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Ultrasound abdomen as a tool to predict difficult cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy is a commonly performed procedure in general surgical practise, which can sometimes be tedious and can have high morbidity. Ultrasound abdomen is a routinely performed radiological investigation for every case of cholecystectomy. This study intends to find correlation between the ultrasound findings and the perceived difficulty during surgery.

Methods: This is a prospective study of 100 patients who underwent cholecystectomy after a preoperative ultrasound. Difficult cholecystectomies were defined and sonographic findings and intraoperative difficulties recorded and tabulated.

Results: Fifty one cholecystectomies were classified as difficult cholecystectomy (20 converted to open procedure and 31 took more than 90 min to complete laparoscopically). The commonest ultrasound finding that was encountered was multiple calculi (62%) followed by gallbladder (GB) wall thickness of >4 mm (33%), stone size >1 cm (22%), contracted GB (17%), intrahepatic biliary radicals (IHBR) dilatation (15%) and the least common finding was empyema of the gallbladder seen in 7% of the cases.

Conclusions: This study is a reflection of surgeries performed by a single team over 3 years which included 100 cases. It was started with an idea to identify the findings on a preoperative ultrasound that predicted a difficult cholecystectomy (laparoscopic or open). In our experience we found that empyema GB, pericholecystic fluid, IHBR dilatation and wall thickness of GB are excellent predictors of a difficult cholecystectomy.

Keywords: Cholecystectomy, Laparoscopic cholecystectomy, Difficult, Ultrasound, Sonography, Gallbladder

INTRODUCTION

Cholelithiasis is a common problem with an estimated 20million people suffering from it in the United States of America, the incidence being 6.5% in males and 10.5% in females, yearly a million people require hospitalisation and 700,000 of them undergo surgery for the same, costing the US government an annual expenditure of 5 billion USD.¹⁻⁴ This makes gallbladder diseases the costliest health problem.

In symptomatic gallstones cholecystectomy, whether laparoscopic or open, offers the only solution, or else recurrence of symptoms and complications ensue.⁵

Laparoscopic cholecystectomy is safe, less painful, provides early recovery, shorter hospital stay and is cosmetically superior, hence it has gained popularity and is unarguably better than open cholecystectomy for the patient as well as the healthcare system.⁶ The incidence of biliary tract injuries is slightly higher in laparoscopic surgery than open surgery.⁷ Complications and bile duct injury in laparoscopic or open cholecystectomy occur while performing the surgery for complicated disease (acute or chronic cholecystitis) and altered anatomy.⁸

Ultrasound abdomen is the most widely used investigative modality for screening of gall stones, it effectively identifies inflammation in and around the

gallbladder, stone size, number. Ultrasound is not as helpful though in variable anatomy and lower bile duct evaluation wherein computed tomography (CT) scan and magnetic resonance cholangiopancreatography (MRCP) have a distinctive advantage.⁹

In our study we intend to study the relationship between various ultrasound findings and their bearing on a difficult laparoscopic cholecystectomy and/or conversion to open procedure.

METHODS

It is a prospective study done between March 2014 to December 2018 that included 100 patients who underwent laparoscopic cholecystectomy by the same surgeon. The study was conducted in the third unit of department of general surgery, SDM college of medical sciences and hospital, Dharwar, India. All the patients were informed and a written consent was obtained before inducting them into the study.

A 100 patients who were diagnosed to have symptomatic cholelithiasis and who underwent a preoperative abdominal ultrasound were offered laparoscopic cholecystectomy. The intraoperative findings, duration of surgery and conversion if any were recorded and compared with preoperative ultrasound to correlate significant indicators for difficult cholecystectomy. A difficult cholecystectomy was defined as any laparoscopic cholecystectomy that required more than 90 minutes to complete or was converted to open surgery. The operating surgeon, the operating room, equipments being the same, the surgeon and hospital based confounding factors were minimised to the least for a better comparison and correlation.

Inclusion criteria

All patients aged >18 years, all patients with symptomatic gallstone disease and undergoing elective laparoscopic cholecystectomy were included.

