Comparative Analysis of Preoperative Ultrasonography Reports with Intraoperative Findings in Cholelithiasis

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Abstract

Introduction: Cholecystectomy is a popular surgical intervention for cholelithiasis. Preoperative abdominal ultrasonography is helpful for diagnosis and prediction of possible surgical complications. This research was planned to correlate the preoperative abdominal ultrasonography findings with intraoperative findings and complications.

Methods: A hospital based retrospective study was conducted among 300 patients visiting Surgery Department and Department of Radiology of Shree Birendra Hospital, Kathmandu, Nepal. Descriptive statistics was used to present the comparative analysis of preoperative ultrasonography reports with intraoperative surgical findings in cholecystectomy.

Results: Total 300 participants were who were diagnosed by ultrasonography and underwent cholecystectomy were included in the study. Complications were reported among 110 subjects with adhesions in 20%, mucoceles in 7.3%, empyema in 8%, and impacted stone in 1.3.%. Out of 75 patients in which preoperative USG reports showed increased GB wall thickness, 17 (22.6%) had adhesions, 10 had mucoceles (1.3%), eight had empyema (10.6%), one had impacted stone (1.3%) and three had hemorrhage (4%).

Conclusion: The most reliable preoperative abdominal ultrasonography indicators of a challenging cholecystectomy are gall bladder wall thickness, impacted gall stones, adhesion and hemorrhage.

INTRODUCTION

Cholelithiasis or gallstones are one of the common medical problems leading to surgical intervention affecting 10% to 15% of the individuals in Western countries.[1] Gallstones are more frequent in females. The other risk factors are obesity, diabetes mellitus, advanced age, estrogen, pregnancy, hemolytic disease, cirrhosis with a considerable geographical / ethnic variation and family history.[1-3] They are mostly asymptomatic with only 10 to 20% becoming symptomatic within five to 20 years of diagnosis. The major complications such as acute cholecystitis, jaundice, cholangitis and acute pancreatitis occurs at rate of 0.1% to 0.3% annually and other minor complications occur in 2 - 2.6% per year.[4] The mortality rate for gallbladder related disease is low at 0.6% but there is still a high burden of disease.[5] Patients may present with epigastric and right upper abdomen pain, nausea and vomiting or referred pain below the right shoulder area or between the shoulder blades, especially right after a fatty meal.[6]

The presence of biliary colic with gallstone on an imaging study aids the diagnosis of chronic cholecystitis.[7] Cholecystectomy is the treatment of choice for all patients with symptomatic gallstones and acute cholecystitis and represents the widely accepted "gold standard", relatively easy, less expensive and safe surgery with mortality and

morbidity of approximately 0.5% and 10% respectively.[8,9]

Ultrasonography is the best imaging modality to diagnose gallstones and associated pathology of gallbladder. Peri-cholecystic fluid and thickened gallbladder walls are identified in acute cholecystitis; occasionally common bile duct stones and gallbladder sludge can also be seen with abdominal ultrasound. It is 84% sensitive, 99% specific and 96% accurate than oral cholecystography or computed tomography.[1,10] It is non-radiating, non-invasive, easily accessible and inexpensive.[11] Hence, this research was carried out to correlate the preoperative abdominal ultrasonography findings with intraoperative findings and associated complications.

METHODS

This retrospective hospital based study was carried out in Surgery and Radiology Departments of Shree Birendra Hospital, Kathmandu, Nepal from January 2021 to January 2023. The study was initiated after taking the ethical approval from the Institutional Review Committee (Re no. 968). Total 300 patients diagnosed with cholelithiasis who underwent cholecystectomy with the preoperative abdominal ultrasound and intraoperative findings were included in this study. Patients who were urgently operated; patients with common bile duct stones; without prior abdominal ultrasonography evaluation; who had ultrasonography reports from outside health center / hospital were excluded from the study. At surgery, gallbladder wall was measured along the peritoneal surface, corresponding to the back wall as seen on sonography. The measurements were done with 0.5 mm graded ophthalmology calipers. The sonographic and surgical measurements were recorded separately and compiled after surgical measurements. Descriptive statistics of sonographic measurements and surgical measurements were recorded along with patient demographics. Data was analyzed by statistical package for social sciences (SPSS) version v 26. Chi square test was used for analyzing data where applicable. The statistical analysis was performed with a statistical significance of P value < 0.05.

