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Assessment of Pre-Operative Scoring Strategy for Prediction of Difficult Laparoscopic Cholecystectomy

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ABSTRACT

Objective: To determine the sensitivity, specificity and diagnostic accuracy of pre-operative scoring in predicting a difficult laparoscopic cholecystectomy.

Study Design: Cross-sectional validation study.

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi Pakistan, from Feb 2022 to Mar 2023.

Methodology: This study was conducted on 153 patients undergoing laparoscopic cholecystectomy. All patients aged between 18 and 60 years who were planned to undergo laparoscopic cholecystectomy for symptomatic gallstones or gallbladder disease, were included. Patients who were pregnant, or were suffering from choledocholithiasis, gallbladder cancer, coagulopathy, or liver cirrhosis were excluded. Participants underwent pre-operative assessment for prediction of difficult surgery via the Randhawa scoring system and a score of 6 or greater indicating a difficult surgery. Subsequently, all patients went to surgery which was said to be difficult if the total surgical time was greater than sixty minutes, there was bile/stone spillage, injury to duct or artery occurred or there was a requirement for conversion to open cholecystectomy.

Results: Our patients had a mean age of 44.18±4.83 years, of whom 91(59.5%) were female. Randhawa score at a cut-off of ≥6 as a predictor for the occurrence of a laparoscopic cholecystectomy had a sensitivity of 89.52%, a specificity of 93.10% and a diagnostic accuracy of 90.20%.

Conclusion: Randhawa score carries good diagnostic accuracy in predicting the occurrence of a difficult laparoscopic cholecystectomy in the Pakistani population.

Keywords: Diagnostic Accuracy, Difficult Laparoscopic Cholecystectomy, Pre-operative Scoring.

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INTRODUCTION

Laparoscopic cholecystectomy involves surgical removal of the gallbladder using minimally invasive techniques; an organ surgery which is performed in over three hundred thousand cases per annum in the United States alone.[1] While this surgical procedure is a safe and effective method of performing such removals, it can be a technically challenging endeavour in patients with certain risk factors.[2] Such factors include obesity, presence of intra-abdominal adhesions, acute gallbladder inflammation and anatomical variations, among others, which can result in increased operative times, increased frequency of complications and a higher frequency of conversion to an open cholecystectomy, and may result in significant post-operative morbidity.[3,4]

It is thus fitting to develop a method to predict the occurrence of a difficult laparoscopic cholecystectomy pre-operatively, with the aim of identifying patients at risk prior to surgery, so that the surgeon is sensitized to the possibility for the development of complications and may take appropriate steps to mitigate them in a timely fashion.[5] A number of different scoring systems and indicators have been proposed to make these predictions based on patient history, clinical examinations, and investigations in an effort to make accurate predictions, such as the Tokyo Guidelines-2018 (TG-18), Sonographic Murphy's Sign and others.[6-8] The Randhawa Score represents one such scoring system which takes into account a number of patient factors, such as age, gender, body mass index (BMI), a past history of intra-abdominal surgery, and the presence of acute cholecystitis.[9,10] The system scores patients from 0 to 15 with progressively higher scores indicating that the laparoscopic cholecystectomy may be prone to complications, and has been validated for use in different populations.[9,10]

The Randhawa scoring system represents a valuable tool for predicting difficult laparoscopic

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cholecystectomy and helps in improving patient outcomes by identifying patients who may require additional measures to mitigate potential complications. However, this scoring systems has never been validated in the Pakistani population. This study was conducted with the aim of determining whether this scoring system was effective in predicting the occurrence of a difficult laparoscopic cholecystectomy in our population and whether routine employment of this score was justified in our populations or not.

METHODOLOGY

We conducted this cross-sectional validation study from Feb 2022 to Mar 2023 in the Department of General Surgery, Combined Military Hospital, Rawalpindi Pakistan, on 153 patients who were to undergo laparoscopic cholecystectomy, after obtaining informed consent from the patients for inclusion in the study and taking the approval of the study from the ethical research committee (ERC) of the institute (ERC no. 362). The patients in our study sample were selected via non-probability, consecutive sampling. The EPI tools sample size calculator was used to calculate the sample size keeping an expected sensitivity of 89.5%, expected specificity of 100%, expected prevalence of 63.3%, a desired precision of 2 and a confidence level of 95%, which were the sensitivity and specificity for the Randhawa score in the prediction of difficult laparoscopic cholecystectomy and its prevalence, from Faraht *et al*.[11]

Inclusion Criteria: All patients aged between 18 and 60 years, of both genders, and planned to undergo laparoscopic cholecystectomy for symptomatic gallstones or gallbladder disease, were included.