Exclusion criteria

Presence of cholangitis, patients with choledocholithiasis, patients who underwent emergency laparoscopic cholecystectomy and unwilling patients were excluded.

Preoperative ultrasound abdomen performed on each patient documented the following findings gallbladder wall thickness >4 mm, pericholecystic fluid collection m IHBR dilatation, contracted gallbladder, gallstone size > 1cm, multiple calculi, polyp.

Intraoperatively, duration of surgery and conversion to open surgery were documented for comparison later.

All patients recruited in the study underwent a detailed history and physical examination and apart for the mandatory ultrasound were also subjected to other investigations needed to further investigate the disease process or those deemed necessary for obtaining fitness for surgery. A preoperative nasogastric tube was inserted in the operating room before the start of the procedure by the anaesthetist. A standard four port laparoscopic cholecystectomy was performed or else converted to open surgery via a right subcostal incision. Intraoperative cholangiogram was not performed in any cases, but critical view of safety demonstrated in each and every case before clipping or ligating any structure. When converted to open surgery a fundus first technique was employed and every attempt was made to identify the cystic duct, when Calot's triangle was frozen then subtotal cholecystectomy was performed making sure not to injure the bile duct. A drain in the Morrison's pouch was placed in all cases of difficult cholecystectomy. Routine post operative antibiotics were not used and only when indicated for other reasons empirical or culture based antibiotics were used appropriately.

RESULTS

A total of 100 patients were included in the study, among them 51 were males and 49 females, with mean age of 47.68 yrs (24-81 yrs) (Table 1).

Table 1: Population characteristic.

Characteristic	Mean (range) %
Male	51
Female	49
Age	47.68 yrs (24-81)

Fifty one cholecystectomies were classified as difficult cholecystectomy (20 converted to open procedure and 31 took more than 90 min to complete laparoscopically). The commonest ultrasound finding that was encountered was multiple calculi (62%) followed by GB wall thickness of >4 mm (33%), stone size >1 cm (22%), contracted GB (17%), IHBR dilatation (15%) and the least common finding was empyema of the gallbladder seen in 7% of the cases. The table gives details of each ultrasound finding and the chance of conversion to open procedure or surgery lasting for >90 min. Out of the 15 patients who had IHBR dilatation on ultrasound 12 had a difficult cholecystectomy with p value being significant for open conversion. 22 out of 33 patients with wall thickness >4 mm had a difficult cholecystectomy. Only one case of pericholecystic fluid collection could be completed laparoscopically within 90 min, rest 24 were difficult cholecystectomies with statistical significance for both open conversion and prolonged laparoscopic surgery. 4 of 17 contracted gallbladders were difficult and 14 out of 22 surgeries with stone size >1 cm were difficult. Multiple calculi on preoperative ultrasound was found to be insignificant as 34 of the 62 were deemed difficult. Empyema gallbladder was the most significant preoperative ultrasound finding wherein all of the seven patients had a difficult cholecystectomy with high statistical significance of open conversion (Table 2).

Table 2: Ultrasound findings and difficult cholecystectomy.

Ultrasound finding	Total patients (n=100)	Duration >90 mins (31 patients) N (%)	P value	Conversion to open (20 patients) N (%)	P value
IHBR dilatation	15	6 (19)	0.413	6 (30)	0.035
Wall thickness >4 mm	33	14 (45)	0.08	8 (40)	0.456
Pericholecystic fluid	25	14 (45)	0.001	10 (50)	0.003
Contracted gall bladder	17	2 (6)	0.059	2 (10)	0.351
Stone size >1 cm	22	8 (25)	0.537	6 (30)	0.334
Multiple calculi	62	20 (64)	0.728	14 (70)	0.409
Empyema	7	2 (6)	0.059	5 (25)	0.00042
Polyp	0	0		0	

Table 3: Intra-operative findings.

