

A Study of Preoperative Predictors of Difficult Laparoscopic Cholecystectomy

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ABSTRACT

INTRODUCTION: Laparoscopic cholecystectomy is the most commonly performed surgery for various gallbladder disorders now a days. Difficulty during laparoscopic cholecystectomy is being faced by many surgeons. If the difficulties are detected preoperatively, management can be planned accordingly by the surgeon. In this study preoperative clinical and radiological evaluation of patient were studied to predict the difficulties during laparoscopic cholecystectomy.

MATERIALS AND METHODS: All patients who are undergoing laparoscopic cholecystectomy are evaluated by their Name, Age, Sex, BMI, clinically palpable gallbladder, ultrasound findings are correlated with the preoperative score for the prediction of difficulty during laparoscopic cholecystectomy in this study.

RESULTS: Upon analysing of risk factors with pre operative risk score, there was a significant association with BMI, palpable gallbladder, GB wall thickness, impacted gall stones and peri cholecystic collection.

CONCLUSION: This study combined the pre operative clinical and radiological parameters for better prediction of difficult Laparoscopic Cholecystectomy. Thus provides a basis for further studies to validate in this aspect and also aids in formulating an efficient scoring system for prediction of difficult Laparoscopic Cholecystectomy and reducing the incidence of complications.

KEYWORDS: Laparoscopic cholecystectomy, preoperative scoring, clinical and radiological evaluation.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is considered gold standard for treatment of symptomatic cholelithiasis.¹⁰ Recently, the early period for LC following stone extraction via endoscopic retrograde cholangiopancreatography (ERCP) has been accepted in terms of conversion rates, bile duct injury, deep surgical wound infections, length of hospital stay and cost. ¹¹ According to recent studies, the overall outcome is better if Laparoscopic Cholecystectomy is performed early (< 72 hours).¹² There was a significant rate of conversion to open cholecystectomy in cases performed after 6 weeks, than within the first week after ERCP.¹³

AIMS AND OBJECTIVES OF THE STUDY

AIM

To determine preoperatively the factors based on clinical and radiological evaluation that can predict the outcome in terms of difficulty in laparoscopic cholecystectomy.

Objectives:

1. To assess the clinical risk factors based on history and physical examination of the patient.
2. To assess ultrasonographically the risk factors pertaining to gall bladder wall thickness, position of gallstones and pericholecystic collection
3. To predict the intra operative risk based on the above clinico-radiological findings using a scoring system preoperatively.
4. To stratify the patients post operatively based on intra-operative findings.
5. The data obtained will be analyzed to establish if any significant correlation exists between the factor analyzed and the event of difficult laparoscopic cholecystectomy and to find effectiveness of scoring system in predicting difficult laparoscopic cholecystectomy.

MATERIALS AND METHODS

Study of Design: Hospital based Prospective Study.

Study Subjects: Study population comprising of patients presenting to Emergency and surgical OPD.

Study Setting: Department of General Surgery, SVRRGGH – Tirupathi.

Study Period: One year duration from the time of IEC approval.

Study Sample: 100

INCLUSION CRITERIA:

- All cases of symptomatic gall stone disease of 20yrs and above age

EXCLUSION CRITERIA:

- Patients below age of 20yrs
- Laparoscopic cholecystectomy performed with other laparoscopic intervention in same setting
- Patients requiring CBD exploration
- Absolute contra indications like cardiovascular, pulmonary diseases, coagulopathies, and end stage liver diseases and other medical comorbidities
- Patients with features of obstructive jaundice

RESULTS

Table 1: Pre operative score

	Frequency	Percentage
Easy	58	58%
Difficult	36	36%
Very difficult	6	6%
Total	100	100%

In 58% of the subjects the pre-operative score was easy, in 36% of the cases it was difficult and in 6% of the cases it was very difficult.

