

Prospective study of correlation between Nassar difficulty grading scale and perioperative outcomes for laparoscopic cholecystectomy

Original
Article

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ABSTRACT

Introduction: Laparoscopic cholecystectomy has varying degrees of complexity; therefore, it is necessary to systematically identify and classify elements of operative difficulty.

Objective: This study aimed to assess the validity and applicability of Nassar difficulty grading scale, correlation between operative findings according to it and perioperative outcomes of laparoscopic cholecystectomy regarding operative time, conversion to open approach, hospital stay, intraoperative and early postoperative complications.

Patients and Methods: This prospective randomized study was conducted at the Department of General Surgery, Tanta University from May 2020 to May 2021. One hundred patients (21 males, 79 females) were included. The age ranged from 22 to 67 years. The Nassar scale was used to assess the risk of a difficult cholecystectomy. Intraoperative outcomes evaluated included bleeding, bile and stone spillage, the presence of bowel or biliary injuries, operative time, and the need for conversion to open surgery. Postoperative outcomes recorded were the total length of hospital stay, 30-day complications, the need for reintervention, and mortality.

Results: Comparison of the Nassar scoring system with outcomes revealed a significant association of rising Nassar grade with bile spillage, stone spillage, bleeding, postoperative drain placement, duration of surgery, and total length of hospital stay. There was no Conversion to open. There was no mortality. The incidence of 30-day reintervention and complications did not have a significant correlation with high grades.

Conclusion: Nassar operating scale is a simple scale that can be used by all levels of surgeons to predict difficult laparoscopic cholecystectomy. Rising grades have a significant correlation with difficulty and complications.

Key Words: Cholecystitis, laparoscopic cholecystectomy, Nassar score.

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INTRODUCTION

Laparoscopic cholecystectomy (LC) is considered the gold standard treatment for symptomatic gallstone (GB) diseases^[1]. Although, a high safety profile, LC can vary significantly in complexity. While some cases are simple and straightforward and can be comfortably handled by a surgeon in training under appropriate supervision, others pose considerable challenges even for the most skilled specialist^[2]. Difficult cholecystectomy procedures not only prolong surgery duration but also elevate the likelihood of perioperative complications and the necessity of switching to open surgery. Hence, it's essential to preemptively recognize these instances, enabling better patient consultation, optimizing operating room conditions, and appropriately assigning highly experienced surgeons rather than trainees to handle such cases^[3]. Several preoperative grading systems have been created to forecast the complexity of surgery in patients having cholecystectomy for cholecystitis. These systems rely solely on clinical factors and diagnostic techniques to primarily indicate the outcomes during and after surgery^[4]. The Nassar operative

difficulty scale, introduced in 1995, depends on three parameters including GB appearance, cystic pedicle, and adhesion, and is categorized into four grades^[5]. Nassar scale was modified in 1996 in the reference cohort to include a Grade 5 (which was defined as the presence of either Mirizzi type 2 or higher, cholecystocutaneous, cholecysto-duodenal or cholecysto-colic fistula)^[6]. Due to its thoroughness and user-friendly nature, this grading system has become widely adopted in numerous research studies assessing the appropriateness of specific procedures and the intra- and postoperative outcomes of laparoscopic cholecystectomy. Recent findings revealed a correlation between higher operative difficulty scores and adverse clinical outcomes, including prolonged hospitalization, postoperative complications, the necessity for conversion to open surgery, and 30-day mortality^[6]. The study aimed to assess the validity and applicability of Nassar difficulty grading scale, correlation between operative findings according to it and perioperative outcomes of LC regarding operative time, conversion to open approach, hospital stay, intraoperative and early postoperative complications.

PATIENTS AND METHODS:

Study design

This prospective study was conducted at Gastrointestinal and Laparoscopic Surgery Unit, Department of General Surgery, Tanta University from May 2020 to May 2021. The study was approved by the institutional ethical committee. Inclusion criteria were: patients aged more than 18 years, and patients who were scheduled for LC in the presence or absence of previous abdominal surgeries. Exclusion criteria were: Patients who were diagnosed with GB cancer, Pregnant females in the last trimester, Patients aged less than 18 years, Patients with BMI more than 35, Patients with American Society of Anesthesiologists grade 3 or more and Patients with common bile duct (CBD) stones. An informed written consent was obtained from the patient or relatives of the patients. All patients underwent evaluation for various clinic-demographic factors, including age, sex, medical comorbidities, anthropometric measurements (BMI), preoperative interventions, and preoperative laboratory tests mainly (Complete blood picture, Prothrombin time and concentration, Liver and Renal functions, C- reactive protein and Blood sugar level). Regarding preoperative imaging, Trans-abdominal ultrasonography served as the main radiological modality, capturing information such as the quantity and dimensions of stones, GB wall thickness, the diameter of the CBD, and the presence of mucocoele. Magnetic resonance cholangiopancreatography was conducted if there were suspicions regarding the presence of bile duct stones.

