Original Research

Assessment of Reliability of Parkland Grading Scale in Accurately Predicting the Outcomes of Laparoscopic Cholecystectomy

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ABSTRACT
Background: Laparoscopic Cholecystectomy (LC) has become the procedure of choice for management of symptomatic gall stones disease. A large number of pre-operative cholecystitis grading scales have been developed in the past that aim to predict both intra-operative and post-operative outcomes; however, few of these scales account for intra-operative anatomical differences. In addition, other than prediction of difficult cases, few of these scales attempt to be utilized as a measure of post-operative complication comparison. The Parkland Grading Scale for Cholecystitis (PGS) was previously developed to stratify the severity of GB disease in response to these problems. This study aims to prospectively validate this grading scale as a measure of LC outcomes.
Materials &Methods: For the study purpose 100 cases for laparoscopic cholecystectomy were taken. The initial grade was solely based on the objective criteria of the scale and was assigned immediately after the 'initial view' was visualized. Three surgeon raters who are independent of original study retrospectively review the stored images of the initial view from the study period, after randomly assigning equal number of cases to each one of them. Each of the independent rater rated the images utilizing parkland grading scale.
Results: The Mean age of patients in our study was 46.45 ±16.43 years. Association of complications across the PGS grades was not statistically significant with a p-value 0.9. In our study in PGS Grade 1 GB was given a score of 1 in 59(88.05%) cases and a score of 2 in 8 (11.94%) cases. PGS Grade 2 GB was given a score of1 in 8 (47.05%) cases, a score of 2 in 8(47.05%) cases, a score of3 in 1(5.9%) case. PGS Grade 3 GB was given a score of 2 in 3(37.5%) cases, a score of 3 in 5 (62.5%) cases. PGS Grade 4 GB was given a score of 3 in 3(75%) cases, a score of 4 in 1(25%) case. All 4 (100%) cases PGS Grade 5 GB was given a score of 5 on difficulty of surgery. The mean difficulty of surgery score in PGS grade 1 was 1.19±0.32, in PGS grade 2 was 1.73±0.73, in PGS grade 3 was 3.22±0.66, in PGS grade 4 was 4.5±0.70, in grade 5 was 5±0.0.
Conclusion: PGS is a highly reliable grading scale of cholecystitis in assessing the difficulty of surgery and expectant operative and post-operative complications. This makes the PGS an easy grading scale for gall bladder diseases which can help predict the outcomes of LC, case allocation to surgeons depending on difficulty and need for conversion.
Key words: Reliability, Parkland Grading Scale, Laparoscopic Cholecystectomy.

INTRODUCTION
Laparoscopic Cholecystectomy (LC) has become the procedure of choice for management of symptomatic gall stones disease since its introduction by P. Mouret in 1987[1]. Laparoscopic cholecystectomy is now one of the most common procedures performed by a general surgeon in the world. Advantages of laparoscopic cholecystectomy beingdecreased post-operative pain, shorter ileus, earlier oral intake and earlier return to normal activities with better cosmesis. However laparoscopic cholecystectomy being a highly technical procedure can lead to dramatic complications in troublesome cases. Therefore, a preoperative predictive scale to assess the gall bladder disease and plan a management is of primary interest.[1,2]

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A large number of pre-operative cholecystitis grading scales have been developed in the past that aim to predict both intra-operative and post-operative outcomes; however, few of these scales account for intra-operative anatomical differences. In addition, other than prediction of difficult cases, few of these scales attempt to be utilized as a measure of post-operative complication comparison. Ultimately, none of these grading scales have been used in clinical practice as they are complex, difficult to remember, and do not allow for effective outcome comparisons[2]. To date, there are no widespread, validated grading systems utilized to stratify the intraoperative severity of GB inflammation.[2]The Parkland Grading Scale for Cholecystitis (PGS) was previously developed to stratify the severity of GB disease in response to these problems.[2] This five-tiered, easy to implement, grading system based on anatomy and inflammatory changes has been demonstrated to be highly reproducible with an Intra-class Correlation Coefficient of 0.804 thus making it a reliable grading system.[3-5] This study aims to prospectively validate this grading scale as a measure of LC outcomes.

