Original Article **Open Access**

Pre-Operative Scoring to Anticipate Intraoperative Difficulty of Elective Laparoscopic Cholecystectomy

Ahmad Yar Khan, Syed Asad Maroof, Muhammad Zarin, Kausar Noor, Muhammad Mazher Irshad, Sheema Gul

Abstract:

Objective: To evaluate the diagnostic accuracy of the Nassar preoperative scoring system in predicting intraoperative difficulty in elective laparoscopic cholecystectomy, using the intraoperative Sugrue score as the reference standard.

Study Design and Setting: A prospective validation study conducted in the Department of Surgery, Khyber Teaching Hospital, Peshawar.

Methodology: A total of 274 patients aged 20–60 years scheduled for elective laparoscopic cholecystectomy were enrolled over six months. Exclusion criteria included prior hepatobiliary surgery, peritonitis, and cholangitis. Preoperative difficulty was assessed using the Nassar scoring system based on clinical and ultrasound findings. Intraoperative difficulty was assessed using the Sugrue scoring system. A Nassar score >6 predicted difficulty. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated.

Results: Difficult laparoscopic cholecystectomy (Sugrue score >4) was observed in 16.1% of patients. The Nassar score showed 84.1% sensitivity, 85.6% specificity, 52.9% PPV, and 96.6% NPV. Stratified analysis showed that age >40 years (p=0.008), male gender (p=0.018), and BMI =30 kg/m² (p=0.032) were significantly associated with increased difficulty.

Conclusion: The Nassar preoperative scoring system is a reliable and clinically useful tool for predicting intraoperative difficulty in elective laparoscopic cholecystectomy. Its high sensitivity and NPV make it particularly valuable in ruling out difficult cases, facilitating better surgical planning and resource allocation in resource-limited settings

Keywords: Body Mass Index; Cholecystectomy, Laparoscopic; Risk Assessment; Sensitivity and Specificity; Ultrasonography.

How to cite this Article:
Khan AY, Maroof SA, Zarin M, Noor K, Irshad MM, Gul S. Pre-Operative Scoring to Anticipate Intraoperative Difficulty of Elective Laparoscopic Cholecystectomy. J Bahria Uni Med Dental Coll. 2026;16(1):107-112 DOI: https://doi.org/10.51985/JBUMDC2025718

Ahmad Yar Khan
Post Graduate Resident, Department of Surgery
Khyber Teaching Hospital, Peshawar
Email: ahmadyar46@yahoo.com

Syed Asad Maroof
Assistant Professor, Department of Surgery
Khyber Teaching Hospital, Peshawar
Email: maroofasad@gmail.com

Muhammad Zarin
Professor, Department of Surgery
Khyber Teaching Hospital, Peshawar
Email: muhammad.zarin@kmc.edu.pk

Kausar Noor
Post Graduate Resident, Department of Surgery
Khyber Teaching Hospital, Peshawar
Email: kausarnoor32@gmail.com

Muhammad Mazher Irshad
Post Graduate Resident, Department of Surgery
Khyber Teaching Hospital, Peshawar
Email: muhammadmazher646@gmail.com

Sheema Gul
Post Graduate Resident, Department of Surgery
Khyber Teaching Hospital, Peshawar
Email: sheemagul101@gmail.com

Received: 17-09-2025
Accepted: 18-12-2025
1st Revision: 26-10-2025

INTRODUCTION:

The most common operation on the biliary tract is cholecystectomy, which involves surgically removing the gallbladder and is usually recommended for gallstones or inflammation. Laparoscopic cholecystectomy has emerged as the gold standard for treating symptomatic cholelithiasis among the surgical options available. The laparoscopic approach has a number of benefits over the traditional open technique, such as less tissue damage, shorter hospital stays, faster recovery, and improved cosmetic results.[1,2,3]

Despite these advantages, laparoscopic cholecystectomy may still be associated with an increased risk of intraoperative complications. These could include gallbladder perforation, bile leakage, injury to the common bile duct, and harm to nearby structures while surgical instruments are being inserted. Other hazards have also been reported, including the development of adhesions, perihepatic collections, foreign body retention, wound infection, port-site metastases, external biliary fistulas, and in rare instances, cholelithoptysis.[2,4,5] It is important to distinguish intraoperative technical difficulty from postoperative complications, as difficult laparoscopic cholecystectomy refers to increased technical complexity during surgery rather than the occurrence of adverse postoperative outcomes.