Table 2: Pre operative predictors for Age

	Easy	Difficult	Very difficult
<50	38	14	6
>50	20	22	0
Total	58	36	6
Chi square test = 5.54, p =0.06, Not statistically significant			

In the present study, there was no significant association was observed between pre operative predictors and age.

Table 3 : pre operative score and Gender

	Easy	Difficult	Very difficult
Male	36	24	6
Female	22	12	0
Total	58	36	6
Chi square test = 1.74, p =0.0641, Not statistically significant			

No significant association was seen between pre operative score and gender.

Table 4: Pre operative score and BMI

	Easy	Difficult	Very difficult
<25	52	10	0
25 – 27.5	6	16	0
>27.5	0	10	6
Total	58	36	6
Chi square test = 34.84, p =0.0001*, statistically significant			

In cases who are having easy pre operative score, majority had BMI <25, in cases with difficult pre operative score 27.7% of the cases had BMI <25, 44.4% of the cases had BMI 25-27.5 and in 27.7% of the cases BMI was >27.5 and in cases with very difficult pre operative scores all the cases had BMI >27.5. There was a significant association between pre operative and BMI. In cases as the difficulty was increased BMI was higher.

Table 5: Pre operative score and Abdominal scar

	Easy	Difficult	Very difficult
Yes	8	10	2
No	50	26	4
Total	58	36	6
Chi square test = 2.30, p =0.67, Not statistically significant			

There was no significant association between pre operative score and abdominal scar.

Table 6: Pre operative score and Palpable bladder

	Easy	Difficult	Very difficult
Yes	0	8	2
No	58	28	4
Total	58	36	6
Chi square test = 23.58, p =0.006*, statistically significant			

There was a significant association between pre operative score and palpable bladder. In cases with difficult pre operative scores was found to be having significantly higher chances of having a palpable bladder.

Table 8: Pre operative score and Gallbladder thickness

	Easy	Difficult	Very difficult
Yes	0	16	2
No	58	20	4
Total	58	36	6
Chi square test = 34.45, p =0.004*, statistically significant			

There was a significant association between pre operative score and bladder thickness. In cases with difficult pre operative scores was found to be having significantly higher chances of having a thicker bladder.

Table 9: Pre operative score and Impacted stone

	Easy	Difficult	Very difficult
Yes	0	14	2
No	58	22	4
Total	58	36	6
Chi square test = 13.21, p =0.001*, statistically significant			

There was a significant association between pre operative score and impacted stones. In cases with difficult pre operative scores was found to be having significantly higher chances of having a impacted stones in the bladder

Table 10: Pre operative score and Peri cholecystic edema

	Easy	Difficult	Very difficult
Yes	6	12	2
No	52	24	4
Total	58	36	6
Chi square test = 4.02, p =0.13, Not statistically significant			

There was no statistically significant association between pre operative score and peri cholecystic edema

Table 11: Pre operative score and H/O hospital admission with Acute Cholecystitis

	Easy	Difficult	Very difficult
Yes	2	6	6
No	56	30	0
Total	58	36	6
Chi square test = 23.17, p =0.0001*, statistically significant			

There was a significant association between pre operative score and H/O hospital admission with Acute Cholecystitis. In cases with history of hospital admission there were significantly higher chances of having a difficult pre operative scores

Table 12: Univariate analysis of Risk factors with pre operative score

	ODDS Ratio	95% CI	P value
Age >50	2.09	0.66 – 6.59	0.20
Male	1.52	0.45 – 5.11	0.49
H/o Hospital admission for acute cholecystitis	11.20	1.23 – 101.88	0.02*
BMI	27.73	5.82 – 132.10	<0.0001*
Upper abdominal scar	2.50	0.60 – 10.32	0.20
Palpable gall bladder	19.66	1.02 – 378.44	0.001*
GB wall thickness	44.84	2.41 – 831.21	0.001*
Impacted gall stones	37.14	1.99 – 691.55	0.01*
Peri cholecystic collection	4.33	0.96 – 19.43	0.04*

Upon univariate analysis of risk factors with pre operative risk score, there was a significant association with BMI, palpable gallbladder, GB wall thickness, impacted gall stones and peri cholecystic collection.

