

The Outcomes of Laparoscopic Cholecystectomy in Children Compared to Adults: A Multiple Iraqi Centers Study

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ABSTRACT

Background: Laparoscopic cholecystectomy now is a proven technique intended for treating symptomatic gallstones or their complications which arises from gallstones. In excess of the last 15 years, gallbladder disease has become a very common problem for older children and young adolescents. Main causes for development of cholelithiasis in children were: hemolytic disease, especially sickle cell disease or hereditary spherocytosis. Non hemolytic stones in adults are primarily cholesterol-based. In younger children, many stones have predominantly calcium carbonate. **Patients and Methods:** This prospective cross-sectional study. All patients undergoing laparoscopic cholecystectomy were included while patients deferred by the anesthetist or undergoing open surgery were excluded from the study. The totals of 75 patients enrolled in this study were divided into two groups. Group I (n = 10) being child patients and Group II (n = 65) being adults patients who underwent laparoscopic cholecystectomy. This study was approved by Institutional Ethical Committee. Informed consent was obtained from all the participants. **Result:** According to the collected data which showed that the percentage of gallbladder stones higher in female than male and for group 2 in values (81.3%). 60% of patients presented with history of vague abdominal pain, 45% of patients and Serum cholesterol was found within the normal range for both groups (13.3%, 52.0%). Percentage of patients with wound infection and abdominal distension was significantly higher in open surgery as likened to laparoscopic surgery. Moreover, post-operative morbidity rates were reported to be higher in open surgery as compared to laparoscopic surgery. **Conclusion:** Laparoscopic cholecystectomy is a safe and effective procedure in almost all patients with cholelithiasis especially now for children. Proper preoperative work up and consciousness for any possible complications and adequate training styles this operation a safe procedure with favorable result and lesser complications.

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Keywords: Cholelithiasis; gallbladder stones; gallstone disease; Laparoscopic cholecystectomy

INTRODUCTION

Laparoscopic cholecystectomy (LC) now is a proven technique intended for treating symptomatic gallstones or their complications which arises from gallstones. This procedure still considered as the Gold standard procedure for treating symptomatic cholecystolithiasis and it became the commonest procedure performed over open cholecystectomy worldwide [1-3].

Still, LC technique is associated with several complications and has got an early post-operative recovery; complications include infection (1%), haemorrhage (1%), intra-abdominal injury (0.3%), and retained stones (0.1%). In addition, up to 30% of patients suffer post-cholecystectomy syndrome which varyingly includes variation dyspepsia, nausea, vomiting, flatulence, bloating, diarrhea as well as pain in the upper abdomen. Furthermore, the rate of post-operative diarrhea has varyingly been reported between the percentages of 9.1% - 33% [4-11].

Generally, risk factors for gallstone disease are female gender, obesity, increasing age as well as smoking and positive family history. Gallstones can lead to biliary colic or be complicated by acute cholecystitis, acute pancreatitis or obstructive jaundice [12-16].

As the risk of intraoperative injury during the laparoscopic cholecystectomy was higher than in open cholecystectomy; Thus, Laparoscopic cholecystectomy put forward the benefits of least invasive surgery for most patients. The intraoperative complications of LC like bile duct injuries decrease with the time, because of: 1/increased experience of the surgeons, 2/ acceptance of the procedure and starter of new instruments [17-19].

In excess of the last 15 years, gallbladder disease has become a very common problem for older children and young adolescents. Main causes for development of cholelithiasis in children were: hemolytic disease, especially sickle cell disease or hereditary spherocytosis. Other causes were: long-term TPN, dehydration, cystic fibrosis, short bowel syndrome, ileal resection, use of oral contraceptives, and obesity. Non hemolytic stones in adults are primarily cholesterol-based. In younger children, many stones have predominantly calcium carbonate [20-26].

PATIENTS AND METHODS

Study Design

This prospective cross-sectional study was carried out in Alkarama teaching hospital, AlYarmouk teaching hospital and Child Center Teaching Hospital, Baghdad from May 2022 - March 2023 in Department of Surgery.

Sample and Setup

Data from 75 patients with cholelithiasis (65 adult patients and 10 child patients) were collected after cholecystectomy at the Department of Surgery; all patients undergoing laparoscopic cholecystectomy were included while patients deferred by the anesthetist or undergoing open surgery were excluded from the study.