Exclusion Criteria: Patients who were pregnant, who were suffering from choledocholithiasis, gallbladder cancer, those with coagulopathy or liver cirrhosis were excluded.

Enrolled patients underwent documentation for relevant demographic details and history upon inclusion, which was followed by a clinical examination. All patients underwent pre-operative assessment for prediction of difficult surgery via the Randhawa scoring system and a score of 6 or greater indicated that the surgery would be difficult, as shown in Table-I.[11] Subsequently, all patients proceeded to receive a laparoscopic cholecystectomy. Surgery was said to be difficult if the total time from completion of anaesthesia induction to closure of surgical wounds was greater than sixty minutes or there was bile/stone spillage or injury was caused to the bile duct or artery, or if there was a requirement for conversion to open cholecystectomy, which was decided by the operating surgeon.

Data analysis was conducted using the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows version 26, IBM Corp; Armonk, USA). Mean and standard deviation/median and interquartile range were calculated for quantitative variables specifically patient age, BMI, white cell count and alkaline phosphatase levels prior to surgery, pre-operative Randhawa score and duration of surgery. Qualitative variables like gender, previous history of acute cholecystitis requiring admission, difficulty status according to Randhawa score and difficulty status according to surgery performed were recorded in terms of frequency and percentage. A 2x2 table was constructed to calculate the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of Randhawa score in predicting a difficult laparoscopic cholecystectomy.

RESULTS

This study was conducted on a total of 153 patients who were to undergo a laparoscopic cholecystectomy, with a mean age of 44.18±4.83 years. A total of 91(59.5%) patients were female. The mean BMI was 27.88±1.97 kg/m2, while 58(37.9%) had a past history of hospital admission for acute cholecystitis. On presentation, the mean total leucocyte count was 12.84±3.21 x 103/µL while the mean alkaline phosphatase levels were 277.53±123.34 U/L for the study sample. Our patients had mean Randhawa score of 7.39±3.25 pre-surgery, which predicted that 113(73.9%) patients would have a difficult surgery. A difficult laparoscopic cholecystectomy occurred in 124(81.0%) patients, with a total mean operative time of 66.51±16.40 minutes.

Table-I: Randhawa Scoring System

Variable	Parameter	Score	Parameter	Score
Age (years)	<50	0	>50	1
Gender	Female	0	Male	1
History of Hospitalization	No	0	Yes	4
Body Mass Index (kg/m2)	<25	0	25.1–27.5	1
			>27.5	2
Palpable Gall-Bladder	No	0	Yes	1
Abdominal Scar	No	0	Infra-Umbilical	1
			Supra-Umbilical	2
Gallbladder Wall Thickness (mm)	<4	0	>4	2
Peri-Cholecystic Collection	No	0	Yes	1
Impacted Stone	No	0	Yes	1

Table-II shows the patient characteristics and study results distributed according to difficulty of surgery.

Table-II. Patient Characteristics/Study Results According to Procedure Difficulty (n=153)

Variable	Difficult (n=124)	Normal (n=29)	*p*-value
Gender			
Male	55(44.4%)	7(24.1%)	0.046
Female	69(55.6%)	22(75.9%)	
Age (years)	43.95±5.05	45.14±3.72	0.236
Body Mass Index (kg/m2)	27.95±1.98	25.56±1.92	0.362
Past History of Hospitalization	52(41.9%)	6(20.7%)	0.034
Total Leucocyte Count (103/µL)	12.87±3.24	12.71±3.18	0.818
Alkaline Phosphatase Levels (U/L)	280.17±122.08	266.24±130.19	0.586
Randhawa Score	7.00(IQR: 3.00)	7.00(IQR: 14.00)	0.169
Surgery Duration (minutes)	71.51±13.76	45.14±6.70	<0.001

Table-III displays the 2x2 table used for Randhawa score to calculate the various test parameters.