Results

- In the present study, 58% of the subjects were aged < 50 years and 42% were aged > 50 years.
- 34% were male and 66% were female
- 14% had history of hospital admission for acute cholecystitis, and 86% did not have any history of hospital admission
- 62% were having BMI <25kg/m², 22% were with BMI 25-27.5kg/m², 16% of the subjects had BMI >27.5.
- 20% of the subjects had upper abdominal scar and 80% did not have any.
- In 20% of the subjects they had a palpable bladder.
- In 82% of the subjects gall bladder thickness was <4mm, 18% were having gall bladder thickness >4mm.
- In 16% of the subjects there was there was an impacted gallstone.
- In 20% of the subjects there was a pericholecystic collection and it was absent in 80% of the subjects
- 74% of the subjects the duration of surgery was < 90 minutes and in 20% of the subjects the duration was > 90 minutes.
- In 12% of the cases there was a bile spillage and in rest there was none
- In 72% of the subjects, the gall bladder was normal, in 4% of the subjects it was contracted, in 22% of the subjects the gall bladder was distended and in 2% of the subjects it was perforated

- In 58% of the subjects the pre-operative score was easy, in 36% of the cases it was difficult and in 6% of the cases it was very difficult
- In the present study, there was no significant association was observed between pre operative predictors and age.
- No significant association was seen between pre operative score and gender
- In cases who are having easy pre operative score, majority had BMI <25, in cases with difficult pre operative score 27.7% of the cases had BMI <25, 44.4% of the cases had BMI 25-27.5 and in 27.7% of the cases BMI was >27.5 and in cases with very difficult pre operative scores all the cases had BMI >27.5.
- There was a significant association between pre operative and BMI. In cases as the difficulty was increased BMI was higher.
- There was no significant association between pre operative score and abdominal scar.
- There was a significant association between pre operative score and palpable bladder. In cases with difficult pre operative scores was found to be having significantly higher chances of having a palpable bladder.
- There was a significant association between pre operative score and bladder thickness. In cases with difficult pre operative scores was found to be having significantly higher chances of having a thicker bladder.
- There was a significant association between pre operative score and impacted stones. In cases with difficult pre operative scores was found to be having significantly higher chances of having a impacted stones in the bladder
- There was no statistically significant association between pre operative score and peri cholecystic edema.
- There was a significant association between pre operative score and H/O hospital admission with Acute Cholecystitis. In cases with history of hospital admission there were significantly higher chances of having a difficult pre operative scores
- Upon univariate analysis of risk factors with pre operative risk score, there was a significant association with BMI, palpable gallbladder, GB wall thickness, impacted gall stones and peri cholecystic collection.

DISCUSSION

Due to a lot of inconclusive literature the present study titled “Pre-operative predictors of difficult laparoscopic cholecystectomy”. Was carried out with an aim to determine preoperatively the factors based on clinical and radiological evaluation that can predict the outcome in terms of difficulty in laparoscopic cholecystectomy.

Associations of various factors to pre operative predictors:

In the present study, there was no significant association was observed between pre operative predictors and age.

No significant association was seen between pre operative score and gender.

In cases who are having easy pre operative score, majority had BMI <25, in cases with difficult pre operative score 27.7% of the cases had BMI <25, 44.4% of the cases had BMI 25-27.5 and in 27.7% of the cases BMI was >27.5 and in cases with very difficult pre operative scores all the cases had BMI >27.5. There was a significant association between pre operative and BMI. In cases as the difficulty was increased BMI was higher.

