Original Article

Is Pre-operative Ultrasound Scoring Helpful in Predicting Conversion to Open in Laparoscopic Surgery?

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Objective: To determine the positive predictive value of preoperative ultrasound score of ≥3 in predicting conversion from laparoscopic to open cholecystectomy.

Methods: Consenting adult patients of both genders who had been evaluated by ultrasound performed by a consultant radiologist 48 hours before the surgery and were undergoing laparoscopic cholecystectomy were included in the study. Patients with American Society of Anesthesia score (ASA) III-IV were excluded from the study. 180 patients were included in the study.

Results: There were 66 males (36.7%) and 114 females (63.3%). The mean age was 47.33± years and the range was from 19 to 77. Conversion to an open procedure was required in only six cases. There was no association between gender, age group, diabetes, obesity No association between preop ultrasound score and conversion was found (Positive predictive value 3.3%).

Conclusions: Preoperative ultrasound scoring doesn't predict conversion from laparoscopic to open cholecystectomy.

Keywords: laparoscopic cholecystectomy, conversion, predictive factors.

Introduction

Management of gallbladder disease has undergone major shift over the past 25 years. The introduction of laparoscopic surgery has dramatically altered the way in which cholecystectomy is done. Laparoscopic surgery has now become the gold standard.[1] The major advantage laparoscopy holds over open surgery are the minimally invasive approach which results in smaller incisions, less patient pain, notable decrease in post-operative pain, decreased hospital stay, shorter post-operative fasting period, early mobilization m earlier return to routine activities, an overall decreased patient morbidity and cosmetic scars.[2,3] There has been evaluation and progression in laparoscopic surgery. Single port laparoscopic surgery and Natural Orifice Endoscopic Surgery (NOTES) are now moving towards mainstream surgery.[4] Despite the advances in laparoscopic technology and technique there is at times a need to convert to open operation.[5] Although necessary this conversion is associated with increased morbidity in terms of wound infections, respiratory comp-lications and prolonged hospital stay.[6,7] Evaluation and understanding of pre-operative predictors for conversion is helpful to the surgical team and patient to prepare for the outcome. The gold standard investigation for the pre-operative investigation of gallbladder disease is abdominal ultrasound.[8,9] Although operator dependent, it provides crucial information on the characteristics of the gallbladder and its contents pre-operatively.[10,11] Long standing inflammation of the gall bladder causes contraction and thickening of the wall of gall bladder. Increased adhesion formation, severe pericholecystic fibrosis and distorted anatomy in Calot's triangle are associated with these. All these can result in increased difficulty for the surgeon performing the surgery and are associated with increased risk of conversion of open surgery.[12]

A scoring system was proposed by O' Leary et al in 2013.[13] They proposed a 4 point scoring system for preoperative ultrasound. They are recorded presence of a gallstone impacted in Hartmann's pouch, diameter of the common bile duct, gallbladder wall thickness (>4 mm) and contraction of the gallbladder. These were noted by means of ultra-sound. They found that patient who had a preoperative score of 2 or more had a 19.2% chance of conversion from laparoscopic to open cholecystectomy.[13,14]

The objective of our study was to determine the positive predictive value of preoperative ultrasound score of ≥3 in predicting conversion from laparoscopic to open cholecystectomy.

Methods

This was an cross sectional study of 180 patients who underwent laparoscopic cholecystectomy at the Department of Surgery, National Hospital & Medical Center, Lahore between January 2016 to December, 2018. We included patients undergoing laparoscopic cholecystectomy between age 18 to 65 years from

both genders and below ASA grade III. Patients with a history of upper abdominal surgery and coagulopathy were excluded. All patients provided informed written consent for the procedure and study protocol. All the patients after clinical history and examination, underwent ultrasound examination before the procedure. Ultrasonic variables that were recorded included presence of a gallstone impacted in Hartmann's pouch, diameter of the common bile duct (CBD), gallbladder wall thickness (> 4 mm) and contraction of the gallbladder. All patients were operated by a single consultant laparoscopic surgeon with more than fifteen year experience after post graduation. Demographic variables collected from hospital record. Demographic and USG findings documented. A score based on the ultrasound calculated with a score of 1 given for each ultrasound feature present. A minimum score of 0 and a maximum score of 4 recorded. Operation notes used to determine whether there was any conversion or not. All data recorded from patient file, ultrasound report, and operation notes and recorded on a questionnaire .