Patient's Selection and Data Collection

All patients were interviewed for a detailed clinical history. Physical examination was conducted according to a definite preform. Patients were investigated by a complete blood count, urine examination, liver function tests, X-ray chest and abdominal ultrasonography. Preoperative prophylactic antibiotics were given to all patients.

All patients were operated under general anesthesia. Patient were informed and detailed about both the procedures and were free to choose any procedure. Mainly 4-ports entry procedure was adopted and also 3-ports entry was adopted. The average operation time was 45-60 minutes. Single doses of injectable antibiotics were given till the next morning. Patients were mobilized on the same evening while they were discharged home the next morning or the second day with advice for follow up visit 10 days after surgery. This study represents our experience of laparoscopic cholecystectomy with the aim to evaluate the complications of laparoscopic cholecystectomy in cholelithiasis, both in symptomatic and asymptomatic among adults and children patients. Demographic data on age and sex was also collected. The stones were classified into three types depending on their color and degree of hardness. Yellow and whitish stones were identified as cholesterol stones, black and dark brown as pigment stones, and brownish yellow or green as mixed stones.

The totals of 75 patients enrolled in this study were divided into two groups. Group I (n = 10) being child patients [≤ 12 years old] who underwent LC and Group II (n = 65) being

adult patients [≥ 12 years old] who underwent LC. This study was approved by Institutional Ethical Committee. Informed consent was obtained from all the participants.

SAMPLE CRITERIA

A/Inclusion Criteria

1. This study included patients whom age between 1-80 years old.
2. This study included all symptomatic and asymptomatic patients whom diagnosed as calculus cholecystitis.
2. Patients attending the surgical consultation department during the study period who were presented for abdominal ultrasound examination for gallstone disease on ultrasonography admitted to the surgical wards.

B/Exclusive Criteria

1. The participants excluded who were more than 80 years old.
2. The participants excluded who were less than 1 years old.
3. Patients with symptoms not related to gallstone disease (gall bladder mass, mucocele, empyema, portal hypertension, cirrhosis of the liver, history of coagulopathy).
4. Patients with history of cholecystectomy.
5. Pregnant women were excluded.

The Statistical Analysis

Analysis of data was carried out using the available statistical package of SPSS-24 (Statistical Packages for Social Sciences-

version 24) for data input and analysis. Data were presented in simple measures of frequency, percentage. The significance of difference of different percentages (qualitative data) was tested using Chi-square test with application of Yate's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05.

RESULTS

Socio-Demographic Characteristics for the Study Patients

The current study was designed for the purpose of evaluating the benefits and outcomes of laparoscopic cholecystectomy among children compared to adults. The totals of 75 patients enrolled in this study were divided into two groups; Group I [$n = 10(13.3\%)$] being child patients [≤ 12 years old] who underwent LC and Group II [$n = 65(86.7\%)$] being adult patients [≥ 12 years old] who underwent LC which their age range from 5 to 80 years of age. Table 1 presented socio-demographic data for patients including: age, gender, occupation, residence and number of children. According to the collected data which showed that the percentage of gallbladder stones (GBS) higher in female than male and for group 2 in value (81.3%) while for male in group 2 (5.3%). Additionally, also it was found that the residence place has an important impact for this study and it presented that residency in urban places for both groups was (10.7%, 60%) which is higher than rural places which was only (29.3%). Furthermore, the most of patients with group 2 were with: government job (32%), Number of children >3 (44%).

Table 1: Socio-demographic characteristics for the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
Age - Range (5-80) years		
	10 (13.3%)	65(86.7%)
Gender		
Female	13.3%	81.3%
Male	0.0%	5.3%
Occupation status		
Governmental job	0.0%	32.0%
Private job	0.0%	24.0%
Non employed	13.3%	9.3%
Housewife	0.0%	20.0%
Residence		
Urban	10.7%	60.0%
Rural	2.7%	26.7%
Number of children		
0-3	13.3%	42.7%
>3	0.0%	44%

Clinical Presentation and Laboratory Findings for the Study Patients

Table 2 showed the clinical presentation and laboratory findings for the study patients for both groups include: History of biliary colic pain, previous lower abdominal pain, pyrexia, thrombocytopenia, elevated serum bilirubin, elevated liver

enzymes, Serum cholesterol (normal less than 200mg/dl). According to the collected data which show that the percentage for absence of for group1 and group 2 respectively: [biliary Colic Pain (5.3%, 26.7%), previous abdominal pain (13.3%, 76.0%), pyrexia was (13.3%, 46.7%), elevated serum bilirubin (6.7%, 85.3%), elevated liver enzymes (13.3%, 81.3%), Serum cholesterol (13.3%, 52.0%).

