International Surgery Journal
Jyoti V et al. Int Surg J. 2026 Jun;13(6):949-954
https://www.ijsurgery.com

pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20261564

Original Research Article

From grading to guidelines: recommendations for safe laparoscopic cholecystectomy based on the Parkland grading system

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Received: 26 March 2026
Revised: 06 May 2026
Accepted: 20 May 2026

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ABSTRACT

Background: Laparoscopic cholecystectomy is one of the most studied laparoscopic surgeries. Recently parkland grading scale has added a simple intra-operative component to assessing difficulty of cholecystectomy. We aim to utilise this Parkland grading system for formulating recommendations on how to proceed in the surgery.
Methods: This was a retrospective study of recorded laparascopic cholecystectomies done at Max Hospital, Gurugram, Haryana. All the patients underwent laparoscopic cholecystectomy from October 2022 to March 2024. The Parkland grading scale (PGS) was noted at the start of the surgery and thereafter the progression of surgery was studied under various headings. All the pre-operative, intra-operative and post-operative findings were assessed to formulate recommendations for safe laparoscopic cholecystectomy.
Results: A total of 416 patients were graded utilizing PGS system. Out of 416 gall bladders graded, 127 (29.3%) were assessed to be grade 1, 146 (35.1%) were grade 2, 90 (21.6%)were grade 3, 34 (8.1%) were grade 4 and 24 (5.7%) were grade 5 as per PGS. When talking about any alteration to standard approach of doing a lap cholecystectomy, fundus first approach was the first change used by the operative surgeons. 32.2% of patients in PGS 3 had to be converted to fundus first approach, 61.7% of PGS 4 and 75% of PGS 5 patients had same surgical fate. Conversion to open cholecystectomy was also done in a small number of patients. Only 3 out of 34 and 4 out of 24 patients from PGS 4 and 5 respectively underwent this bailout procedure. Use of harmonic scalpel was used more frequently in higher grades of PGS as high as 95.8% patients in PGS 5 and 50% patients in PGS 4 and 11% in PGS 3. The use of hemolock for clipping of vessel and ducts was similar in occurrences 50% in PGS 5 and 35.2% in PGS 4, 5% in PGS 2, 8.8% in PGS 3. When studied about intra-op injuries, vascular injuries although low in number had a relative increased incidence with increasing parkland grade
Conclusion: PGS can be highly predictive for difficult cholecystectomy and every surgeon with or without adequate experience should be aware of potential complications. PGS grade 4 and higher have higher rate of conversion to fundus-first approach. PGS 4 and 5 had lesser complication rates and have shorter operative time if the decision to convert to a fundus first or open cholecystectomy was taken earlier. Planning appropriate line of further management without wasting much time is what we advocate. The author would like to stress upon the fact that no role of subtotal cholecystectomy was found in our study when timely decisions regarding change in approach was taken.

Keywords: Laparoscopic cholecystectomy, Parkland grading scale, Recommendations, Fundus-first technique, Open cholecystectomy

INTRODUCTION

Cholelithiasis is the most common disease of biliary tree and laparoscopic cholecystectomy has become the gold standard modality of its treatment. This surgical approach provides a number of benefits such as lesser trauma, pain, reduced duration of hospital stays, a superior aesthetic cosmetic result, and faster healing.[1,2]

Every lap cholecystectomy is not always easy to perform. There are various factors for the assessment of difficulty in lc like difficult access, difficult grasping and retraction of the gallbladder, difficult dissection of calot's triangle, abnormal anatomy, difficult retrieval of the specimen, and total operative time >180 min.[5-7] The conversion rate from laparoscopic to open surgery ranged between 2% and 15% in the initial days of the method. The conversion rate decreased to about 1% to 6% after years of studying and mastering the laparoscopic method and gaining experience with surgeons. Due to different difficulties posed throughout the procedure, this conversion was an effort to minimize complications.[3]

When there are dense adhesions in calot's triangle, a fistula (cholecystoduodenal/cholecystogastric), surgical history of the abdomen (upper) or cholecystostomy, a Mirizzi's syndrome, and empyematous/inflamed/gangrenous GB, the difficulty is taken into account.[4]