There was no significant association between pre operative score and abdominal scar. There was a significant association between pre operative score and palpable bladder. In cases with difficult pre

operative scores was found to be having significantly higher chances of having a palpable bladder. There was a significant association between pre operative score and bladder thickness. In cases with difficult pre operative scores was found to be having significantly higher chances of having a thicker bladder. There was a significant association between pre operative score and impacted stones. In cases with difficult pre operative scores was found to be having significantly higher chances of having a impacted stones in the bladder. There was no statistically significant association between pre operative score and peri cholecystic edema. There was a significant association between pre operative score and H/O hospital admission with Acute Cholecystitis. In cases with history of hospital admission there were significantly higher chances of having a difficult pre operative scores. Upon univariate analysis of risk factors with pre operative risk score, there was a significant association with BMI, palpable gallbladder, GB wall thickness, impacted gall stones and peri cholecystic collection. The gold standard treatment for gallbladder diseases especially for symptomatic cholelithiasis is laparoscopic cholecystectomy. But this treatment is not devoid of complications and require caution from the surgeon. The present study was aimed to assess the various preoperative predictors (history/ clinical/ imaging) and develop a scoring method for difficult laparoscopic cholecystectomy with a secondary objective of correlating preoperative predictive factors with intraoperative difficulty in lap cholecystectomy. This study was carried out to understand the pre-operative predictors of difficult laparoscopic cholecystectomy revealed that most of them were females (65.3%, n=49) and there is no much difference in the age of presentation. LC being the standard in the management of symptomatic GB stones, preoperative determination of the risk of conversion is a crucial aspect of planning laparoscopic surgeries. It is crucial to predict difficult LC preoperatively so that senior surgeons can be requested to be present during surgery rather than less experienced junior surgeons prolonging the surgery which may lead to intraoperative complications; therefore, early decision of conversion can be made¹. Many studies have attempted to design a scoring system to determine difficult LC, but most of them are complex, use a large number of determining factors, and they are difficult to use in day to day practice^{1,2}. In our study, BMI was studied as a sole factor in causing difficulty to peritoneal access and it was found highly significant ($P < 0.001$), with strict use of open Hasson's technique of pneumoperitoneum.

Obesity is known to make access to the peritoneal cavity difficult. This result was concurred by other authors who stated that BMI more than 27.5 to BMI more than 30 is a significant risk factor for difficult umbilical port entry. Thus, in morbidly obese patients it is more beneficial and less complicating to use the Veress needle technique. In this study, difficulty in dissection of adhesion, Calot's triangle, and GB bed dissection were statistically significant in patients with a history of acute attacks, patients with a history of ERCP, patients with positive Murphy's sign on clinical examination, patients with thickened GB wall thickness more than 3 mm, and patients with adhesions on first 5-min inspection). Also, **Vivek et al**³ and **Ishizaki et al**⁴ have reported that a history of previous attacks, post-ERCP status, and nonvisualization of GB are associated with significant inflammatory process that causes difficulty in dissection of adhesiolysis and the Calot's triangle. **Rizvi et al**⁵ stated that the thickened GB was difficult to dissect because it had dense adhesions with the surrounding structures and in Calot's triangle. **Chumillas et al**⁶ have reported that to remove a difficult thick-walled inflamed GB using the fundus first technique was found to be very useful and helpful to clearly and safely expose the anatomy of the cystic duct, cystic artery, and common bile duct. Preoperative endoscopic sphincterotomy has been considered to be associated with significant difficulty during LC by several authors^{7,8}. **Ranjith et al**¹² in their study observed a linear relevance between the time interval of post-ERCP and LC and the difficulty encountered