Conversion rates to open operations during the early stages of laparoscopic surgery's adoption varied from 2% to 15%; however, as surgical experience has grown, these rates have decreased to approximately 1% to 6%.[3,6] In difficult circumstances, conversion is frequently required to prevent difficulties. Dense adhesions in Calot's triangle, prior upper abdominal surgeries, gallbladder inflammation or gangrene, cholecystoenteric fistulas, and Mirizzi syndrome are some of the factors that can make an operation difficult.[4,7] Numerous preoperative rating systems have been created to help foresee these difficulties. Studies have indicated that one such approach, put out by Nassar et al., has demonstrated promise in forecasting challenging instances, with a sensitivity of 88.2% and a specificity of 73.8%.[5,8-10] Although several preoperative scoring systems, including the Nassar score, have been proposed and validated internationally, their diagnostic performance may vary across populations due to differences in patient characteristics, disease severity, and healthcare settings. Therefore, local validation remains essential before routine clinical adoption.According to one study, 14.6% of laparoscopic cholecystectomies were deemed challenging.[5]

Predicting a challenging laparoscopic cholecystectomy with accuracy can help with improved surgical planning, resource allocation, and patient education. Using the intraoperative Sugrue score as the reference standard, this study aims to assess the diagnostic accuracy of the Nassar preoperative scoring system in identifying challenging laparoscopic cholecystectomy cases. Intraoperative difficulty in laparoscopic cholecystectomy is best assessed using standardized intraoperative grading systems, such as the Sugrue score, which objectively evaluates operative complexity rather than relying solely on conversion to open surgery. By focusing exclusively on elective laparoscopic cholecystectomy, this study aims to determine the diagnostic accuracy of the Nassar score in predicting intraoperative difficulty and to assess its clinical utility for surgical planning and resource optimization.

Using the intraoperative Sugrue score as the reference standard, this study's primary objective is to assess the diagnostic accuracy of the Nassar preoperative scoring system in identifying challenging laparoscopic cholecystectomy cases. As a secondary aim, the study explores associations between patient demographics (age, gender, BMI) and intraoperative difficulty.

METHODOLOGY

Six months after the research summary was approved by Institutional Review Board Khyber Medical College, Khyber Teaching Hospital, ERC number: 661/DME/KMC. This study was carried out as a validation study in the surgery department of Khyber Teaching Hospital in Peshawar from 1st December 2024 to 31st May 2025. Buderer's formula was used to determine the sample size, which was based on the estimated prevalence of difficult laparoscopic cholecystectomy at 14.6%, 88.2%, and 73.8%, with a 10% margin of error and a 95% confidence level. A total of 274 patients were enrolled. The method used was non-probability sequential sampling.

Participants who were scheduled for elective laparoscopic cholecystectomy and were between the ages of 20 and 60 were included. Individuals who had a history of prior hepatobiliary surgery, severe cardiac impairment, cholecystoenteric fistula, peritonitis, or cholangitis were excluded.

Following an explanation of the study's goals, possible risks, and advantages, informed consent was acquired. Age, gender, BMI, place of residence, education, occupation, and socioeconomic position were among the demographic and baseline clinical data that were documented. Every participant had an abdominal ultrasound and a clinical evaluation. One day prior to surgery, a pre-operative Nassar score was determined based on clinical and sonographic observations. Age, gender, ASA classification, primary diagnosis, gallbladder wall thickness, CBD dilatation, pre-ERCP status, and admission type were all included in the Nassar scoring system. Every characteristic was given a score, and a total score higher than six was thought to be indicative of a challenging laparoscopic cholecystectomy.

Under general anaesthesia, the surgeries were carried out by consultant general surgeons who had over five years of experience doing laparoscopic procedures using the usual three-port approach. The Sugrue score, which took into account factors such gallbladder appearance, the extent of distension or contraction, accessibility, infection, and the time required to locate the cystic duct and artery, was determined by intraoperative observations. A challenging laparoscopic cholecystectomy was thought to be confirmed by a Sugrue score higher than 4.

The principal investigator used a standardised proforma to collect data. Every discovery was painstakingly recorded, including the pre- and intraoperative scores.

IBM SPSS version 25 was utilised for data analysis. Depending on the data distribution evaluated by the Shapiro-Wilk test, continuous variables such as age, BMI, Nassar score, and Sugrue score were expressed as means ± standard deviation or median with interquartile range. Frequencies and percentages were used to represent categorical characteristics, including gender, education, domicile, occupation, socioeconomic status, and the incidence of difficult laparoscopic cholecystectomy.