Various scoring systems had been tried in the past to accurately stratify difficulty of lap chole most of the scoring systems are based on pre-operative clinical and radiological findings while some also included intra-operative findings.[8-10] One of the major factors to predict difficulty in LC is inflammation of the gall bladder.[9] Severity of gallbladder inflammation cannot be made out clearly until gall bladder is visualized during surgery.[11] In 2018, parkland grading scale system was introduced by Madni et al.[11] This is a simple intra-operative based grading scale system based on anatomy and inflammatory changes of gallbladder which is seen on initial intra-operative view during lap cholecystectomy.[11]

PGS is a simple and good score based on intra operative findings, but there are a few parameters which can be easily added to it for better use of the scale like the condition of the liver. Our study aims to enable surgeons to select case appropriate evidence based surgical technique that minimizes complication and reduces the surgery duration by taking quick decisions.

METHODS

This was a retrospective study of recorded laparoscopic cholecystectomies done at max hospital Gurugram, Haryana. All the patients underwent laparoscopic cholecystectomy from October 2022 to March 2024. The patients were taken up for surgery after fully informed consent regarding all possible complications and need for conversion of surgical techniques.

The Parkland grading scale (PGS) was noted at the start of the surgery. The grading was ascertained by a group of four surgeons while studying the recorded video of the surgeries done. Thereafter the progression of surgery was studied under various headings. Statistical analyses were performed using IBM statistical package for the social sciences (SPSS) statistics, version 29.0.2.0 (2023).

Pre operative history and investigations and post-operative period parameters were assessed based on electronic health record data system of the hospital.

Inclusion criteria

All patient undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis, acute cholecystitis, resolved biliary pancreatitis and chronic cholecystitis were included.

Exclusion criteria

Patient with histopathology being labelled as CA gall bladder were excluded. The operative procedure was done under standard hospital protocol for LC. The main surgeon graded the PGS on the basis of initial view of the gallbladder.

The initial view was defined as follows: if the GB was visualized easily, it was grasped and retracted cephalad giving the "initial view" and if severe inflammation was present which limited mobilization or the ability to visualize the GB, the "initial view" was defined as the view of the inflamed area.

The grading was done as follows according to Parkland grading scale system (Figure 1).[11]

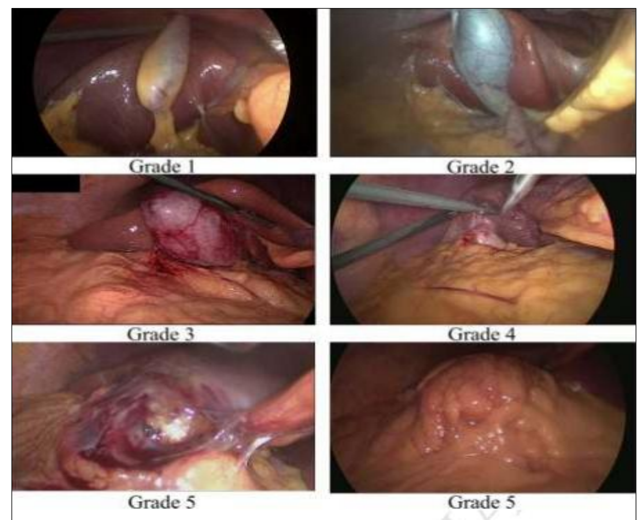

Figure 1: LC grading according to Parkland grading scale system.

Grade 1: normal GB/no adhesions, grade 2: minor adhesions at the neck, grade 3: presence of any of the following: hyperemia, peri-cholecystic fluid, adhesions to the body, distended GB, grade 4: presence of any of the following: adhesions obscuring majority of GB or grade I–III with abnormal liver anatomy, intrahepatic GB, or impacted stone (Mirizzi), and grade 5: presence of any of the following: perforation, necrosis, inability to visualize the GB due to adhesions.