Data was analyzed on SPSS statistical software version 21. Qualitative data i.e gender, comorbid condition, ultrasound features and score based on ultrasound were represented with frequency and percentage. Chi square was used for association between demographic, comorbid condition and conversion to open.

Results

A total of 180 were included in our study. There were 66 males (36.7%) and 114 females (63.3%). Female to male ratio was 1.72:1. The mean age was 48.15 years ±14.40 SD and the range was from 19 to 77. The mean ASA grade was 2. 78 (43.3%) patients had DM. 54(30.0%) had HTN. Obesity was prevalent in only 36 (20.0%) patients.

Ultrasound scores of all the patients were recorded. Mean score for male patients was 1.14 ± 0.89 and mean score for female patients was 1.34 ± 0.99. There was conversion from laparoscopic to open surgery in six cases. The reason for conversion in all patients was inability to proceed due to dense adhesions and thick walled gallbladder. The overall rate of conversion was 3.34%. A total of 4 ultrasonic features were noted and used for analysis. The overall mean gallbladder wall thickness was 2.6±2.4 mm and ranged from 1.4 mm to 6.7 mm. The gallbladder wall thickness in the converted group was 4.6 mm. Of the 180 cases

studied 138 patients had gall bladder wall thickness more than 4 mm and two were converted. 6 cases had a stone impaction at the neck. None were converted to open procedure. In our study there were 144 contracted gallbladders out of which 6 were converted to open cholecystectomy. 24 patients had dilated CBD on ultrasound. None were converted. However none of these were statistically significant. After univariate analysis of the pre-operative variables, 1 patient variable and no ultrasonic variable was found to be significantly associated with conversion to an open procedure. The positive predictive value for an ultrasound score of ≥3 came out to be only 3.3%. Age (p= 0.09) and gender (p=0.6) had no effect on conversion. The most common age group affected was 41 to 60 years old patients. Diabetes and obesity also had no significant effect on conversion (p-value 0.85 and 0.31 respectively). Hypertension , surprisingly , being the only patient variable that showed significant correlation with conversion to open. (P=0.0006) When we stratified the results according to the ultra-sound score , we had 42 cases with ultra-sound score 0 out of which there were no conversions , 66 cases had ultra-sound score 1 of which 2 were converted , 57 had score of 2 with there being 2 conversions while 12 had score of 3 out of which one was converted. There were 3 patients

Table-1: Clinical features and their distribution.

Clinical Features		n(%)
Gender	Male	66 (36.7%)
	Female	114 (63.3%)
Comorbid	Hypertension	54 (30.0%)
	Diabetes	78 (43.3%)
	Obesity	36 (20.0%)
Ultrasound features	Thick wall	138 (76.60%)
	Contacted gallbladder	6 (3.33%)
	Hartman pouch stone	144 (80.0%)
	Common bile duct dilation	24 (13.3%)
Score	0	42 (23.3%)
	1	66 (36.7%)
	2	57 (31.7%)
	3	12(6.7%)
	4	3 (1.7%)
Age Groups	40 years or less	54 (30.0%)
	41 60 years	90(50.0)
	61 and above	36 (20.0%)
Conversion		6 (3.3%)

346

Having score of 4 and 1 had to be converted. Results are summarized in (**table-2**). Even though patients having score of 3 or more were more likely to undergo conversion(3 % converted for ultrasound score of 1 vs 33% converted for ultrasound score of 4) this difference was not found to be significant. (p = 0.08) . None of the ultrasound features had a positive correlation with conversion.

Table-2: Ultra-sound and conversion to open.

USG Score	Number of Cases	Conversion to Open
0	42	0
1	66	2 (3%)
2	57	2 (3.5%)
3	12	1 (8.3%)
4	3	1 (33.3%)

Table-3: Association of gender, age group and comorbid condition w.r.t conversion to open.