during surgery. **Boerma et al**⁹ and **Metin et al**¹⁰ assumed that the reasons for difficulty were due to changes in the anatomy and presence of dense adhesions. It has been postulated that repeated passage of small gallstones through the cystic duct into the biliary tract, multiple previous ERCPs and contrast material injection may cause obstruction, inflammation, or distortion of anatomy at Calot's triangle. It is also a known fact that ERCP and stenting increases the bacterial colonization in the bile, which may be a factor that may induce inflammation simulating cholangitis and subsequent scarring of the hepatoduodenal ligament, ultimately hindering the dissection of Calot's triangle¹¹. The change in GB structure is also a factor which makes handling difficult. GB tends to become thick walled as a result of fibrosis secondary to previous inflammation. The ERCP-trigger off inflammatory reaction in the biliary tree and Calot's triangle may be the cause for scarring and fibrosis of the GB in the long run⁴⁸. In our study, bile and stone spillage were found statistically significantly affected with distended GB and dense adhesion. This may be attributed to multiple perforations in GB during dissection. **Sarli et al**¹² reported that when the analysis took the experience of the surgeon into account and the various parameters were evaluated with multivariate analyses, the surgeon's experience was the only factor related to GB perforation. It is likely that the expert surgeon carries out the LC without procuring lesions of the GB wall, even under conditions of great difficulty. This is in agreement with **Jones et al**¹³, who have observed that the event is more frequent when most laparoscopic cholecystectomies are performed by junior surgical residents. In our study, a history of biliary pancreatitis, history of ERCP, and presence of adhesions were statistically significant factors affecting the risk of bleeding during dissection. **Ranjith et al**⁸ have stated that in cases with a history of preoperative ERCP, the bleeding was diffuse making visibility a problem and the subsequent fear of inadvertently damaging structures with an attempt to control the bleeding. Liver bed bleeding was also higher as the plane of dissection was altered due to adhesions and liver capsule tears. Use of a surgical gauze during dissection alleviated much of this difficulty. In the current study, difficult extraction of GB was found in cases with a positive history of ERCP, distended GB, GB wall thickness more than 3 mm, and cases with dense adhesions on the first 5 min of inspection. **Vivek et al**³ and **Gabriel et al**¹⁴ perceived that difficulty in GB extraction was associated with distended GB and presence of multiple stones. A distended GB or the presence of multiple stones cause difficulty in extracting the specimen through the small incision, thus leading to the need to aspirate the GB, extend the epigastric port, and the increased probability of GB perforation during this procedure. **Schrenk et al**¹⁵ have reported in a study of 1300 patients assessing 24 variables for conversion that patients with a history of acute cholecystitis within the last 3 weeks were at an increased risk of conversion. GB wall thickness has been identified as a risk factor for conversion in several studies. The thickness of GB associated with conversion varies from study to study. It was 3 mm in studies by **Nachnani and Supe**¹⁶, **Fried et al**¹⁷, and **Nidoni et al**¹⁸ and 4 mm in a study by **Jansen et al**¹⁹, but in our study, GB wall thickness was not a significant factor for conversion to open. Several other studies have reported oppositely that GB wall thickness was of little or no benefit in predicting operative technical difficulty or conversion to an OC^{20,21}. **Ranjith et al**⁷ and **Le et al**¹⁵ stated that adhesions is a major risk for conversion to open. While **Prabhu et al**¹⁶ stated that biliary pancreatitis is not a risk factor for conversion to open. The **de Vries et al**¹⁷ study showed that a significantly higher conversion rate was encountered when LC was performed 2–6 weeks after ERCP, as compared with 1 week after ERCP. Reports of LC performed within days after endoscopic sphincterotomy show conversion rates as low as those for patients with uncomplicated cholelithiasis. This agrees with our study for LC post-ERCP, all of the cases with a history of ERCP in this study were done at 6 weeks post-ERCP. In our study, the method employed was to develop a scoring system to preoperatively ascertain the