Table 2: Clinical presentation and laboratory findings for the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
History of biliary Colic Pain		
No	5.3%	26.7%
Yes	8.0%	60.0%
previous lower abdominal pain		
No	13.3%	76.0%
Yes	0.0%	10.7%
pyrexia		
No	13.3%	46.7%
Yes	0.0%	40.0%
thrombocytopenia		
No	5.3%	41.3%
Yes	8.0%	45.3%
elevated serum bilirubin		
No	6.7%	85.3%
Yes	6.7%	1.3%
elevated liver enzymes		
No	13.3%	81.3%
Yes	0.0%	5.3%
Serum cholesterol (normal less than 200mg/dl)		
Normal	13.3%	52.0%
Elevated	0.0%	34.7%

Medical Conditions Characteristics for the Study Patients

Table 3 showed that medical conditions characteristics for the study patients including: Presence of chronic disease, Presence of hemolytic Anemia, Family History of Gallstone, history of contraceptive use, Smoking. The existing study results showed that the most of patients for group1 and

group 2 respectively did not have: any chronic disease and the percentage were [13.3%, 76.0%], hemolytic anemia and percentage was [10.7%, 86.7%], and no smoking with a percentage of [12.0%, 58.7%]. While other such as Family History of Gallstone that present with a percentage of [8%, 60%] and presence of previous contraceptive use with a percentage of 69.3%.

Table 3: Medical conditions characteristics for the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
Presence of chronic disease		
Not presence	13.3%	76.0%
Presence	0.0%	10.7%
Presence of haemolytic Anemia		
Not presence	10.7%	86.7%
Presence	2.7%	0.0%
Family History of Gallstone		
No	5.3%	26.7%
Yes	8.0%	60.0%
history of contraceptive use		
No	13.3%	17.3%
Yes	0.0%	69.3%
Smoking		
No	12.0%	58.7%
Yes	1.3%	28.0%

Diagnosis and gallstone content for the study patients

Table 4 showed that most results were presented as an emergency over elective and the percentage for group 1 and group 2 respectively were [0.0%, 65.3%]. Moreover, the

diagnosis of most results were acute > chronic and Acute on chronic and the percentage for group 1 and group 2 were [0.0%, 48.0%]. Also, Gallstone content was Cholesterol stone type > pigment stone and Mixed stone and the percentage for group 1 and group 2 respectively were [10.7%, 52.0%].

Table 4: Diagnosis type of surgery and gallstone content for the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
Elective or emergency		
elective	13.3%	21.3%
emergency	0.0%	65.3%
Diagnosis		
Acute	0.0%	48.0%
Chronic	8.0%	20.0%
Acute on chronic	5.3%	18.7%
Gallstone content		
Pigment stone	0.0%	21.3%
Cholesterol stone	10.7%	52.0%
Mixed stone	2.7%	13.3%

Operative and histological features for the study patients

Table 5 showed that most study results for operative features were not present for the LC surgery for group 1 and group

2 respectively: severe adhesion distended, contracted gallbladder and perforated gallbladder [13.3%, 82.7%], [13.3%, 84.0%], [13.3%, 82.7%].

Table 5: Operative and histological features of the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
Severe adhesion		
No	13.3%	82.7%
Yes	0.0%	4.0%
Distended gallbladder		
No	13.3%	78.7%
Yes	0.0%	8.0%
Contracted gallbladder		
No	13.3%	84.0%
Yes	0.0%	2.7%
Perforated gallbladder		
No	13.3%	82.7%
Yes	0.0%	4.0%

Post-operative Complications for the Study Patients

Table 6 showed that most study results for the post-operative complications for the LC surgery for group 1 and group 2

respectively were not present especially: wound infection (port site) [12.0%,70.7%], post-cholecystectomy syndrome [13.3%,84.0%], postoperative mortality (due to co-morbidity) [9.3%, 50.7%], etc...