MATERIALS & METHODS

The present study aimed to prospectively validate this grading scale as a measure of LC outcomes. For the study purpose 100 cases for laparoscopic cholecystectomy were taken. Prior informed consent from the participants was taken. Routine blood examination includingComplete blood count, differential leucocyte count, PT/INR,biochemistry-blood sugar, s. urea,s. creatinine, s. electrolytes,s. bilirubin, SGOT, SGPT, s. alkaline phosphatase, s. amylase, s. lipase were carried out. A standardized general anesthesia was given to all participants. Rocuronium (0.8 mg/kg), remifentanil (0.2-0.5 μg/kg/minute) and propofol (1-2 mg/kg) were utilized for induction. Fentanyl, sevoflurane and remifentanil combination utilized for maintenance. Standardized four-port laparoscopic cholecystectomy was performed in all patients by experienced surgeons. During the surgery, after the insertion of first 10-mm-trocar, a general abdominal exploration with a laparoscope was done and initial view of the gall bladder was photographed once the gall bladder was visualized. The operating surgeonthen self-graded the 'initial view' of gall bladder intra-operatively.The initial grade was solely basedon the objective criteria of the scale and was assigned immediately after the 'initial view' was visualized. Three surgeon raters who are independent of original study retrospectively review the stored images of the initial view from the study period, after randomly assigning equal number of cases to each one of them. Each of the independent raters rated the images utilizing parkland grading scale.

RESULTS

The Mean age of patients in our study was 46.45 ±16.43 years.78 (78%) patients were females and 22 (22%) were males. Out of a total of 100 patients PGS grade 1 was assigned to 67 (67%) patients, PGS grade 2 assigned to 17 (17%) patients, grade 3 assigned to 8 (8%) patients,grade 4 assigned to 4 (4%) patients, grade 5 assigned to 4 (4%) patients. Out of 13 (13%) patients were diagnosed with acute cholecystitis, 18 (18%) patients had chronic cholecystitis, 69 (69%) patients were operated on for symptomatic cholelithiasis. Out of 13 patients with acute cholecystitis 7 (53.84%) patients had grade 1 GB, 3 (23.07%) patients had grade 2 GB, 2 (15.38%) patients had grade 3 GB, 1 (7.69%) patient had grade 4 GB, and no patients had grade 5 GB. Out of 18 patients with chronic cholecystitis 6 (33.33%) patients had grade 1 GB, 5(27.77%) patients had grade 2 GB, 3 (16.66%) patients had grade 3 GB, 1 (5.55%) patient had grade 4 GB, and 3 (16.66%) patients had grade 5 GB.Out of 69 patients with symptomatic cholelithiasis 54 (78.26%) patients had grade 1 GB, 9 (13.04%) patients had grade 2 GB, 3 (4.34%)patients had grade 3 GB, 2 (28.98%) patients had grade 4 GB, and 1 (1.44%) patient had grade 5 GB. Out pf 37 instances of gall bladder aspiration, grade 1 GB was aspirated in 23(34.32%) cases, grade 2 GB was aspirated in 5 (29.41%) cases, grade 3 GB was aspirated in 3 (37.5%) cases, grade 4 GB was aspirated in 3(75%) cases, grade 5 GB was aspirated in 3(75%) cases.32 cases in our study had Intra-op adhesions. In grade 1 GB 7 (10.44%) cases and in grade 2 GB 9 (64.28%) cases had intraoperative adhesions. Out of 17 patients with Intra-operative bile spillage, grade 1 GBhad 8 (11.94%) cases, grade 2 GB had 3 (21.42%) cases, grade 3 GB had 1(12.5%) case, in grade 4 GB had 1 (25%) case, grade 5 GB had 4(100%) cases. Grade 5 GB had one post-operative bile leak and One Post operative wound infection. Association of complications across the PGS grades was not statistically significant with a p-value 0.9. In our study in PGS Grade 1 GB was given a score of 1 in 59(88.05%) cases and a score of 2 in 8 (11.94%) cases. PGS Grade 2 GB was given a score of1 in 8 (47.05%) cases, a score of 2 in 8(47.05%) cases, a score of3 in 1(5.9%) case. PGS Grade 3 GB was given a score of 2 in 3(37.5%) cases, a score of 3 in 5 (62.5%) cases. PGS Grade 4 GB was given a score of 3 in 3(75%) cases, a score of 4 in 1(25%) case. All 4 (100%) cases PGS Grade 5 GB was given a score of 5 on difficulty of surgery.The mean difficulty of surgery score in PGS grade 1 was 1.19±0.32, in PGS grade 2 was 1.73±0.73, in PGS grade 3 was 3.22±0.66, in PGS grade 4 was 4.5±0.70, in grade 5 was 5±0.0.One way ANOVA test showed excellent statistical significance between difficulty of surgery score across PGS Grades with a P-value of0.001.