Table-III: 2x2 Table for Randhawa Score

2x2 Table		Occurrence of Difficult Surgery according to Criteria		Total
		Yes	No	
Prediction of Difficult Surgery According to Randhawa Score	Yes	True Positive: 111	False Positive: 2	113
	No	False Negative: 13	True Negative: 27	40
Total		124	29	153

Randhawa score at a cut-off of ≥6 as a predictor for the occurrence of a difficult surgery in patients who are to receive a laparoscopic cholecystectomy had a sensitivity of 89.52%, a specificity of 93.10% and a diagnostic accuracy of 90.20%, as shown in Table-IV.

Table-IV: Test Characteristics

Test	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Diagnostic Accuracy
Randhawa Score ≥ 6	89.52%	93.10%	98.23%	67.50%	90.20%

DISCUSSION

The present study was conducted with the aim of assessing the sensitivity, specificity, and diagnostic accuracy of the Randhawa score in predicting a difficult laparoscopic cholecystectomy. Our results demonstrated that the Randhawa score had a high sensitivity, specificity and diagnostic accuracy in this regard, indicating that it can accurately predict the occurrence of a difficult procedure.

In the current study, the mean age of the patients was 44.18±4.83 years, age did not appear to be significantly associated with difficulty during surgery, (p=0.236). Bhandari *et al.,* compared two groups of patients with median ages of 65 and 45 years, and found that there was no difference between the two groups with regards to difficulty, the occurrence of complications and conversion to open cholecystectomy, (p<0.05).[12] Similarly, Ghadhban *et al.,* also noted that frequency of difficult laparoscopic cholecystectomy did not very across different age groups, (p=0.26), which was also in agreement with our study.[13] However, it should be noted that the Randhawa score operates on the presumption that patients aged over fifty years old have a higher risk for the development of complications during surgery.[9] We believe this variable within the Randhawa score needs further study to decide whether it should be retained within the score or not, which should be the subject of future research.

Approximately three-fifths of the patients in the current study were female, and it was noted that the male gender appeared to be associated with a higher frequency of difficult procedures, (p=0.046). A female preponderance for symptomatic gallbladder disease is well-established in literature and both Amer *et al.,* and Atif *et al.,* are recent studies which validate this conclusion, in accordance with our study. Moreover, Utsumi *et al.,* also reported that male gender had a higher association with a difficult laparoscopic cholecystectomy, (p=0.003), as in our study.[16] This may be attributable to a higher incidence of more severe gallbladder disease in males as well as higher degrees of adhesion formation and inflammation.[17] However, it is pertinent to note here that not all studies are in agreement with the purported increased risk in males: Paul *et al.,* in the recent study, reported that males did not have an increased frequency of difficult laparoscopic cholecystectomy when compared to females, (p=0.81).[18] We believe that the latter study may have come to this conclusion due to a comparatively smaller sample size, but concede that this aspect of our research requires further study before adequate conclusions can be drawn.

Our study showed that while the mean BMI was higher in cases with a difficult surgery, the difference did not reach statistical significance, (p=0.362). Chen *et al.,* reported that patients who had a BMI greater than 25 kg/m2 had a higher risk for the development of complications during laparoscopic cholecystectomy,

(p=0.004), which was at odds with our study.[19] Nassar *et al.,* also reported their findings by classifying the difficulty of laparoscopic cholecystectomy according to grades ranging from one to five and noted that BMI did not appear to have an effect on occurrence of a difficult surgery across a majority of the grades.[20] We believe that this aspect of our research also requires further study but that the variation in results may be attributable to techniques employed, degree of experience in operating on obese patients as well as general population characteristics.

An estimated two-fifths of our patients had a past history of admissions for acute cholecystitis, and these patients tended to have a higher frequency of difficult laparoscopic cholecystectomies, (p=0.034). This is in keeping with existing studies on the subject such as Wibowo *et al.,* and Karim *et al.,* who also report that a past history of admissions for acute cholecystitis is associated with an increased risk of complications.[5,21]