Table 6: Post-operative complications for the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
Wound infection (port site)		
No	12.0%	70.7%
Yes	1.3%	16.0%
Port site hernia		
No	13.3%	81.3%
Yes	0.0%	5.3%
Bile leakage due to liver injury		
No	13.3%	85.3%
Yes	0.0%	1.3%
Chest infection		
No	13.3%	85.3%
Yes	0.0%	1.3%
Urinary tract infection		
No	12.0%	70.7%
Yes	1.3%	16.0%
Bleeding from gallbladder bed		
No	13.3%	74.7%
Yes	0.0%	12.0%
Sub-hepatic abscess		
No	13.3%	85.3%
Yes	0.0%	1.3%
Post cholecystectomy syndrome		
No	13.3%	84.0%
Yes	0.0%	2.7%
Postoperative mortality (due to co-morbidity)		
No	9.3%	50.7%
Yes	4.0%	36.0%

Post-operative stay and pain for the study patients

Table 7 showed that most study results for the post-operative stay and pain for the LC surgery for group 1 and group 2 respectively were not present especially: post-operative

pain (hours) [8.0%, 49.3%, post-stay/days [12.0%, 61.3%]. Moreover, post-operative returns to normal life (days) were good for group 1 and group 2 respectively with percentage of [9.3%, 76.0%].

Table 7: Post-operative stay and pain for the study patients.

Character	Group 1 No. (Percentage %)	Group 2 No. (Percentage %)
Post-operative pain (hours)		
No	8.0%	49.3%
Yes	5.3%	37.3%
Post stay /days		
No	12.0%	61.3%
Yes	1.3%	25.3%
Returns to normal life (days)		
No	4.0%	10.7%
Yes	9.3%	76.0%

Relationship between type of stone content for each patient's group and serum cholesterol level

Table 8 showed that most study results for the Relationship between type of stone content for each patient's group and

serum cholesterol level for the LC surgery. The results for elevation of cholesterol level and percentage for presence of cholesterol type of stone was much more than other type of stone especially for group 2 adult patients [61.5%].

Table 8: Relationship between type of stone content for each patient's group and serum cholesterol level.

Character	Cholesterol stones No. (Percentage %)	Pigment stones No. (Percentage %)	Mixed stones No. (Percentage %)	p-value
Serum cholesterol (normal less than 200mg/dl)				
Group 1 (≤ 12 years old) Normal	0.0%	60.0%	40.0%	0.004
Group 1 (≤ 12 years old) Elevated	0.0%	0.0%	0.0%	
Group 2 ≥ 12 years old Normal	51.3%	23.1%	25.6%	0.231
Group 2 (≥ 12 years old) Elevated	61.5%	23.1%	15.4%	

Relationship between Returns to Normal Life (Days) For Each Patient's Group and Clinical Diagnosis

Table 9 showed that most study results for relationship between returns to normal life (days) for each patient's group

and clinical diagnosis. for the LC surgery. The results for positive returns to normal life (days) for each patient's group and percentage for diagnosis with acute presentation was much more than other type of presentation [71.4% for group 1, 64.9% for group 2].

Table 9: Relationship between returns to normal life (days) for each patient's group and clinical diagnosis.

Character	Acute No. (Percentage %)	chronic No. (Percentage %)	Acute on chronic No. (Percentage %)	p-value
Returns to normal life (days)				
Group 1 (≤ 12 years old) yes	71.4%	0.0%	28.6%	0.105
Group 1 (≤ 12 years old) no	100.0%	0.0%	0.0%	
Group 2 (≥ 12 years old) yes	64.9%	19.3%	15.8%	0.209
Group 2 (≥ 12 years old) no	25.0%	62.5%	12.5%	

DISCUSSION

The current study was designed for the purpose of evaluating the benefits and outcomes of laparoscopic cholecystectomy among children compared to adults. The study showed that patients who underwent LC which their age range from 5 to 80 years of age and it found that currently cholelithiasis in children and teenagers is developing and subsequent cholecystectomies at early age [27].

According to the collected data which showed that the percentage of GBS higher in female than male and for group 2 in value (81.3%) while for male in group 2 (5.3%). These results agreed with Giri S. study which showed that main patients presented were females with a female to male ratio of 1.7:1[28].

Additionally, also it was found that the residence place has an important impact for this study and it presented that residency in urban places for both groups was (10.7%, 60%) which is higher than rural places which was only (29.3%). This disagreed with Bhasin SK, Gupta A, et al., which showed that (75%) belonged to rural areas and rest to urban set up [29].

The results of the study showed the clinical presentation and laboratory findings for the study patients for both groups include: According to the collected data which show that the percentage of absence for group1 and group 2 respectively: [biliary Colic Pain (5.3%, 26.7%), previous abdominal pain (13.3%, 76.0%)]. This agreed with previous study [30] which showed that in symptomatic group, 60% of patients presented with history of vague abdominal pain, 45% (n=36) each had dyspeptic symptoms and intermittent colic [30].