The primary analysis focused on the diagnostic accuracy of the Nassar score against the Sugrue reference standard, calculating sensitivity, specificity, PPV, and NPV. Secondary (exploratory) analyses included stratification by age, gender, BMI, place of residence, education, occupation, and socioeconomic status to assess potential associations with

intraoperative difficulty.

The Sugrue score was used as the reference standard to assess the Nassar score's diagnostic accuracy. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were used to gauge the effectiveness of the diagnosis. Sensitivity, which was determined as follows, was the Nassar score's capacity to accurately identify patients who had challenging laparoscopic cholecystectomy:

Sensitivity = TP / (TP + FN) × 100

Specificity denoted the ability to correctly identify patients without difficulty:

Specificity = TN / (TN + FP) × 100

Positive predictive value indicated the proportion of patients who tested positive on the Nassar score and were confirmed as difficult intraoperatively:

PPV = TP / (TP + FP) × 100

Negative predictive value referred to the proportion of patients predicted as not difficult who were also confirmed intraoperatively as not difficult:

NPV = TN / (TN + FN) × 100

For this analysis, a 2x2 contingency table was created. Age, gender, BMI, place of residence, education, occupation, and socioeconomic position were additional stratification factors for difficult laparoscopic cholecystectomy. When necessary, the Chi-square or Fisher's exact test was used after stratification, and a p-value of less than 0.05 was regarded as statistically significant.

RESULTS:

The study included 274 patients undergoing elective laparoscopic cholecystectomy. The mean age was 42.8 ± 9.6 years, with 32.8% (n=90) male and 67.2% (n=184) female patients. The mean BMI was 28.4 ± 3.2 kg/m². Regarding place of residence, 58.4% of patients were from urban areas and 41.6% from rural areas. Educational status was distributed as 18.2% primary/none, 43.8% secondary, and 38.0% graduate. Occupation included 51.1% employed and 48.9% unemployed or housewives. Socioeconomic status was low in 29.2%, middle in 54.7%, and high in 16.1% of patients. Median Nassar and Sugrue scores were 5 (IQR: 3–8) and 3 (IQR: 2–5), respectively (Table 1)." Based on the intraoperative Sugrue score (>4), 44 patients (16.1%) out of 274 had a challenging laparoscopic cholecystectomy. A cutoff value of >6 was used to predict difficult laparoscopic cholecystectomy in order to assess the diagnostic accuracy of the Nassar score. A contingency table measuring 2 by 2 was created.

Based on this, the diagnostic accuracy indicators were calculated as follows:

- Sensitivity = 37 / (37 + 7) × 100 = 84.1%
- Specificity = 197 / (197 + 33) × 100 = 85.6%
- Positive Predictive Value (PPV) = 37 / (37 + 33) × 100 = 52.9%
- Negative Predictive Value (NPV) = 197 / (197 + 7) × 100 = 96.6%

Further stratification was performed to evaluate the relationship between patient characteristics and the occurrence of difficult laparoscopic cholecystectomy. Secondary analyses were conducted to explore associations between patient characteristics (age, gender, BMI) and the occurrence of difficult laparoscopic cholecystectomy.

Table 1: Baseline Characteristics of Study Population (n = 274).

Variable	Category / Mean ± SD / n (%)
Age (years)	42.8 ± 9.6
Gender	Male: 90 (32.8%)Female: 184 (67.2%)
BMI (kg/m²)	28.4 ± 3.2
Place of residence	Urban: 160 (58.4%)Rural: 114 (41.6%)
Education	Primary/None: 50 (18.2%) Secondary: 120 (43.8%) Graduate: 104 (38.0%)
Occupation	Employed: 140 (51.1%) Unemployed/Housewife: 134 (48.9%)
Socioeconomic status	Low: 80 (29.2%) Middle: 150 (54.7%) High: 44 (16.1%)
Nassar Score (median, IQR)	5 (3–8)
Sugrue Score (median, IQR)	3 (2–5)

Table 2: Frequency of Difficult Laparoscopic Cholecystectomy

Classification	Percentage (%)	Percentage (%)
Difficult LC (Sugrue > 4)	16.1%	16.1%
Not Difficult LC (Sugrue = 4)	83.9%	83.9%