Intraoperative finding	Number
Right upper quadrant phlegmon	30
Colonic adhesions	16
Duodenal adhesions	22
Calot triangle inflammation	47
GB bed inflammation	25
Altered anatomy in Calot	12
Duct of Luschka	2

Intraoperative findings were also noted and calot triangle inflammation and flimsy duodenal adhesions to GB were the commonest findings. Right upper quadrant phlegmon was seen in 30 cases. A quarter of cases had gallbladder bed inflammation, especially those who had undergone previous ERCP or had cholangitis earlier. There were 16 cases with colon being adhered to the GB which were tackled laparoscopically as they were flimsy and could be easily separated without injuring the bowel. Altered Calot anatomy was seen in 12, which included ductal and vascular elements and duct of Luschka was seen in 2 cases wherein i was clipped before cutting (Table 3).

Since it was a single surgeon the operative times could be relatively compared, however there are many factors such as assistant surgeon, scrub nurse, instruments, equipments, anaesthesia related delay and others that can have an effect on operative time. We chose to ignore those and classify difficult cholecystectomy based on average operating time for a so called simple laparoscopic cholecystectomy.

No injury to the common bile duct was noted in any of the cases, neither were duodenal or colonic injuries.

DISCUSSION

Cholecystectomy whether laparoscopic or open has been a commonly performed surgery in general surgical practice, it has been associated with dreaded complication of injury to biliary ductal system, thereby making this frequently performed surgery a major cause for morbidity and mortality. There has always been a search for ways to predict a "difficult cholecystectomy" which might lead to biliary complications, so that prior knowledge of a potentially risky case might initiate a careful approach from the surgeon. Ultrasound abdomen is an excellent screening investigation which is almost always done in a case of cholelithiasis, certain findings on the scan are known to influence the outcome of surgery. This present study is in fact concerned with determining the predictive value and correlation of difficult cholecystectomy by using preoperative ultrasound findings.

There have been multiple attempts previously to identify the use of ultrasound as a predictor of difficult cholecystectomy. ^{10,11} Lal et al did a similar study and found the incidence of difficult cholecystectomy to be around 33% and gallbladder wall thickness, gallbladder size, common bile duct diameter, common bile duct stones, and any abnormal anatomy of the biliary tract were significant predictors of difficulty during cholecystectomy. ¹² A large single institution study published in 2012 who were utilising ultrasound to predict open conversions in a setting of acute cholecystitis opine that the presence of two in the triad of GB wall thickening, blurred Calot anatomy and pericholecystic fluid or abscess resulted in a 70% conversion to open surgery. ¹³

In our study we found that empyema GB on preoperative ultrasonography had 100% prediction of a difficult cholecystectomy (laparoscopic or open), followed by pericholecystic fluid collection (96%), IHBR dilatation (80%), GB wall thickness >4 mm (66.6%), stone size >1 cm (63.6%), multiple calculi (54.8%) and the least significant was contracted GB (23.5%). Individually IHBR dilatation (6), pericholecystic fluid collection (10) and empyema GB (5) were significant in predicting open conversions while pericholecystic fluid predicted prolonged (>90 min) laparoscopic surgery in 14 patients.

In this study the rate of conversion to open surgery was 20%, which is higher than the average rates in many other studies, this may be because of the team's learning curve and that we are a referral centre and thus have a slightly higher number of acute cholecystitis cases or our selection of cases. Similar conversion rates were seen

with Singh et al, who among 6147 cases converted 1518 patients (21.5%) as they were identified as difficult cases.¹⁴

Of all the factors gallbladder wall thickening has been considered most significant, as studied by Dinkel et al, it has a sensitivity, specificity, positive predictive value and accuracy in predicting difficulty during surgery were 66.7%, 94.1%, 84.2%, and 85.3% respectively.¹⁵

CONCLUSION

This study is a reflection of surgeries performed by a single team over 3 years which included 100 cases. It was started with an idea to identify the findings on a preoperative ultrasound that predicted a difficult cholecystectomy (laparoscopic or open). In our experience we found that empyema GB, pericholecystic fluid, IHBR dilatation and wall thickness of GB are excellent predictors of a difficult cholecystectomy. These when present should alert the surgeon to continue with careful dissection all the while trying to avoid any biliary injury. Larger study population with more detailed ultrasound findings and their correlation with intraoperative difficulty will be much more effective in future ventures.

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