Table 1: Intra-Operative Grade as per PGS

Intra-op Grade	No. of Patients	Percentage
1	67	67
2	17	17
3	8	8
4	4	4
5	4	4
Total	100	100

Table 2: Incidence of Acute Cholecystitis, Chronic Cholecystitis, Symptomatic Cholecystitis across PGS Grades

Diagnosis(N/%)	Grade 1 (n=67)	Grade 2 (n=17)	Grade 3 (n=8)	Grade 4 (n=4)	Grade 5 (n=4)	P-Value
Acute cholecystitis	7 (53.84)	3 (23.07)	2 (15.38)	1(7.69)	0(0)	
Chronic cholecystitis	6(33.33)	5 (27.77)	3 (16.66)	1(5.55)	3(16.66)	0.020*
Symptomatic cholelithiasis	54 (78.26)	9 (13.04)	3(4.34)	2(28.98)	1(1.44)	

*: Significant

Table 3: Post-operative finding across Grades

Complications	Grade 1 (n=67)	Grade 2 (n=17)	Grade 3 (n=8)	Grade 4 (n=4)	Grade 5 (n=4)	P-Value
Post-op Retained stone	0	0	0	0	0	
Post-op wound infection	0	0	0	0	1	0.9
Post-op bile duct leak	0	0	0	0	1	

Table 4: Difficulty of surgery score across PGS Grades

Difficulty of Surgery	Grade 1 (n=67)	Grade 2 (n=17)	Grade 3 (n=8)	Grade 4 (n=4)	Grade 5 (n=4)
1	59	8	0	0	0
2	8	8	3	0	0
3	1	0	5	3	0
4	0	0	0	1	1
5	0	0	0	0	3

DISCUSSION

Gallstones are the most common biliary pathology and also a major cause for the development of Acute Cholecystitis. It affects about 10-15% of the population,in which majority are symptomatic (above 80%). Only 20-30% of the patients will develop symptoms within 20 years. The prevalence of gallstones is related to factors like age, gender, and ethnic background. The prevalence of gallstone varies widely from place to place. Women are three times more affected and first-degree relatives of patients with gallstones have a two-fold greater prevalence.[6-8]

Certain conditions predispose to the development of gallstones includes - Obesity, Pregnancy, Dietary factors, Crohn's disease, Terminal Ileal resection, Gastric surgery, Hereditary Spherocytosis, Sickle Cell Disease and Thalassemia. Gallstones can be divided into three main types: cholesterol, pigment (brown/black) or mixed stones. Other conditions affecting gall bladder are Biliary dyskinesia, Biliary pancreatitis, Trauma, Polyps, Malignancy.[6-8]