		Conversion to Open Yes	No	P-value
Gender	Male	3 (4.5%)	63 (95.5%)	0.60
	Female	3 (2.6%)	111 (97.92%)	
Age Groups	40 & less	3 (2.08%)	141 (100.0%)	0.09
	More than 40	3 (8.3%)	33 (91.7%)	
Diabetes	Yes	3 (3.8%)	75 (96.2%)	1.00
	No	3 (2.9%)	99 (97.1%)	
Hypertension	Yes	6 (11.1%)	48 (88.9%)	0.0006
	No	0 (0.0%)	126 (100.0%)	
Obesity	Yes	3 (8.3%)	33 (91.7%)	0.09
	No	3 (2.1%)	141 (97.9%)	
USG Score Variables	No	4	132	0.6
	Wall thickness	0	42	
	>4mm	0	24	1.00
	Dilated CBD	0	156	
	Stone	0	6	1.00
	Impaction	0	174	
	Contracted Gb	138	6	1.60
		36	0	
USG Score of 3 or more than 3	No	4 (2.2%)	161 (89.44%)	0.08
	Yes	2 (1.11%)	13 (3.33%)	

Discussion

We studied the ultra-sound features of 180 patients . Out of these , almost one third were male(36.7%) while two third were female(63.3%). This is inline with findings of other researchers who have shown an increased tendency of formation of gallbladder stones in female gender.[15,16] Only 30 % of the patients were under the age of 40 , while majority (70%) were older. The same has been noted in other studies which showed a dramatic increase in the incidence of gall bladder disease after age of 40.[15,16] In our study only six patients had conversion. (3.34%). This figure is comparable to international literature. The conversion rates documented in different studies range from 5% to 10%.[17] In our study we have included 180 patients in which four ultrasonic parameters for predicting difficult laparoscopic cholecystectomy were analyzed. The parameters in literature for predicting difficult laparoscopic cholecystectomy are: Gall stone size, Gall bladder wall thickness, Gall bladder volume, Number of stones, Common bile duct size, and stone impaction in the neck of gall bladder.[18,19,20] Out of these gall bladder wall thickness, common bile duct diameter, contraction of gall bladder and stone impaction shows the maximum correlation with the difficulty during laparoscopic cholecystectomy and/or risk of conversion to open procedure.[21,22] In our study however, we found no statistical correlation between preoperative ultrasound score and conversion in the laparoscopic cholecystectomy. This is different from what has been reported in international literature which suggest a role of ultrasound in the preoperative prediction of conversion to open.[10,23,24] We failed to reach this conclusion and our results suggest otherwise. There appears to be no role of ultrasound in predicting conversion to open in laparoscopic cholecystectomy. Such conclusion were also reached in other studies which showed that shows that there is no correlation between the ultrasonographic findings and difficult laparoscopic cholecystectomy.[25]

Our study shows that preoperative ultrasound does not predict conversion to open for laparoscopic cholecystectomy to a good extent.However our study has a small sample size and larger more powered studies are needed to confirm the findings of our study.

Conclusion

On the basis of our study we conclude that the use of preoperative ultrasonography to predict the conversion from laparoscopic cholecystectomy to open is not a very reliable tool. It can however be used tp predict the difficult anatomy and serve as a warning to the surgeon.The role of hypertension in prediction of conversion need to be further investigated.

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References

1. Agrawal N, Singh S, Khichy S. Preoperative Prediction of Difficult Laparoscopic Cholecystectomy: A Scoring Method. Niger J Surg. 2015;21(2):130133.

2. Buia A, Stockhausen F, Hanisch E. Laparoscopic surgery: A qualified systematic review. World J Methodol. 2015;5(4):238254.

3. Coccolini F, Catena F, Pisano M, Gheza F, Fagiuoli S, Di Saverio S, et al. Open versus laparoscopic cholecystectomy in acute cholecystitis. Systematic review and meta-analysis. Int J Surg. 2015;18:196204.

4. Peng C, Ling Y, Ma C, et al. Safety Outcomes of NOTES Cholecystectomy Versus Laparoscopic Cholecystectomy: A Systematic Review and Meta-Analysis. Surg Laparosc Endosc Percutan Tech. 2016;26(5):347353.

5. Agresta F, Bedin N. Is there still any role for minilaparoscopic-cholecystectomy? A general surgeons' last five years experience over 932 cases. Updates Surg. 2012;64(1):31-6.

6. Ramakrishna HK. Predictive factors for conversion of laparoscopic cholecystectomy. Indian J Surg. 2013;75(2):152.

7. O'Leary DP, Myers E, Waldron D, Coffey JC. Beware the contracted gallbladder - Ultrasonic predictors of conversion. Surgeon. 2013;11(4):187-90.