All patients underwent standard 4 ports Laparoscopic Cholecystectomy. Intraoperative findings were graded intraoperatively according to the Nassar difficulty grading scale.

Nassar difficulty grading scale,^{5,6}

Grade 1

- GB floppy, non adherent.
- Cystic pedicle thin and clear.
- Adhesions Simple up to the neck/Hartmann's pouch.

Grade 2

- GB Mucocoele, Packed with stones.
- Cystic pedicle Fat laden.
- Adhesions Simple up to the body.

Grade 3

GB Deep fossa, Acute cholecystitis, Contracted, Fibrosis, Hartmans adherent to CBD, Impaction.

Cystic pedicle-Abnormal anatomy or cystic duct-short, dilated or obscured.

Adhesions-Dense up to fundus; Involving hepatic flexure or duodenum.

Grade 4

GB-Completely obscured, Empyema, Gangrene, Mass.

Cystic pedicle-Impossible to clarify.

Adhesions-Dense, fibrosis, wrapping the GB, Duodenum or hepatic flexure difficult to separate.

Intraoperative outcomes recorded include:

Duration of surgery (from time of skin incision to the closure of the last abdominal port), bile spillage, stones spillage, bleeding, blood transfusion, bowel injury, CBD injury, postsurgical drain, the need for Intraoperative Cholangiogram (IOC), resorting to alternative bailout techniques, which include: subtotal cholecystectomy, retrograde cholecystectomy, tube cholecystostomy, conversion to open approach or even abortion of the procedure altogether. Patients were discharged once they tolerated oral feeding and were instructed to follow-up in the outpatient clinic after 1, 2, 3, and 4 weeks postoperative.

Postoperative outcomes recorded include

Hospital stay (from the time of the end of the operation till discharge), readmission, complications (such as biliary leakage, bile duct injury, wound infection, intra-abdominal collection, pancreatitis, bile duct stones), readmission, reintervention, and mortality. These outcomes were recorded within the first month postoperative.

Statistical analysis

Statistical analysis was done by SPSS v28 (IBM, Armonk, NY, USA). Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The significance of the obtained results was judged at the 5% level. The used tests were: χ^2 test, for categorical variables, to compare separate groups, Monte Carlo correction for χ^2 when more than 20% of the cells have expected count less than 5, Kruskal-Wallis test for abnormally distributed quantitative variables to compare between more than two studied groups.

RESULTS:

A total of 100 patients were enrolled in the study. Most patients were females (79%), while the remaining were men. BMI of the studied patients has a mean of 30.90 ± 3.12 kg/m². Ten of our patients were diabetic while 21 (21%) patients were hypertensive. Demographic characteristics, distribution of medical diseases, imaging, and surgical histories of our patients are illustrated in (Table 1).

Operative data and hospital stay

All operations were performed and completed laparoscopically with no conversion to open approach. Regarding intraoperative findings and their grade according to Nassar scale, most of our patients, (41%), had a grade of II, while, no patients were graded as V according to the Nassar scale, (Table 2). Regarding intraoperative outcomes and mishaps, bile and/or stone spillage occurred in 35 (35%) patients, minimal to mild intraoperative bleeding occurred in 21 (21%) patients, mostly from the GB bed, and all were controlled by compression and/or cautery. Intra-abdominal drain was inserted in 46 (46%) patients. Intraoperative cholangiography was performed in two (2%) patients. Partial cholecystectomy was done in one (1%) patient. Blood transfusion, bowel injury, and CBD injury did not occur in any patient. The mean operative time was 78.70 ± 33.47 min (range, 25–130 min). The mean duration of hospital stay was 1.23 ± 0.62 days, (range: 1–6 day).