Although medical management is implicated only in the acute settings presenting after 48-72 hours but surgery remains the mainstay treatment especially for recurrent or chronic cholecystitis. In order to perform a cholecystectomy either for symptomatic or asymptomatic cases, thorough evaluation via clinical, bio-chemical and radiological parameters are very much necessary.The laparoscopic cholecystectomy is one of the most common surgeries performed by general surgeons and is preferred over open technique. Laparoscopic cholecystectomy (LC) can bedone with a basic laparoscopic setup, limited resources and hasa faster learning curve which has led to change of trend in surgical management of gall bladder disease. But not all cholecystectomies can be treated equal; increased

inflammation can lead to increased operative timing, conversion rates and intra and post-operative complications. The factors leading to difficult laparoscopic cholecystectomy can be predicted. The accurate and reliable stratification of the severity of gallbladder disease require a grading system which can be easily employed and implemented which further helps in operability, intra & postoperative outcome of the patient.[9-12]

Out of 17 patients with Intra-operative bile spillage, grade 1 GBhad 8 (11.94%) cases, grade 2 GB had 3 (21.42%) cases, grade 3 GB had 1(12.5%) case, in grade 4 GB had 1 (25%) case, grade 5 GB had 4(100%) cases. Grade 5 GB had one post-operative bile leak and One Post operative wound infection. Association of complications across the PGS grades was not statistically significant with a p-value 0.9. In our study in PGS Grade 1 GB was given a score of 1 in 59(88.05%) cases and a score of 2 in 8 (11.94%) cases. PGS Grade 2 GB was given a score of1 in 8 (47.05%) cases, a score of 2 in 8(47.05%) cases, a score of3 in 1(5.9%) case. After proposing the Parkland grading scale Madni et al (2018)[3] went on to validate the PGS as an accurate measure of LC outcomes to pave the way for a more simple, accurate measure of outcome comparison. The simple, five-tiered scoring system was found to correlate significantly with both post-operative outcomes, such as biliary leak rate, as well as peri-operative factors such as open conversion rate, length of operation, and case difficulty. In addition, an ICC of 0.8210 between the prospective graders and the retrospective reviewers confirmed the reliability of this scale when utilized in an intra-operative fashion. Overall, these results suggested that potential utility of PGS was an easy to use system for outcome comparison which can be calculated quickly, and reliably, during the intraoperative period. A prospective study was done by Gs et al to validate parkland grading scale in assessing expectant operative and post- operative complication of LC. A total of 110 cases were evaluated & underwent LC. Gallbladder status was assessed intraoperatively with the application ofParkland Grading System. The study concluded that PGS is a highly reliable, simple, intra operative based scale that can accurately predict difficult Laparoscopic Cholecystectomy and its outcomes. As the grade increases severity of the disease and difficulty in surgery and its outcomes.[13]

All 4 (100%) cases PGS Grade 5 GB was given a score of 5 on difficulty of surgery. The mean difficulty of surgery score in PGS grade 1 was 1.19±0.32, in PGS grade 2 was 1.73±0.73, in PGS grade 3 was 3.22±0.66, in PGS grade 4 was 4.5±0.70, in grade 5 was 5±0.0.One way ANOVA test showed excellent statistical significance between difficulty of surgery score across PGS Grades with a P-value of0.001. A study by Baral et al used parkland grading scale to intra-operatively

assess the anatomy and inflammation and studied the outcomes of LC. A total of 178 patients were included in the study and PGS grade was applied to all the cases and outcomes like conversion of surgery to open, length of surgery, subtotal cholecystectomy, bile leak etc were correlated. The study concluded that with higher grades of PGS the incidence of above outcomes increased.[14]

CONCLUSION
PGS is a highly reliable grading scale of cholecystitis in assessing the difficulty of surgery and expectant operative and post-operative complications. This makes the PGS an easy grading scale for gall bladder diseases which can help predict the outcomes of LC, case allocation to surgeons depending on difficulty and need for conversion.

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