Table 3: Cross-tabulation of Nassar Score with Sugrue Score

	Sugrue Positive (Difficult)	Sugrue Negative (Not Difficult)	Total
Nassar Positive (>6)	37 (True Positive)	33 (False Positive)	70
Nassar Negative (=6)	7 (False Negative)	197 (True Negative)	204
Total	**44**	**230**	**274**

Table 4: Diagnostic Accuracy of Nassar Score (>6 Cutoff)

Parameter	Value (%)
Sensitivity	84.1%
Specificity	85.6%
Positive Predictive Value	52.9%
Negative Predictive Value	96.6%

Table 5: Stratification of Difficult LC by Demographic Variables

Variable	Category	Difficult LC (n=44)	p-value
Age	<40 years	14 (10.2%)	0.008*
	>40 years	30 (23.4%)	
Gender	Male	21 (23.3%)	0.018*
	Female	23 (12.5%)	
BMI	<30 kg/m²	32 (13.6%)	0.032*
	>30 kg/m²	12 (27.3%)	

DISCUSSION

This study evaluated the diagnostic accuracy of the preoperative Nassar scoring system in predicting intraoperative difficulty during elective laparoscopic cholecystectomy, using the intraoperative Sugrue score as the reference standard. Secondary analyses examining associations between patient characteristics and intraoperative difficulty provide additional clinical context.

According to the Sugrue score, 16.1% of the 274 patients that were included had a difficult laparoscopic cholecystectomy. With a cutoff value greater than 6, the Nassar scoring system showed 84.1% sensitivity, 85.6% specificity, 52.9% positive predictive value (PPV), and 96.6% negative predictive value (NPV).

Although it is a little lower than other worldwide estimates, the prevalence of intraoperative difficulties seen in this study falls within the range documented in comparable studies. A higher percentage of acute and advanced disease cases, such as acute cholecystitis and gallbladder empyema, which were not included in our study population because only elective procedures were taken into consideration, were probably included in Ahmed et al.'s (2025) cohort from a tertiary centre in Ethiopia, which reported a prevalence of 40.2%.[11,12]

The Nassar scoring system's diagnostic performance in this investigation is in good agreement with previous validations. With an AUC of 0.948 and sensitivity of 95.5% and specificity of 96.9%, another study demonstrated a high level of discriminating in a situation with limited resources.[7,14] The usefulness of the scoring system in anticipating operative challenges was further supported by another study, which showed that patients classified as high-risk (score >7) had a significantly higher chance of intraoperative difficulty and conversion to open surgery.[10,15] Given the high NPV of 96.6%, which shows the system's strong usefulness in ruling out challenging instances, our sensitivity and specificity values, albeit being somewhat lower, are still within clinically acceptable levels. Practically speaking, this can simplify operating room scheduling and team allocation in hospitals with limited resources by accurately identifying cases that are unlikely to pose intraoperative difficulties.

Our study's moderate PPV of 52.9% was in line with other recent validations. Due to the relatively low proportion of challenging cases, which has a greater impact on PPV than other performance variables, the PPV was similarly moderate in a prospective analysis with 367 patients, although having acceptable sensitivity.[11,16] While the scoring method can identify the majority of actually difficult cases (as indicated by sensitivity), it will also flag a significant number of cases as tough that turn out not to be, resulting in some over triage. This discovery highlights the difficulty that comes with preoperative prognosis. However, if such over triage results in better readiness and fewer negative outcomes, it might be clinically justified given the potentially severe consequences of intraoperative problems.

A stratified analysis showed that higher BMI, male gender, and advanced age were all substantially correlated with difficulty performing a laparoscopic cholecystectomy. The incidence of difficult surgery was 23.4% for patients over 40 and only 10.2% for patients under 40 (p=0.008). Ahmed et al. found similar results, stating that age above 50 was an independent predictor of problematic LC, most likely due to fibrotic alterations and cumulative inflammatory events in older individuals.[7,17] Additionally, male gender was linked to a higher incidence of difficulties (23.3% vs. 12.5%; p=0.018), which has been a consistent pattern in previous research.

For example, studies[9,18,19] reported a markedly greater difficulty rate in male patients, which they attributed to a higher prevalence of dense pericholecystic adhesions, delayed presentation, and more advanced disease at the time of surgery.

