage	Frequency & percentage	Frequency & percentage	
<b>Gall bladder (GB)</b>				
Normal floppy GB	76 (97.4%)	2 (2.6%)	78 (29.1%)	>0.05
Adherent GB to omentum	98 (83.0%)	20 (17.0%)	118 (44.0%)	>0.05
Adherent GB to the bowel	28 (66.7%)	14 (33.3%)	42 (15.7%)	>0.05
Distended GB	132 (97.0%)	4 (3.0%)	136 (50.7%)	>0.05
Contracted GB	8 (40.0%)	12 (60.0%)	20 (7.5%)	0.001
Intra-abdominal adhesions	30 (88.2%)	4 (11.8%)	34 (12.7%)	>0.05
<b>Stones</b>				
None	26 (92.8%)	2 (7.2%)	28 (10.5%)	>0.05
Single	134 (93.0%)	10 (7.0%)	144 (53.7%)	>0.05
Multiple	86 (89.6%)	10 (10.4%)	96 (35.8%)	>0.05
<b>Calot's Triangle Findings</b>				
Fibrosis	20 (62.5%)	12 (37.5%)	32 (11.9%)	0.001
Cystic artery bleeding	22 (78.6%)	6 (21.4%)	28 (10.4%)	>0.05
Cystic artery anomalies	22 (91.7%)	2 (8.3%)	24 (9.0%)	>0.05
Cystic duct anomalies	10 (83.3%)	2 (16.7%)	12 (4.5%)	>0.05
CBD injury	12 (100.0%)	00 (00.0%)	12 (4.5%)	>0.05
Bile spilt	66 (89.2%)	8 (10.8%)	74 (27.6%)	>0.05
Stone spilt	46 (88.5%)	6 (11.5%)	52 (19.4%)	>0.05
Pancreatic head tumors	4 (100.0%)	00 (00.0%)	4 (1.5%)	>0.05
Porta hepatis secondaries	2 (100.0%)	00 (00.0%)	2 (0.8%)	>0.05
Cholecysto-duodenal fistula	2 (100.0%)	00 (00.0%)	2 (0.8%)	>0.05

Regarding intra-operative findings there was strong statistical association between contracted gall bladder and conversion of laparoscopic cholecystectomy to open surgery ( $P$  value = 0.001). (Table 5)

#### 4. Discussion

This study aimed to determine Preoperative and Intraoperative Predictive Factors for Conversion of Laparoscopic Cholecystectomy in Wad Madani Teaching Hospital (September 2020 - June 2021) and covered 268 study participants who were enrolled in this study. Our study reported that the conversion rate was 8.2% which is nearly close to other studies [3, 10]. Twenty-two cases (8.2%) were converted to open. About 72.3% of the converted cases were in this age group (40-60 years) which is closely similar to other studies [6,16]. Majority (87.3%) of the study participants were females. About 72.3% of converted cases were female unlike many international studies [7, 8, 11]. Our study revealed that most of cases that underwent conversion were having normal BMI, which is inconsistent with other studies [6,13,19]. This may return to the anthropobiologic features of the human of Aljazeera state, who is characterized by

small body build. There was no statistical association between different co-morbid diseases and conversion of laparoscopic cholecystectomy to open surgery which is similar to other studies [4, 13, 14]. There was no statistical association between number of admissions and conversion of laparoscopic cholecystectomy to open surgery unlike other studies [9]. There was strong statistical association between contracted gall bladder and conversion of laparoscopic cholecystectomy to open surgery which is consistent with many international studies [9].

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## 5. Conclusion and Recommendation

The high conversion rate took place among: age group (40-60 years) and female gender. There was no statistical relation between (different co-morbid diseases and number of admissions) and conversion of laparoscopic cholecystectomy to open surgery. The main predictive factor for conversion of laparoscopic cholecystectomy to open surgery was the contracted gall bladder. Identifying preoperative patient-related variables, predicting the need for conversion of laparoscopic cholecystectomy to open surgery may help to identify high-risk patients and redefine the surgical strategy that insuring availability of expertise for complicated cases. Raising awareness of the population to present earlier for treatment. To conduct this study in a multi-centric population.

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### Compliance with ethical standards

#### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

#### *Statement of ethical approval*

Ethical approval was obtained from the concerned bodies.

#### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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