RESULTS

A total of 416 patients were graded utilizing Parkland grading scale system. The patient's demographic, peri-operative and post-operative characteristics were illustrated in Table 1.

The study included 136 (32.6%) males and 280 (67.4%) females with around 173 (41.5%) patients being less than 40 years of age and 243 (58.5) being 40 or more years in age.

Out of 416 gall bladders graded, 127 (29.3%) were assessed to be grade 1, 146 (35.1%) were grade 2, 90 (21.6%) were grade 3, 34 (8.1%) were grade 4 and 24 (5.7%) were grade 5 as per PGS.

Assessment of pre-op parameters revealed that most of the patients with PGS 3 (91%) had raised TLC levels, 75% patients with PGS 5 and 47% patients in PGS 4, followed by equal percentages (19% each) of patients in PGS 1 and 2 (Table 2).

One important relation was the one of PGS scales with gamma GT. 70.8% of patients with PGS 5 had gamma GT more than 100 iu/l. Similarly, 63% PGS 4 and 40% PGS 3. On the other hand, only 4% PGS 2 and no PGS 1 patients had GGT more than 100.

Diabetes mellitus had a slightly female preponderance as expected, the related incidences were also found to be more in higher grades of PGS. The duration of surgery had a direct relation in respect to the fact that 62.5% patients in PGS 5 and 38.2% had surgeries going upwards of 90 min in duration, whereas bulk of the surgeries belonging to PGS 1 and 2 were completed within 45 min (83% PGS1 and 80% PGS2).

Moving on to the intra-operative findings, in respect to the conditions of GB wall 76.9% of patients with gangrenous gall bladder belonged to PGS 4 and 5. however the presence of inflamed gall bladder wall had an increasing preponderance with increasing PGS grade (Table 3).

When talking about any alteration to standard approach of doing a lap cholecystectomy, fundus first approach was the first change used by the operative surgeons. 32.2% of patients in PGS 3 had to be converted to fundus first approach, 61.7% of PGS 4 and 75% of PGS 5 patients had same surgical fate.

Conversion to open cholecystectomy was also done in a small number of patients. Only 3 out of 34 and 4 out of 24 patients from PGS 4 and 5 respectively underwent this bailout procedure.

Table 1: Description of patient characteristics and patients belonging to different Parkland grades.

Demographics	N (%)	Parkland grades	No. of cases	Percentage (%)
Total patients	416			
Male	136 (32.6)	1	122 (m-36, f-86)	29.3
Female	280 (67.4)	2	146 (m-46, f-100)	35.1
		3	90 (m-20, f-70)	21.6
Age (in years)		4	34 (m-23, f-11)	8.1
<40	173 (41.5)	5	24 (m-11, f-13)	5.7
≥40	243 (58.5)			
Planned cholecystectomy	292 (70.1)			
Cholecystectomy for acute cholecystitis	124 (29.9)			

Table 2: Pre-operative laboratory parameters.

Pre-op parameters		PGS 1 (n=122), (%)	PGS 2 (n=146), (%)	PGS 3 (n=90), (%)	PGS 4 (n=34), (%)	PGS 5 (n=24), (%)
Raised TLC	>11000 cells/mm^3 (168)	24(19)	28 (19)	82 (91)	16 (47)	18 (75)
Raised direct BIL	>0.3 mg/dl (42)	2 (1.6)	12 (8.2)	24 (26)	1 (2.9)	3 (12.5)
Raised ALP >200 iu/l	>200 iu/l (116)	12 (9.8)	46 (31.5)	23 (25.5)	11 (32.3)	24 (100)
Gamma-GT	0-58 (247)	112 (91)	80 (54.7)	40 (44.4)	5 (14.7)	4 (16.6)
	59-100 (91)	10 (9)	66 (45.2)	14 (15.5)	10 (29.4)	3 (12.5)
	>100 (78)	-	6 (4.1)	36 (36.6)	19 (55.8)	17 (70.8)

Continued.