RESULTS

The demographics of the study population and the number of stones in the atudy population are shown in tables 1 and 2.

Table 1: Patients demographics

Characteristic	Value
Age (years)	
Mean ± SD	41.13 ± 10.83
Range	20 - 72
Gender	
Male, n (%)	83 (27.7%)
Female, n (%)	217 (72.3%)
BMI (kg / m^2)	
Mean ± SD	27.71 ± 2.79
Range	23.2 - 33.5

n: number of cases; SD: standard deviation

Table 2: Distribution of study population according to number of stones

No. of gall stones	USG findings		Intraoperative findings	
	Frequency	Percentage	Frequency	Percentage
Single	85	28.3%	76	25.3%
Multiple	215	71.7%	224	74.7%

There was a significant correlation between presence / absence of stone in ultrasonography and intraoperatively (X^2 = 0.841 and P = 0 < 0.001). In this study, there was difference in the sizes of stones when compared by ultrasonography and during operation where the stone sizes range from 2 mm to 26 mm by ultrasonography (Mean ± SD = 10.01 ± 6.01) and 2 mm to 25 mm during operation (Mean ± SD = 9.8 ± 5.91). But we found a positive association between size of stone and intraoperative complication (X^2 = 0.612 and P = 0 < 0.001). Four patients (1.33%) who had intraoperative complications had gall stone size of 7 to 10 mm.

Table 3: Comparison of gallstone thickness according to ultrasound with that found during operation

	GB wall thickness according to operative finding			Mc Nemar test	Agreement	
GB wall thickness according to US	No	Yes	Total	P	Kappa	P
No	63	159	222	1.000	0.111	0.001
Yes	8	70	78	NS		HS
Total	71	229	300			

NS: not significant at P ≤ 0.05; Highly significant at P ≤ 0.05

Table 3 shows the comparison of gallstone thickness according to ultrasound with that found during surgery. The mean thickness of gall bladder wall according to ultrasound report was 2.29 ± 0.74 mm with a range of 0.8 to 9.1 and that from operative finding was 2.82 ± 1.56 mm; the difference was statistically insignificant (P = 0.791). The level of agreement was supported by lack of significant variation according to McNemar test (P = 1.000) and a kappa statistic of (0.111) with high significant level of (P = 0.001). The difficulties which were experienced during surgery were significantly correlated with gallbladder wall thickness more than 4 mm. There was significant association between gallbladder wall thickness by ultarsonography and perioperative complication (X^2 = 0.789 and P < 0.001) and conversion to open (X^2 = 0.584 and P < 0.001).

Table 4: Comparison of gall stone impaction according to ultrasound and operative findings

GS impaction in operative findings				McNemar test	Agreement	
GS impaction in US	Absent	Present	Total	P	Kappa	P
Absent	285	0	285	1.000	1.000	<0.001
Present	0	15	15	NS		HS
Total	285	15	300			

NS: not significant at P ≤ 0.05; Highly significant at P ≤ 0.05

There was complete agreement between ultrasound and operative findings with respect to absence or presence of impacted stone as demonstrated in Table 4. The level of agreement was supported by lack of significant variation according to McNemar test and a kappa statistic of (P = 1.000) with high significant level of (P < 0.001). In this study, 20 (4%) subjects underwent conversion to open cholecystectomy. There was no significant association with the gender and rate of conversion to open surgery as suggested by X^2 = 0.756 and P = 0.308. But, there was significant association between rate of conversion and intraoperative complications (X^2 = 0.125 and P = 0.03). Out of 300, four had complications of hemorrhage and were subjected to conversion. The mean time taken in patients who had intraoperative hemorrhage was 100 minutes as compared to 65 minutes for those without haemorrhage.