Another important predictor was obesity; patients with a BMI of =30 was more likely to have difficult procedures (27.3% vs. 13.6%; p=0.032). This conclusion is consistent with earlier research that found that higher BMI was associated with impaired visualisation, problems accessing Calot's triangle, and technical issues during port insertion.[8,20] According to research by Farhat et al., BMI is a powerful indicator of conversion and difficulty during laparoscopic cholecystectomy.[8] Therefore, it seems sense to include BMI in scoring models, such as the Nassar system, as it improves their predictive ability.

It should be noted that the intraoperative Sugrue score includes more subjective components like gallbladder appearance, adhesion presence, and time taken to dissect critical structures, whereas the preoperative Nassar score includes clinical and sonographic parameters like gallbladder wall thickness, common bile duct dilatation, and pre-ERCP status. Despite its value, the latter could differ depending on the surgeon's experience and intraoperative judgement, which could affect difficulty rating and cause interobserver differences. However, an intraoperative grading system and a standardised preoperative score offer a formal framework for researching surgical complexity and enhancing results.[14,15]

Our reliance on the Sugrue intraoperative score provides a

more nuanced view of operative difficulty than other studies that used different difficulty benchmarks, such as conversion to open surgery. This is because it captures challenges that may not result in conversion but still present significant intraoperative hurdles. This is particularly important in high-volume facilities because difficult intraoperative situations are still encountered, even though conversions may be uncommon because of skilled surgical teams.

Additionally, the preoperative score cutoff of >6 might not be the best threshold in every population, even if it was chosen based on earlier research, such as that conducted by Nassar et al. To better balance sensitivity and specificity, a receiver operating characteristic (ROC) curve analysis may be helpful in determining the optimal cutoff value for this particular cohort. Finally, even though this study concentrated on difficulty prediction, future investigations should examine whether the application of such grading systems results in better clinical outcomes, including shorter hospital stays, fewer problems, or faster operating times. To determine whether the regular use of preoperative scoring warrants the possible resource allocation related to more aggressively managing high-risk cases, cost-effectiveness assessments would also be necessary.

Despite its strengths, this study has limitations. Exclusion of emergency cases, patients older than 60 years, and those with prior hepatobiliary surgery limits generalizability, particularly to more complex cases. Additionally, the single-centre design and procedures performed by experienced consultants may limit applicability to settings with less surgical expertise.Further multicentre and prospective studies are recommended to validate these findings across diverse patient populations and healthcare settings.

CONCLUSION

This study demonstrates that the Nassar preoperative rating system, which has strong sensitivity, specificity, and an excellent negative predictive value, is a therapeutically useful and dependable tool for predicting intraoperative difficulty in elective laparoscopic cholecystectomy. When used properly, it can improve surgical readiness, aid in patient counselling, and facilitate more effective use of surgical resources, especially in settings with high patient volume or restricted resources. The need of individualised risk assessment is shown by the substantial correlations found between intraoperative difficulties and male gender, age over 40, and obesity. Although the scoring system shows good diagnostic performance, it should be interpreted cautiously because of its modest positive predictive value, which indicates that overestimation of complexity is still possible. To improve predictive thresholds and confirm the system's suitability for larger patient populations, such as emergency and difficult surgical cases, more multicentre study is advised.

Conflicts of interest: Nil

Source of Funding: Nil

Acknowledgement: Nil

Authors Contribution:
Ahmad Yar: Introduction, Data collection, Result
Syed Asad Maroof: literature review Result
Muhammad Zarin: Result and Discussion
Kausar Noor: literature review, Data Collection
Muhammad Mazher Irshad: Data collection and introduction
Sheema Gul: Data collection

REFERENCES:

1. Vivek MA, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. J Minim Access Surg. 2014;10(2):62 7. doi:10.4103/0972 9941.129947
2. Solmaz A, Gülçiçek OB, Biricik A, Erçetin C, Yiðitbaº H, Yavuz E, et al. Evaluation of the parameters increasing intraoperative difficulty scores of elective laparoscopic cholecystectomy. J Liver Clin Res. 2016;3(1):1023 8. doi:10. 47739/2379 0830/1023
3. Majeski J. Significance of preoperative ultrasound measurement of gallbladder wall thickness. The American surgeon. 2007 Sep;73(9):926-9 DOI:https://doi.org/10.1177/ 000313480707300922
4. Gupta G, Sharma PK, Gupta S, Bhardwaj A. Pre and per operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. Int J Res Med Sci. 2015;3(11):3342 6. doi:10.18203/2320 6012.ijrms 20151 188
5. Baral S, Chhetri RK, Thapa N. Utilization of an intraoperative grading scale in laparoscopic cholecystectomy: a Nepalese perspective. Gastroenterol Res Pract. 2020;2020:8954572. doi:10.1155/2020/8954572
6. 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. doi:10.7759/cureus.35767
7. Teerawiwatchai C, Polprative J, Rattanachueskul K, Thomtong R. Pre operative score development: predicting difficulty in elective laparoscopic cholecystectomy. J Health Sci Med Res. 2024;42(2):2023994. doi:10.31584/jhsmr.2023994
8. Omar AM, Moustafa AF, Mohammed MA. Preoperative prediction and good planning for technically difficult laparoscopic cholecystectomy: a scoring method. Menoufia Med J. 2021;34(2):682 90. doi:10.4103/mmj.mmj_314_20
9. Sarkar D, Paul SK, Bandha BC, Sarkar M, Seraz SB. Pre operative difficulty assessment of elective laparoscopic cholecystectomy: validation of a scoring system. Mugda Med Coll J. 2024;7(2):102 7. doi:10.3329/mumcj.v7i2.78774
10. Trehan M, Mangotra V, Singh J, Singla S, Gautam SS, Garg R. Evaluation of preoperative scoring system for predicting difficult laparoscopic cholecystectomy. International Journal of Applied and Basic Medical Research. 2023 Jan 1;13(1):10-5. DOI: 10.4103/ijabmr.ijabmr_553_22
11. Ahmed NM, Djote SM, Alemayehu GD, Amtataw W, et al. Validation of preoperative predictor score for difficult laparascopic cholecystectomy and a modified intraoperative grading score of the difficulty of laparascopic cholecystectomy: from a resource limited setting. BMC Surg. 2025;25:42. doi:10.1186/s12893 025 02784 1

12. Saha D, Chattopadhyay H, Bhar P. Prevalence of Difficult Laparoscopic Cholecystectomy and Evaluation of its Pre-Operative Predictive Factors. European Journal of Cardiovascular Medicine. 2025 Aug 14;15:468-72. DOI: 10.47372/ejcm.2025.15.8.468

13. Naseem H, Tam A, Naseem H, Hutton M, Clarke M, Finlay I, Clark J. Development and Validation of a Novel Intraoperative Scoring Tool Using Video Analytics to Standardise the Complexity of Gallbladder Surgery. Journal of Surgery and Research. 2025;8:423-36. DOI: 10.21203/rs.3.rs 3940315/v1

14. Hashish S. Validation of Nassar difficulty grading scale in predicting difficult laparoscopic cholecystectomy. Ain Shams J Surg. 2023;16(2):110 29. doi:10.21608/asjs.2023.298749

15. Bin-Gadeem FH. Simple preoperative scoring system to predict difficult laparoscopic cholecystectomy. University of Aden Journal of Natural and Applied Sciences. 2022 Apr 30;26(1):95-103. doi:10.47372/uajnas.2022.n1.a09

16. Ramírez-Giraldo C, Torres-Cuellar A, Van-Londoño I. State of the art in subtotal cholecystectomy: An overview. Frontiers in surgery. 2023 Apr 21;10:1142579. DOI: https://doi.org/ 10.3389/fsurg.2023.1142579

17. HAITHAM ME, MAHMOUD SF, HOSSAM SA, WALEED M. preoperative prediction of difficult laparoscopic cholecystectomy: A scoring method. The Medical Journal of Cairo University. 2021 Sep 1;89(September):1659-67.. DOI: https://doi.org/10.21608/mjcu.2021.194983

18. Zia SA, Ashraf I, Ashraf S, Sufyan M, Ashraf J, Fawad M. Assessment of pre operative scoring strategy for prediction of difficult laparoscopic cholecystectomy. Pakistan Armed Forces Med J. 2025;75(Suppl 2):S187 S191. DOI: https://doi.org/10.51253/pafmj.v75iSUPPL-2.10160

19. Di Buono G, Romano G, Galia M, Amato G, Maienza E, Vernuccio F, Bonventre G, Gulotta L, Buscemi S, Agrusa A. Difficult laparoscopic cholecystectomy and preoperative predictive factors. Sci Rep. 2021;11(1):2559. doi:10.1038/ s41598 020 80135 5

20. Potnuri R, Sahu RK, Chavda H. A prospective study of various pre operative factors and the development of a scoring system in predicting difficult laparoscopic cholecystectomy. Asian J Med Sci. 2024;15(6):130 5. doi:10.71152/ajms.v15i6.1891