Pre-op parameters		PGS 1 (n=122), (%)	PGS 2 (n=146), (%)	PGS 3 (n=90), (%)	PGS 4 (n=34), (%)	PGS 5 (n=24), (%)
H/o surgical jaundice	Either recently or in past (28)	2 (1.6)	7 (4.7)	3 (3.33)	12 (35.2)	4 (16.6)
H/o T2 DM	156 (m-68, f-88)	69 (56.5)	32 (21.9)	23 (25.5)	14 (41.1)	18 (75)

Table 3: Intra-operative parameters.

Intra-op parameters	Variables	PGS1 122, (%)	PGS 2 146, (%)	PGS 3 90, (%)	PGS 4 34, (%)	PGS 5 24, (%)
Duration of surgery	<45 min (284)	102 (83.6)	117 (80.1)	54 (60)	5 (14.7)	6 (25)
	45-90 min (90)	17 (13.9)	25 (17.1)	29 (32.2)	16 (47)	3 (12.5)
	>90 min (42)	3 (2.4)	4 (2.7)	7 (7.7)	13 (38.2)	15 (62.5)
Liver morphology	Normal (402)					
	Cirrhotic (14)	-	2 (0.54)	5 (5.55)	4 (11.7)	3 (12.5)
Gb wall	Normal (273)	119	117	33	4	
	Inflamed (117)	3	29 (19.8)	51 (56.6)	21 (61.7)	13 (54.1)
	Gangrenous/perforated (26)	-	-	6 (6.67)	9 (26.4)	11 (45.8)
Change of approach/bail out procedure	Fundus first approach (68)	-	1 (0.6)	29 (32)	21 (61.7)	18 (75)
	Open cholecystectomy (4)	-	-	1 (1.1)	1 (2.9)	2 (8.3)
Intra-op injury	Vascular injury (4)		1 (0.6)	1 (1.1)	2 (5.8)	1 (4.1)
	Bowel injury (0)					
	Biliary tree injury (3)	-	1 (0.68)	1 (1.1)	1 (2.9)	-
Drain placement	Yes (36)					
	Altered approach/ modifications					
Use of advanced energy sources	Harmonic scalpel (58)	2 (1.6)	6 (4.1)	10 (11.1)	17 (50)	23 (95.8)
Use of advanced clipping devices	Hemolock (46)	6 (4.9)	8 (5.4)	8 (8.8)	12 (35.2)	12 (50)
	Stapler (2)	-	-	-	-	2 (8.3)

Table 4: Post-operative parameters.

Post op parameters		PGS 1, 122 (%)	PGS 2, 146 (%)	PGS 3, 90 (%)	PGS 4, 34 (%)	PGS 5, 24 (%)
Post-op hospital stays	<2 days (384)	122 (100)	144 (98.6)	80 (88.8)	26 (76.4)	12 (50)
	>2 days (32)	-	2 (1.4)	10 (11.2)	8 (23.5)	12 (50)
Post-op leak	Bile leak				1 (2.9)	
	Chyle leak					1 (4.1)
Readmission after 72 hours	SSI (14)	2 (1.6)	1 (0.6)	3 (3.3)	-	7 (29.1)
	Pain (4)	1 (0.81)	1 (0.6)	-	1 (2.9)	1 (4.1)

Use of advanced energy sources and clipping devices was also studied. Use of harmonic scalpel was used more frequently in higher grades of PGS as high as 95.8% patients in PGS 5 and 50% patients in PGS 4 and 11% in PGS 3. The use of hemlock for clipping of vessel and ducts was similar in occurrences (50% in PGS 5 and 35.2% in PGS 4, 5% in PGS2, 8.8% in PGS 3). In two patients of PGS 5 even linear stapler had to be used for ligation of cystic pedicle.

When studied about intra-op injuries, vascular injuries although low in number had a relative increased incidence with increasing parkland grade. No intra-op bowel injuries were reported. However, the incidence of biliary tree injury was equal in number across various parkland grades with 4 patients of PGS5 and 3 patients of PGS3 having encountered it.

Moving on to post-operative assessments most of the patients operated were discharged within 48 hrs of surgery. Post-op bile leak was encountered in one PGS4 patient and chyle leak in one PGS 5 patient (Table 4).