In the current study, Randhawa score at a cut-off of ≥6 as a predictor of the occurrence of a difficult laparoscopic cholecystectomy had a sensitivity of 89.52%, a specificity of 93.10% and a diagnostic accuracy of 90.20%. Our findings are consistent with previous studies that have evaluated the Randhawa score in predicting a difficult laparoscopic cholecystectomy, such as by Faraht *et al.,* who reported a sensitivity of 89.5% and a specificity of 100%,[11] while Randhawa *et al.,* reported a sensitivity and specificity of 75.00% and 90.24%, respectively.[9] Paul *et al.,* noted that the Randhawa score carried a sensitivity of 82.6% and a lower specificity of 63.5%,[18] which was similar to Pal *et al.,* who reported a showed that it carried a sensitivity and specificity of 88.2% and 73.8%, respectively.[22]

Lastly, Phillip *et al.,* reported that the Randhawa score carried a sensitivity of 51.9 % and a specificity of 100%, in their study.[23] We believe the differences in the diagnostic accuracy of the Randhawa score reported in these studies may be due to variations in patient populations, surgical techniques, and the definition of a difficult laparoscopic cholecystectomy.

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LIMITATIONS OF STUDY

This study was conducted on a relatively small sample size, in a single center, and was limited to armed forces personnel and their wards, which can place limitations on the generalizability of the results. Secondly, certain variables within the Randhawa score such as a palpable gallbladder and the measurement of gallbladder wall thickness by ultrasound are observer-dependent and some variability between observers may have affected our results. Moreover, the patients studied in this research protocol were mostly overweight or even obese and may not be representative of the broader population undergoing laparoscopic cholecystectomy. Lastly, obese patients are generally thought to be more likely to have a difficult procedure, and since our patients were mostly overweight, this may have produced some bias in our study.

CONCLUSION

The Randhawa score has strong sensitivity, specificity, and diagnostic accuracy for determining if a laparoscopic cholecystectomy will be challenging to perform and can be used often in patients who will have this procedure. But, it shouldn't be used alone; instead, clinical judgement should always be used to customise management for each unique case.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SAZ & IA: Data acquisition, data analysis, critical review, approval of the final version to be published.

SA & MS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

JA & MF: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Blythe J, Herrmann E, Faust D, Falk S, Edwards-Lehr T, Stockhausen F, et al. Acute cholecystitis - a cohort study in a real-world clinical setting (REWO study, NCT02796443). Pragmat Obs Res 2018; 9(1): 69-75. https://doi.org/10.2147/POR.S169255