As shown in Table 5, 110 patients had intraoperative complications like adhesions, empyema, mucoceles and impacted stones. Surgery was prolonged beyond 90 minutes in 23 patients where 12 had adhesions, four had impacted stones, four had hemorrhage, two had empyema and one had mucocele.

Out of 75 patients with preoperative increased gall bladder wall thickness in ultrasonography, 17 (22.6%) had adhesions, 10 had mucocele (1.3%), eight had empyema (10.6%), three had hemorrhage (4%) and one had impacted stone (1.3%) and the average time taken in these patients was 95 minutes. There was a significant association between the operative complications and duration of surgery (X^2 = 0.826 and P = 0.004).

Table 5: Distribution of study population correlating gall bladder wall thickness with other intraoperative findings

Gallbladder wall thickness		Adhesions	Mucocele	Empyema	Impacted stone	Hemorrhage
Normal	221	43 (19.4%)	12 (5.4%)	16 (7.2%)	3 (1.3%)	1 (0.4%)
Increased	75	17 (22.6%)	10 (1.3%)	8 (10.6%)	1 (1.3%)	3 (4%)

Discussion

Cholecystectomy is popular surgical procedure performed globally, accounting 20% of prevalence for surgical admission and subsequent surgical intervention.[1] In the third US National Health and Nutrition Examination Survey (20 - 74 years old) who had undergone gallbladder USG (from 1988 - 1994) showed the prevalence of gallstones was 7.1% and cholecystectomy was 5.3% with increased mortality.[12,13] The surgical predictability can help to approach experienced surgical team for the surgical difficulties.[14]

The prevalence of cholecystectomy in our study is 36.3% with the mean age of study population is similar to other study done in similar settings.[15] In line with our findings, as age advances, the risk for gallstone disease narrows to near equality, however, the female predominates the risk during reproductive age by four times than men.[1] Simon

E et al reported male gender had a significant higher risk of the operation being converted to open than women,[16] which was not found in our study. The ethnic differences in gallbladder disease prevalence differs according to sex and they can be partly explained by known risk factors.[3,17] Age was not found significant for conversion to open surgery in our study. Studies have shown that the conversion rate is greater in patients with acute cholecystitis.[18]

The ultrasound examination is very dependable in estimation of gallbladder wall thickness. The intraoperative difficulties were significantly correlated with gallbladder wall thickness more than 4 mm, which is consistent to other research.[19] Furthermore, the gall bladder wall thickness and common bile duct diameter was good ultrasonographic indicator to predict difficult surgery. Studies have reported that the gallbladder wall thickness > 3 mm, male, sessile, difficult anatomy of Calot's with adhesions, pericholecystic fluid were at greater risk of conversions to open procedure and increased risk of intra or postoperative complications, increased the operative time as well was the total duration of hospital stay.[20,21] In our study the gall bladder wall thickness was associated with adhesions, mucocele, empyema, impacted stone and hemorrhage and this was helpful in predicting difficult laparoscopic cholecystectomies. Ultrasonography is not a good indicator of adhesions and therefore has a little prediction value for conversion due to adhesion in our study. There was fair agreement between ultrasound and operative findings regarding stone size and also stone impaction. Flavio et al reported that the ultrasound report was found imperfect in standardization as they lack some variables to predict perioperative complications and surgical conversion.[22] The surgery went challenging in case of stone impaction as the stone was near Hartmann's pouch. This study suggests the difficulties in extraction was related to larger calculi more than 7 mm and not attributed to number of stone.

This study has to acknowledge few limitations. As this is a retrospective study based on a relatively small number of population in a single centre, the findings may not be applicable to all.

CONCLUSION

The study concludes that the most reliable indicator of a challenging cholecystectomy was gall bladder wall thickness, impacted gall stones and adhesion. The more severe the wall thickening, the greater the chance of conversions and intraoperative complications. Ultrasonography is not a good predictor of adhesions.

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