Total 14 patients had to be readmitted due to SSI with 50 % of them belonging to PGS 5 and 21% to PGS 3. The

other reason for readmission was pain non responsive to oral analgesics with a total of 4 patients having such incidence among 416 total patients.

DISCUSSION

The main aim of our study was to validate the use of PGS for grading of difficulty of performing laparoscopic cholecystectomy and formulating some recommendations that can be used in future.

As suggested by many studies in the past like Madni et al that PGS system is feasible to assess the difficulty level of laparoscopic cholecystectomy very early in the course of surgery.[11]

The important preoperative characteristics which show statistical significance is raised gamma-GT more than 100 IU/l is an indicator of difficulty of cholecystectomy as starting from grade 3, 40% patients had this finding. This can be explained by the fact gamma-GT is a highly specific marker of active biliary inflammation. Gamma-glutamyl transferase is an enzyme found throughout the body, though mostly found in the liver. It may leak into the bloodstream in cases of liver damage, so high levels of this enzyme in the blood may be a sign of liver disease or bile duct damage.[12]

The preponderance of acute cholecystitis in diabetics is already very well established. As stated by Hickman et al, acute cholecystitis in diabetics is associated with a higher incidence of infection-related complications and supports the need for expeditious operative therapy in symptomatic patients.[13]

Starting from PGS grade 3, the change of approach to surgery was seen with increasing parkland grades. The most common diversion from standard laparoscopic cholecystectomy is use of fundus-first approach and use of harmonic scalpel.

The conversion rate can be high during LC in patients with acute gangrenous cholecystitis. The use of FF and partial cholecystectomy techniques during difficult cases can avoid conversion to open surgery. In the study of Mahmud et al, the conversion rate to open surgery decreased from 5.2% to 1.2% with the use of FF technique.[14] Gupta et al reported that the use of FF technique decreased the conversion rate from 18.8% to 2.1% in patients with chronic cholecystitis.[15]

Harmonic scalpel was used more frequently in higher parkland grades (more than 50% cases in PGS 4 and 5). As stated by Zaidi et al, the harmonic scalpel is safe and a surgeon friendly instrument. Clarity of operative field and effective haemostasis is remarkable with its use.[16] Hence the use of ultrasonic energy helps for better delineation of anatomical variations and avoiding unnecessary collateral damage.

The use of hemolock for clipping of vessel and dilated ducts was similar in occurrences (more than 60% cases of PGS 4 and 5 combined). This clubbed with use of stapler for cystic duct ligation in case of wide mouthed duct avoids going for subtotal/partial cholecystectomy and leaving behind a part of gall bladder wall unnecessarily.

Other advanced gelatin-based tissue hemostatic agents can be used but the major factor is the cost and availability of these. If available, these are advised to be used when needed as patient safety is paramount.

Post operative complications were relatively less when compared to other data, but this the author corroborates with swift decision to take altered approaches for hemostasis and dissection as described earlier.

Limitations

Being a single centre analysis can be considered as the limitation of our study. So, the studies of multicentric in nature and larger sample size are necessary to validate the present scoring system in predicting the difficult cases of laparoscopic cholecystectomy. In our study, some bias might be there in view of grading of the PGS as interobserver variability was not assessed.

CONCLUSION

PGS can be highly predictive for difficult cholecystectomy and every surgeon with or without adequate experience should be aware of potential complications. PGS grade 4 and higher have higher rate of conversion to fundus-first approach. PGS 4,5 had lesser complication rates and have shorter operative time if the decision to convert to a fundus first or open cholecystectomy was taken earlier. Planning appropriate line of further management without wasting much time is what we advocate. The author would like to stress upon the fact that no role of subtotal cholecystectomy was found in our study when timely decisions regarding change in approach was taken.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Jyoti V, Singh D, Yadav R, Dey S. From grading to guidelines: recommendations for safe laparoscopic cholecystectomy based on the Parkland grading system. Int Surg J 2026;13:949-54.