8. Yamamoto H, Hayakawa N, Yamamoto T, Momiyama M, Nagino M. Laparoscopic cholecystectomy in patients with a previous history of gastrectomy. Hepatogastroenterology. 2013;60(123):443-6.

9. Asai K, Watanabe M, Kusachi S, Matsukiyo H, Saito T, Kodama H, et al. Risk factors for conversion of laparoscopic cholecystectomy to open surgery associated with the severity characteristics according to the Tokyo guidelines. Surg Today. 2014;44(12):2300-4.

10. Kim SG, Moon JI, Choi IS, Lee SE, Sung NS, Chun KW, et al. Risk factors for conversion to conventional laparoscopic cholecystectomy in single incision laparoscopic cholecystectomy. Ann Surg Treat Res. 2016;90(6):303-8.

11. Terho PM, Leppaniemi AK, Mentula PJ. Laparoscopic cholecystectomy for acute calculous cholecystitis: a retrospective study assessing risk factors for conversion and complications. World J Emerg Surg. 2016;11:54.

12. Hu ASY, Menon R, Gunnarsson R, de Costa A. Risk factors for conversion of laparoscopic cholecystectomy to open surgery - A systematic literature review of 30 studies. Am J Surg. 2017;214(5):920-30.

13. O'Leary D, Myers E, Waldron D, Coffey J. Beware the contracted gallbladder Ultrasonic predictors of conversion. Surgeon. 2013;11(4):187-90.

14. Beksac K, Turhan N, Karaagaoglu E, Abbasoglu O. Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Surgery: A New Predictive Statistical Model. J Laparoendosc Adv Surg Tech A. 2016;26(9):693-6.

15. Shaffer EA. Epidemiology and risk factors for gallstone disease:has the paradigm changed in the 21st century? Curr Gastroenterol Rep 2005;7:132-140.

16. Stinton LM & Shaffer EA. Epidemiology of Gallbladder Disease: Cholelithiasis and Cancer. Gut and Liver, Vol. 6, No. 2, April 2012, pp. 172-187.

17. Livingston EH, Rege RV.A nationwide study of conversion from laparoscopic to open cholecystectomy.Am J Surg. 2004 Sep;188(3):205-11.

.18. Chavez KV, Marquez-Gonzalez H, Aguirre I, Orellana JC. Prognostic risk factors for conversion in laparoscopic cholecystectomy. Updates Surg. 2018;70(1):67-72.

19. Utsumi M, Aoki H, Kunitomo T, Mushiake Y, Yasuhara I, Taniguchi F, et al. Preoperative Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy and the Usefulness of the 2013 Tokyo Guidelines. Acta Med Okayama.2017;71(5):419-25.

20. Cinar H, Ozbalci GS, Tarim IA, Karabulut K, Kesicioglu T, Polat AK, et al. Factors affecting the conversion to open surgery during laparoscopic cholecystectomy in patients with cholelithiasis undergoing ERCP due to choledocholithiasis. Ann Ital Chir. 2017;88:229-36.

21. Sutcliffe RP, Hollyman M, Hodson J, Bonney G, Vohra RS, Griffiths EA, et al. Preoperative risk factors for conversion from laparoscopic to open cholecy- stectomy: a validated risk score derived from a prospective U.K. database of 8820 patients. HPB (Oxford). 2016;18(11):922-8.

22. Philip Rothman J, Burcharth J, Pommergaard HC, Viereck S, Rosenberg J. Preoperative Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Surgery - A Systematic Review and Meta-Analysis of Observational Studies. Dig Surg. 2016;33(5):414-23.

23. Tosuna A, Hancerliogullarib KO, Serifogluc I, Capand Y, Ozkaya Enis. Role of preoperative sonography in predicting conversion from laparoscopic cholecystectomy to open surgery. European Journal of Radiology. 2015 84(3), 346 - 349.

24. Ćwik, G., Skoczylas, T., Wyroślak-Najs, J. et al. Surg Endosc (2013) 27: 2561.

25. kreimer Flávio, Cunha Daniel José Dias, Ferreira Carolina Cavalcanti Gonçalves, Rodrigues Thais Menezes, Fulco Lucas Gomes De Morais, godoy eduardo sávio nascimento. comparative analysis of preoperative ultrasonography reports with intraoperative surgical findings in cholelithiasis. abcd, arq. bras. cir. dig. [Internet]. 2016 Mar; 29(1): 26-29.