Serum cholesterol was found within the normal range for both groups (13.3%, 52.0%) and to be incompatible with previous study, found that Serum cholesterol levels were found elevated in majority of patients with a mean value of 221.92mg% [31].

The present study revealed that medical conditions characteristics for the study patients including: Presence of chronic disease, Presence of hemolytic Anemia, Family History of Gallstone, history of contraceptive use, Smoking. The existing study results showed that the most of patients for group1 and group2 respectively did not have: any chronic disease and the percentage were [13.3%, 76.0%], hemolytic anemia and percentage was [10.7%, 86.7%], and no smoking with a percentage of [12.0%, 58.7%]. This differed from Wesdorp I, Bosman D, et al. study which reported that 95 patients (52.5%) had no risk factors, 24% patients (n = 51) had family history, 16 patients (7.6%) had hemolytic disorders [32]. While other such as Family History of Gallstone that present with a percentage of [8%, 60%]and goes with previous study with the same results [32].

Table 4 showed that most results were presented as an emergency over elective and the percentage for group 1 and group 2 respectively were [0.0%, 65.3%]. Moreover, the diagnosis of most results were acute > chronic and Acute on chronic and the percentage for group1 and group 2 were [0.0%, 48.0%]. Also, Gallstone content was Cholesterol stone type > pigment stone and Mixed stone and the percentage for group 1 and group 2 respectively were [10.7%, 52.0%], this goes with Holcomb et al. study which observed that in majority of the patients, the gallstones were composed of

cholesterol primarily and varied in color from pale yellow to dark yellowish brown with a few having greenish color [33, 34].

Table 5 showed that most study results for operative features were not present for the LC surgery for group 1 and group 2 respectively: severe adhesion distended, contracted gallbladder and perforated gallbladder [13.3%, 82.7%], [13.3%, 84.0%], [13.3%, 82.7%], this disagreed with Al Ghadhban MR, Alkumasi HA, et al. which showed that the most common cause for conversion in the study is due to presence of dense adhesions and disturbed anatomy in the triangle of Calot that could not guaranteed safe dissection and clipping (33.3%) [35,36].

Table 6 showed that most study results for the post-operative complications for the LC surgery for group 1 and group 2 respectively were not present especially: wound infection (port site) [12.0%,70.7%], post-cholecystectomy syndrome [13.3%,84.0%], Postoperative mortality (due to co-morbidity) [9.3%, 50.7%], etc, this compatible with Coccolini F, Catena F, et al. which found that percentage of patients with wound infection and abdominal distension was significantly higher in open surgery as likened to laparoscopic surgery. Moreover, in previous studies too, post-operative morbidity rates were reported to be higher in open surgery as compared to laparoscopic surgery, which matched with the present study on same results [37].

Table 7 showed that most study results for the post-operative stay and pain for the LC surgery for group 1 and group 2 respectively were not present especially: post-operative pain (hours) [8.0%, 49.3%, post stay/days [12.0%, 61.3%]. Moreover, post-operative returns to normal life (days) were good for group1 and group2 respectively with percentage of [9.3%, 76.0%]. The decrease in post-operative pain for Lc agreed with earlier study for Doke A, Gadekar N, et al. just for few hours after LC operation this because of LC surgery being a minimally invasive procedure affects a limited tissue area and hence resultant pain is less [38].

In this study, post-operative duration of hospital stay decrease this agreed with Anmol N, et al. which showed that shorter hospital stay remains the main advantage of the laparoscopic cholecystectomy procedure [39]. Furthermore, early return to normal occupational activities has been reported to be a key characteristic of laparoscopic surgery in different studies [40].

CONCLUSIONS

Laparoscopic cholecystectomy is one of the most frequently performed laparoscopic operations. It presents a low rate of mortality and morbidity. It is considered as a safe and effective procedure in almost all patients presenting with cholelithiasis. Most of the complications are due to lack of experience or knowledge of typical error. A standard selection of patients and proper preoperative work up as well as knowledge of possible complications, initial assessment of anatomy of that intended site prior to operation with the combination of an adequate training are required. As a result, to this assessment of correct decision requires optimal experience of laparoscopy under proper supervision, makes this operation a safe procedure with satisfactory results.

LIMITATIONS

The prospective nature and small sample size of this study limit generalization of our data. Nevertheless, we believe the present analysis provides useful information regarding the use of LC in a heterogeneous population typically encountered in clinical practice.

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