Postoperative mortality and morbidity

Nine patients had postoperative complications, seven (7%) of which had wound infections, and one (1%) patient had a port site hernia, which occurred through the epigastric port, and was readmitted and underwent surgical repair after 2 weeks. One (1%) patient had postoperative biliary leakage, which was discovered on the 2nd day postoperative, with about 500 ml³ bile-stained discharge through the drain. Magnetic resonance cholangiopancreatography was done and revealed intact CBD with cystic duct leakage

By analyzing statistical relations between patient scores, there were positive correlations between Nassar scale and duration of surgery, bile and stone spillage, intraoperative bleeding, drain insertion, IOC, partial cholecystectomy, and hospital stay with all of them having a *P* value less than 0.05. Overall complication rate, readmission and reintervention did not have a statistically significant correlation with the patient's score (Table 3).

Table 1: Distribution of the studied cases according to demographic data, medical and surgical history, imaging, and previous biliary interventions (n=100)

Variable	Study group (n=100)
Mean age (years)	43.34±11.04
Female n (%)	79 (80)
Mean BMI	30.90±3.12
Medical History	
Type 2 diabetes mellitus, n (%)	10 (10)
Hypertension, n (%)	21 (21)
Cardiac history n (%)	5 (5)
Bronchial asthma n (%)	4 (4)
Hepatic disease n (%)	7 (7%)
Hypothyroidism (on medical treatment) n (%)	5 (5)
Rheumatoid Arthritis n (%)	2 (2)
Surgical History	
Upper abdominal surgery n (%)	10 (10)
Lower abdominal surgery n (%)	65 (65)
Laparoscopic surgery n (%)	6 (6)
Imaging and previous biliary interventions	
CBD diameter (≥ 7 mm) n (%)	8 (8)
GB wall thickness (> 0.5 cm) n (%)	36 (36)
Previous ERCP n (%)	8 (8)
Previous CBD Stent n (%)	5 (5)

Table 2: Distribution of the studied cases according to patient score

Patient score	Patients (n=100)
Grade 1	28 (28)
Grade 2	41 (41)
Grade 3	17 (17)
Grade 4	14 (14)
Grade 5	0

Table 3: Relation between patient score and different parameters (n=100)

	Patient score				P
	Grade 1 (n=28) N (%)	Grade 2 (n=41) N (%)	Grade 3 (n=17) N (%)	Grade 4 (n=14) N (%)	
Bile and/or stone spillage					
No	22 (78.6)	35 (85.4)	6 (35.3)	2 (14.3)	<0.001*
Yes	6 (21.4)	6 (14.6)	11 (64.7)	12 (85.7)	
Reintervention and readmission (Hernia repair)					
No	28 (100.0)	41 (100.0)	16 (94.1)	14 (100.0)	0.314
Yes	0	0	1 (5.9)	0	
Bleeding					
No	28 (100.0)	39 (95.1)	11 (64.7)	1 (7.1)	<0.001*
Yes	0	2 (4.9)	6 (35.3)	13 (92.9)	
Drain insertion					
No	23 (82.1)	29 (70.7)	2 (11.8)	0	<0.001*
Yes	5 (17.9)	12 (29.3)	15 (88.2)	14 (100.0)	
IOC					
No	28 (100.0)	41 (100.0)	17 (100.0)	12 (85.7)	0.019*
Yes	0	0	0	2 (14.3)	
Partial Cholecystectomy					
No	28 (100.0)	41 (100.0)	17 (100.0)	13 (92.9)	0.145
Yes	0	0	0	1 (7.1)	
Duration of surgery (min)					
Mean±SD.	45.7±14.0	75.1±18.7	97.1±18.3	132.9±25.5	<0.001*
Median (minimum–maximum)	40 (30–90)	80 (40–120)	90 (60–140)	120 (90–180)	
Hospital stay					
Mean±SD	1.0±0.0	1.27±0.84	1.35±0.49	1.50±0.52	0.001*
Median (minimum–maximum)	1.0 (1.0–1.0)	1.0 (1.0–6.0)	1.0 (1.0–2.0)	1.50 (1.0–2.0)	
Complication					
No	28 (100.0)	37 (90.2)	14 (82.4)	12 (85.7)	0.165
Bile leak	0	1 (2.4)	0	0	
Port side hernia	0	0	1 (5.9)	0	
Wound infection	0	3 (7.3)	2 (11.8)	2 (14.3)	