difficulty in laparoscopic cholecystectomy based on clinical findings, history, and radiology. The grades were given as easy (<5), difficult (5-10) and very difficult (11-15). The scoring system was able to predict correctly in 70 (93.3%) out of the 75 patients in consideration. **Randhawa JS et al**¹⁸ in 2009 (88-92%, easy to difficult) and **Dhanke PS**¹⁹ et al. in 2014 (94.05-100%, easy to difficult) published similar findings. Only 5 cases did not correlate with the score due to adhesions. In this study higher BMI (>30), Gall bladder thickness >4mm, previous history of hospitalization, female gender, and pericholecystic collection are associated with difficult and very difficult grading of score with positive correlation with total score and operation time with significant p value. This result is in agreement with study done by **Dhanke PS et al**²⁰, in 2014 who reported that a history of prior hospitalization; high BMI and pericholecystic collection are predictors of the difficult laparoscopic cholecystectomy. **Prabhu et al**¹⁴ stated that interval cholecystectomy following an attack of acute biliary pancreatitis had prolonged operative time; this was attributed to dense adhesions and prolonged time taken for dissection and for braking down these adhesions. The current scoring system used in this study is very effective in predicting the difficulty of the laparoscopic cholecystectomy with very high sensitivity

CONCLUSION

- Laparoscopic Cholecystectomy is a minimally invasive surgery. What would look simple might not be simple all the time and in that case the consequences can be devastating. Hence there needs to be a way in which a difficulty could be anticipated preoperatively. The following conclusions can be drawn from the study;
- Surgeons encounter difficulty when there are dense adhesions in the calot's triangle, fibrotic and contracted GB, acutely inflamed GB, gangrenous gall bladder and cholecystoenteric fistula, etc.
- Parameters namely female sex, previous episode of cholecystitis, previous upper abdominal surgery, sonographically ascertained thick gallbladder wall, age >50 years and preoperative diagnosis of acute cholecystitis were found to have a significant effect on the risk of conversion on a statistical analysis.
- Preoperative prediction of the risk of conversion or difficulty of operation is an important aspect of planning laparoscopic surgery. Multiple studies and scoring systems have already been formulated in the past few years for pre operative prediction of difficulty.
- This study combined the pre operative clinical and radiological parameters for better prediction of difficult Laparoscopic Cholecystectomy. Thus provides a basis for further studies to validate in this aspect and also aids in formulating an efficient scoring system for prediction of difficult Laparoscopic Cholecystectomy and reducing the incidence of complications.

REFERENCES

1. Mallery JS, Baron TH, Dominitz JA et al. Complications of ERCP. *Gastrointest Endosc* 2003;57(6):633-8.
2. Schirmer BD, Edge SB, Dix J, Hyser MJ, Hanks JB, Jones RS. Laparoscopic cholecystectomy. Treatment of choice for symptomatic cholelithiasis. *Ann Surg*. 1991;213:665-76. doi: 10.1097/00000658-199106000-00018.
3. Reinders JS, Goud A, Timmer R, et al. Early laparoscopic cholecystectomy improves outcomes after endoscopic sphincterotomy for choledochocystolithiasis. *Gastroenterology*. 2010;138:2315-20. doi: 10.1053/j.gastro.2010.02.052.