2. Di Buono G, Romano G, Galia M, Amato G, Maienza E, Vernuccio F, et al. Difficult laparoscopic cholecystectomy and preoperative predictive factors. Sci Rep 2021; 11(1): 2559. https://doi.org/10.1038/s41598-021-81938-6
3. Lucocq J, Scollay J, Patil P. Elective laparoscopic cholecystectomy: recurrent biliary admissions predispose to difficult cholecystectomy. Surg Endosc 2022; 36(9): 6403-6409. https://doi.org/10.1007/s00464-021-08986-x
4. Ramírez-Giraldo C, Alvarado-Valenzuela K, Isaza-Restrepo A, Navarro-Alean J. Predicting the difficult laparoscopic cholecystectomy based on a preoperative scale. Updates Surg 2022; 74(3): 969–977. https://doi.org/10.1007/s13304-021-01216-y
5. Wibowo AA, Putra OT, Helmi ZN, Poerwosusanta H, Utomo TK, Sikumbang KM. A Scoring System to Predict Difficult Laparoscopic Cholecystectomy: A Five-Year Cross-Sectional Study. Minim Invasive Surg 2022; 2022(1): 3530568. https://doi.org/10.1155/2022/3530568
6. Veerank N, Togale MD. Validation of a scoring system to predict difficult laparoscopic cholecystectomy: a one-year cross-sectional study. J West Afr Coll Surg 2018; 8(1): 23-39.
7. Yan Y, Hua Y, Yuan W, Zhu X, Du Y, Zhu S, et al. Utility of Tokyo Guidelines 2018 in early laparoscopic cholecystectomy for mild and moderate acute calculus cholecystitis: A retrospective cohort study. Front Surg 2023; 9(1): 1022258. https://doi.org/10.3389/fsurg.2022.1022258
8. Murphy MC, Gibney B, Gillespie C, Hynes J, Bolster F. Gallstones top to toe: what the radiologist needs to know. Insights Imaging 2020; 11(1): 13. https://doi.org/10.1186/s13244-019-0825-4
9. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. Indian J Surg 2009; 71(4): 198-201. https://doi.org/10.1007/s12262-009-0055-y
10. Raza M, Rajeev-M V. Predicting difficulty in laparoscopic cholecystectomy preoperatively using a scoring system. Int Surg J 2019; 6(1): 957. https://doi.org/10.18203/2349-2902.isj20190831
11. Faraht MS, Elmaleh HM, Hassan WM, Abdel-Rahim HS. Preoperative Prediction of Difficult Laparoscopic Cholecystectomy: A Scoring Method. Med J Cairo Univ 2021; 89(4): 1659-1667. https://doi.org/10.21608/mjcu.2021.194983
12. Bhandari TR, Shahi S, Bhandari R, Poudel R. Laparoscopic Cholecystectomy in the Elderly: An Experience at a Tertiary Care Hospital in Western Nepal. Surg Res Pract 2017; 2017(1): 8204578. https://doi.org/10.1155/2017/8204578
13. Ghadhban BR. Assessment of the difficulties in laparoscopic cholecystectomy among patients at Baghdad province. Ann Med Surg (Lond) 2019; 41(1): 16-19. https://doi.org/10.1016/j.amsu.2019.03.008
14. Amer NM, Alarfaj MA, Othman SA, Alshammary S, Alshammari EM. Emergency versus elective cholecystectomy: Experience at a university hospital in the Eastern Province, Saudi Arabia. J Family Community Med 2023; 30(1): 37-41. https://doi.org/10.4103/jfcm.jfcm_116_22
15. Atif QA, Khan MA, Nadeem F, Ullah M. Health-Related Quality of Life After Laparoscopic Cholecystectomy. Cureus 2022; 14(7): e26739. https://doi.org/10.7759/cureus.26739
16. Utsumi M, Sakurai Y, Narusaka T, Tokunaga N, Kitada K, Hamano R, et al. C-reactive protein to albumin ratio predicts difficult laparoscopic cholecystectomy in patients with acute cholecystitis diagnosed according to the Tokyo Guidelines 2018. Asian J Endosc Surg 2022; 15(3): 487-494. https://doi.org/10.1111/ases.13035
17. Magnano-San-Lio R, Barchitta M, Maugeri A, Quartarone S, Basile G, Agodi A. Preoperative Risk Factors for Conversion from Laparoscopic to Open Cholecystectomy: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health 2022; 20(1): 408. https://doi.org/10.3390/ijerph20010408
18. Paul S, Khataniar H, Ck A, Rao HK. Preoperative scoring system validation and analysis of associated risk factors in predicting difficult laparoscopic cholecystectomy in patients with acute calculous cholecystitis: A prospective observational study. Turk J Surg 2022; 38(4): 375-381. https://doi.org/10.47717/turkjsurg.2022.5816
19. Chen G, Li M, Cao B, Xu Q, Zhang Z. Risk prediction models for difficult cholecystectomy. Wideochir Inne Tech Maloinwazyjne 2022; 17(2): 303-308. https://doi.org/10.5114/wiitm.2022.114539
20. Nassar AH, Khan KS, Ng HJ, Sallam M. Operative Difficulty, Morbidity and Mortality Are Unrelated to Obesity in Elective or Emergency Laparoscopic Cholecystectomy and Bile Duct Exploration. J Gastrointest Surg 2022; 26(9): 1863-1872. https://doi.org/10.1007/s11605-022-05344-7
21. Karim ST, Chakravarti S, Jain A, Patel G, Dey S. Difficult Laparoscopic Cholecystectomy Predictors and its Significance: Our Experience. J West Afr Coll Surg 2022; 12(4): 56-63. doi: https://doi.org/10.4103/jwas.jwas_162_22
22. Pal A, Ahluwalia PS, Sachdeva K, Kashyap R. Intraoperative Scoring System to Assess the Difficult Laparoscopic Cholecystectomy: A Prospective Study From a Tertiary Care Centre. Cureus 2023; 15(3): e35767. https://doi.org/10.7759/cureus.35767
23. Phillip AM, Anjarbeedu RR. Predicting difficulty in laparoscopic cholecystectomy preoperatively using modified Randhawa scoring system. Int J Surg 2023; 10(3): 403-407. https://doi.org/10.18203/2349-2902.isj20230491