DISCUSSION

The parameters of intraoperative complexity of LC have not been standardized as of yet. Multiple factors might affect intraoperative difficulty, making it difficult to establish a widely acknowledged score. Factors affecting laparoscopic access, GB dissection, extraction, and surgeon related factors may all play a role^[7]. There is a lack of agreement between proposed intraoperative scales for measuring intraoperative difficulties and actual clinical outcomes^[6]. We have opted to utilize the Nassar score, however, other scores such as the Cuschieri score, the Sugrue *et al.* score, the Parkland score, and others are available for research. Our research is predicated on the hypothesis that the Nassar scale may serve as a reliable indicator

of intraoperative challenges. The study's goal is to provide evidence for or against this claim. One hundred patients in our research had routine laparoscopic cholecystectomy. In the current study, the operative time of greater than 80 min were significantly associated with a higher Nassar grade. Although the operative time extended up to 3 h in some cases with a grade 4 Nassar scale, we reported no conversion to open surgery. Various studies have identified prolonged operating times and the conversion of the procedure to open surgery as indicators of difficulty in LC^[8–10]. However, the decision to convert to open surgery and the length of the procedure can vary significantly based on the operator's skill and expertise. Additionally, other factors may extend the duration or necessitate conversion to open surgery, such as challenges with

access, equipment failure, or managing intraoperative complications like bowel or vascular injuries. These factors are separate from those directly related to the GB or surrounding structures^[11]. In the present study, bile and stone spillage, intraoperative bleeding, and drain insertion, were found to have a strong relationship with the Nassar scale ($P=0.001$), these findings were nearly identical to that reported by Sah *et al.*^[8].

Griffiths *et al.*^[6] conducted research using a sizable multi-center dataset of patients to assess the reliability of the intraoperative Nassar scale and its correlation with perioperative and postoperative outcomes. The study included two large data sets: The reference dataset, which was performed by a single consultant surgeon (AHM Nassar), and the CholeS dataset, which was performed across multiple centres. Both datasets, agreed with our study in terms of operative time, hospital stay, bile and stone spillage, intraoperative bleeding and drain insertion ($P=0.001$), but differed from our study regarding 30-day complication, readmission, reintervention and mortality rates, as they had a significant correlation with the patient score (P values <0.05) unlike our study. In the current study, no occurrences of CBD damage or intestinal injury were recorded, suggesting that there was no association between the score and any of these problems. In the current study, IOC was done for two cases due to wide cystic duct and dilated CBD with a suspected impacted stone, however, no filling defects were discovered. In terms of postoperative data, we found that the patient's score was significantly associated with length of hospital stay ($P=0.001$); however, we found no significant statistical correlation between the patient's score and 30-day overall complication rate ($P=0.165$), 30-day reintervention rate or readmission rate ($P=0.314$). Both datasets of Griffiths *et al.*^[6], agreed with our study in terms of hospital stay ($P=0.001$), but differed from our study regarding 30-day complication, readmission, reintervention, and mortality rates, as they had a significant correlation with the patient score (P values <0.05) unlike our study. There are a few other intraoperative scores which have been proposed. One of the first scores proposed was the Cuschieri score, which focused on conversion to the open approach as a main difficulty factor. As laparoscopic surgical proficiency has increased, the necessity to convert to an open method has decreased, rendering the Cuschieri score irrelevant. Retrograde and partial cholecystectomy are just two examples of the rescue procedures that have been recommended since the score was developed to prevent conversion. Also, depending on the circumstances, such as iatrogenic damage, an open conversion may be necessary regardless of how severe the GB illness is. In addition, no research has been done to link this score to clinical outcomes^[12]. Another difficulty grading scale was proposed by Sugrue *et al.*, which used GB

adhesions, distention, contraction, pericholecystic bile or pus, fistula formation, and factors causing difficult laparoscopic access as predictors of operative difficulty. While open conversion was shown to be significantly correlated with better scores on this scale, no other clinical outcomes were examined. More studies need to be done to validation of this score and to correlate its grades with other clinical outcomes^[13]. So far, the only intraoperative score that can be compared with the Nassar score is the Parkland score. Validation and correlation studies with clinical outcomes are few. Madni *et al.* conducted research with 317 participants. Correlation with perioperative outcomes was done, such as conversion rate, partial cholecystectomy, surgical length, postoperative wound infection, retained stones, and postoperative bile leakage within 60 days. Scores were found to be significantly correlated with open conversion, partial cholecystectomy, bile leakage, and total surgical time and difficulty^[14]. Liu *et al.*^[15] conducted a separate investigation to corroborate these findings. Hospital stay, surgical time, blood loss, rates of open conversion, and degrees of morbidity were all documented for the 261 participants in this study. Higher scores were related to greater operating difficulties and morbidity, as found by the study. There was considerable disagreement between the Parkland score and surgical difficulties among grades 2, 3, and 4, which demonstrated that the Parkland score is less helpful for evaluating the inflammatory status of the Calot's triangle. The Nassar scale and the Parkland score both demonstrated promising results in gauging intraoperative difficulties. Additional research is required to validate, or compare, the two sets of results.