4. Boerma D, Rauws EA, Keulemans YC, et al. Wait-and-see policy or laparoscopic cholecystectomy after endoscopic sphincterotomy for bile-duct stones: A randomized trial. *The Lancet* 2002 Sep 7;360(9335):761–65.
5. Soltes M, Radoak J. A risk score to predict the difficulty of elective laparoscopic cholecystectomy. *Videosurg Other Miniinv Tech* 2014; 4:608–612.
6. Sugrue M, Sahebally S, Ansaloni L, Zielinski M. Grading operative findings at laparoscopic cholecystectomy- a new scoring system. *World J Emerg Surg* 2015; 10:48.
7. Vivek MK, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. *J Min Access Surg* 2014; 10:62–67.
8. Ishizaki Y, Miwa K, Yoshimoto J, Sugo H, Kawasaki S. Conversion of elective laparoscopic to open cholecystectomy between 1993 and 2004. *Br J Surg* 2006; 93:987–991.
9. Rizvi SAA, Ali SA, Akhtar S, Faridi S, Ahmad M. Forecast of difficult laparoscopic cholecystectomy by sonography: an added advantage. *Biomed Res* 2012; 23:425–429.
10. Chumillas MS, Ponce JL, Delgado F, Viciano V. Pulmonary function and complications after laparoscopic cholecystectomy. *Eur J Surg* 1998; 168:433–437.
11. Erdal BB, Metin E, Ilter O, Teke Z, Parlak E, Akoglu M. Timing of elective laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreatography with sphincterotomy: a prospective observational study of 308 patients. *Langenbecks Arch Surg* 2010; 395:661–666.
12. Ranjith RM, Sunil KM, Sathyanarayana N. Pre-operative ERCP is a significant difficulty predictor for laparoscopic cholecystectomy – an analysis. *IOSR-JDMS* 2015; 14:64–69.
13. Boerma D, Rauws EA, Keulemans YC, Janssen IM, Bolwerk CJ, Timmer R et al. Wait-and-see policy or laparoscopic cholecystectomy after endoscopic sphincterotomy for bile-duct stones: a randomised trial. *Lancet* 2002; 360:761–765.
14. Metin E, Birol EB, Zafer T, Karaman K, Dalgic T, Ulas M et al. Predictive factors for conversion to open surgery in patients undergoing elective laparoscopic cholecystectomy. *J Laparoendosc Adv Surg Tech A* 2010; 20:427–434.
15. Reinders JS, Kortram K, Vlamincx B, van Ramshorst B, Gouma DJ, Boerma D. Incidence of bactobilia increases over time after endoscopic sphincterotomy. *Dig Surg* 2011; 28:288–292.
16. Sarli L, Pietra N, Costi R, Grattarola M. Gallbladder perforation during laparoscopic cholecystectomy. *World J Surg* 1999; 23:1186–1190.
17. Jones DB, Dunnegan DL, Soper NJ. The influence of intraoperative gallbladder perforation on long-term outcome after laparoscopic cholecystectomy. *Surg Endosc* 1995; 9:977.
18. Gabriel R, Kumar S, Shrestha A. Evaluation of predictive factors for conversion of laparoscopic cholecystectomy. *Kathmandu Univ Med J* 2009; 7:26–30.
19. Schrenk P, Woisetschläger R, Wayand WU. Laparoscopic cholecystectomy-cause of conversion in 1,300 patients and analysis of risk factors. *Surg Endosc* 1995; 9:25–28.
20. Nachnani J, Supe A. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. *Indian J Gastroenterol* 2005; 24:16–18.
21. Fried GM, Barkun JS, Sigman HH, Joseph L, Clas D, Garzon J et al. Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. *Am J Surg* 1994; 167:35–41.
22. Nidoni R, Udachan TV, Sasnur P, Baloorkar R, Sindgikar V, Narasangi B. Predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment. *J Clin Diagn Res* 2015; 9:9–12.

23. Jansen S, Jorgensen J, Caplehorn J, Hunt D. Preoperative ultrasound to predict conversion in laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Techniq* 1997; 7:121–123.
24. Le VH, Smith DE, Johnson BL. Conversion of laparoscopic to open cholecystectomy in the current era of laparoscopic surgery. *Am Surg* 2012; 78:1392–1395.
25. Prabhu RY, Irpatgire R, Naranje B. Influence of timing on performance of laparoscopic cholecystectomy for acute biliary pancreatitis. *Surg Gastroenterol* 2016; 10:1–4.
26. de Vries A, Donkervoort SC, van Geloven AA, Pierik EG. Conversion rate of laparoscopic cholecystectomy after endoscopic retrograde cholangiography in the treatment of choledocholithiasis: does the time interval matter? *Surg Endosc* 2005; 19:996–1001.
27. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. *Indian J Surg* 2009;71:198-201.
28. Dhanke PS, Ugane SP. Factors predicting for difficult laparoscopic cholecystectomy: a single institution experience. *Int J Stud Res* 2014;4:3-7.