We recommended doing bigger, multicenter studies. This may be the first step in developing a universal metric for measuring intraoperative difficulty, which would have far-reaching implications for intraoperative decision-making, as well as the ability to forecast and prepare for outcomes both before and after surgery.

Limitations

The sample size was relatively small. The study was in a single center. The follow-up of patients was limited for a relatively short period.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCES

- Schreuder AM, Busch OR, Besselink MG, *et al.* Long-term impact of iatrogenic bile duct injury. *Dig Surg* 2020; 37:10–21.

2. Sugrue M, Sahebally SM, Ansaloni L, Zielinski MD. Grading operative findings at laparoscopic cholecystectomy—a new scoring system. *World J Emerg Surg* 2015; 10:14.
3. Nassar A, Ashkar K, Mohamed A, Hafz A. Is laparoscopic cholecystectomy possible without video technology? *Minim Invasive Ther* 1995; 4:63–65.
4. Bourgouin S, Mancini J, Monchal T, Calvary R, Bordes J, Balandraud P. How to predict difficult laparoscopic cholecystectomy? Proposal for a simple preoperative scoring system. *Am J Surg* 2016; 212:873–881.
5. Baral S, Chhetri RK, Thapa N. Utilization of an Intraoperative Grading Scale in Laparoscopic Cholecystectomy: A Nepalese Perspective *Hindawi Gastroenterol Res Pract* 2020; 4:1–5.
6. Griffiths EA, Hodson J, Vohra RS, Marriott P, Katbeh T, Zino S, Nassar A. Utilisation of an operative difficulty grading scale for laparoscopic cholecystectomy. *Surg Endosc* 2019; 33:110–121.
7. Pal A, Ahluwalia P, Sachdeva K, Kashyap R. Intraoperative Scoring System to Assess the Difficult Laparoscopic Cholecystectomy: A Prospective Study From a Tertiary Care Centre. *Cureus* 2023; 15:e35767.
8. Sah NP, Gupta RK, Awale L, Deo KB, Sah RP, Kumar A, *et al.* Operative difficulty grading scale for laparoscopic cholecystectomy at a tertiary care hospital in Eastern Nepal. *J Kathmandu Med Coll* 2022; 11:58–67.
9. Lal P, Agarwal PN, Malik VK, Chakravarti AL. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. *J Soc Laparoendosc Surg* 2002; 6:59–63.
10. Ghadhban BR. Assessment of the difficulties in laparoscopic cholecystectomy among patients at baghdad province. *Ann Med Surg* 2019; 41:16–19.
11. Nassar AHM, Hodson J, Ng HJ, Vohra RS, Katbeh T, Zino S, *et al.* Predicting the difficult laparoscopic cholecystectomy: Development and validation of a pre-operative risk score using an objective operative difficulty grading system. *Surg Endosc* 2020; 34:4549–4561.
12. Cuschieri Aa. *Laparoscopic biliary surgery.* Cuschieri A, Berci G, editors. Philadelphia, PA: Blackwell Science; 1992
13. Sugrue M, Coccolini F, Bucholtz M, Johnston A, from Contributors WSES. Intra-operative gallbladder scoring predicts conversion of laparoscopic to open cholecystectomy: a WSES prospective collaborative study. *World J Emerg Surg* 2019; 14:12–24.
14. Madni TD, Leshikar DE, Minshall CT, Nakonezny PA, Cornelius CC, Imran JB, *et al.* The Parkland grading scale for cholecystitis. *Am J Surg* 2018; 215:625–630.
15. Liu Y-Q, Wang C, Cai X, Zheng Z-X, Bi J-T. Can the parkland grading scale predict the difficulty of laparoscopic cholecystectomy? A new approach to validation. *BMC Surg* 2023; 23:53–62.