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Pre-operative evaluation with parkland grading system in assessing difficult laparoscopic cholecystectomy and expectant operative and post-operative complications

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Abstract

Aims: Pre-operative factors with Parkland grading system in assessing difficult Laparoscopic Cholecystectomy and expectant operative and post-operative complications.

Materials and Methods: A prospective study done in hospitals attached to BMC&RI, Department of General Surgery, Bengaluru from Dec 2017- Dec 2018. A total of 110 cases were evaluated & underwent laparoscopic procedure. Gallbladder status was assessed intraoperatively with the application of Parkland grading system.

Results: Out of 110 cases-majority were Grade I (30%), shortest (64.09 mins) & longest surgery duration (152.85 mins) for Grade I&5 respectively & more complications for Grade 4&5. The length of hospital stay was higher (12.85 days for Grade 5).

Conclusion: Parkland grading system 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.

Keywords: Parkland grading, laparoscopic cholecystectomy, gallbladder, severity, outcome

1. Introduction

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%)^[1]. Only 20-30% of the patient 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^[13]. Women are three times more affected and first-degree relatives of patients with gallstones have a two fold greater prevalence. 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^[4].

Other conditions affecting gall bladder being^[5]

1. Biliary dyskinesia
2. Biliary pancreatitis
3. Trauma
4. Polyps
5. Malignancy

Although medical management is implicated only in the acute settings presenting after 48-72 hours still surgery remains the mainstay treatment especially for the recurrent or chronic cholecystitis^[2]. In order to perform a cholecystectomy either for symptomatic or asymptomatic cases, thorough evaluation via clinical, bio-chemical and radiological assessment is very much mandatory^[14]. The laparoscopic cholecystectomy is one of the most common operation performed by general surgeons and is preferred over open technique^[5]. Laparoscopic cholecystectomy (LC) does not require advanced techniques, and its performance has therefore

rapidly spread worldwide. However, the rate of biliary injuries has not decreased¹⁰. And not all cholecystectomies are created equal; increased inflammation can lead to increased operative timing, conversion rates, intra and post operative complications^[3]. The factors leading to difficult laparoscopic cholecystectomy can be predicted^[12].

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^[6]. Multiple grading scales have been developed to predict the difficult laparoscopic surgery in which most are based on pre operative clinical findings^[9]. Here we propose that true determination of severity of gall bladder inflammation can be made out clearly until Gall Bladder is visualised during surgery. Thus a simple grading system i.e The Parkland grading system (PGS) is been employed⁴. Here we hypothesize the Parkland grading system which is based on intraoperative findings/images which can stratify the severity of the gallbladder disease which is also been compared in association with the clinical, bio-chemical & radiological findings.

2. Aim

Pre-operative factors with Parkland Grading System (PGS) in assessing difficult Laparoscopic Cholecystectomy (LC) and expectant operative and post-operative complications.

3. Materials and Methods

3.1 Study design

Prospective Study

3.2 Source

Victoria Hospital & Bowring and Lady Curzon Hospital attached to Bangalore Medical College and Research Institute, Bengaluru, Karnataka, India.

3.3 Study Period

One year (December 2017- December 2018)

3.4 Sample Size

110

3.5 Inclusion Criteria

- All the patients present with Acute Cholecystitis, Recurrent/Chronic Cholecystitis, Cholelithiasis.
- Age above 18 years

3.6 Exclusion Criteria

- Presence of CBD stones.

- Malignancy.

- Trauma.

- Presence of ongoing Cholangitis / Gallstone pancreatitis.

3.7 Methodology

3.7.1 Procedure

All the patients who present to our institution with the gallbladder disease over a period of 1 year were evaluated and those who are subjected for surgery are included in the study. Patients were evaluated clinically, biochemically and radiologically and further classified according to age, gender, radiological and bio-chemical aspects. Patients underwent laparoscopic procedure. Gallbladder is assessed intraoperatively and pictures were taken after the placement of all laparoscopic ports and status of gallbladder is assessed with the application of Parkland's grading system with which the operability and outcome is assessed.

Our hypothesis is a 5-tyre grading system which would give an appropriate stepwise range of severity of gallbladder.

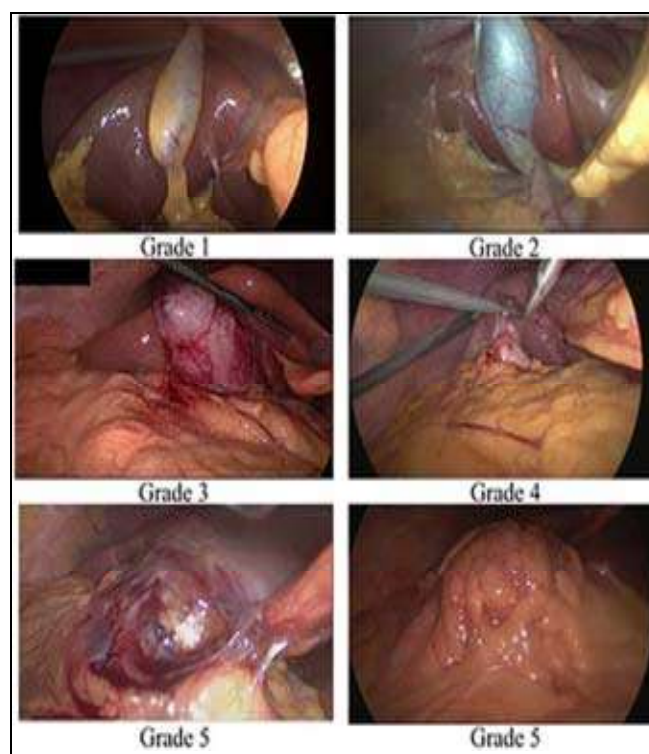


Fig 1: Intraoperative images of gallbladder graded using Parkland grading scale (cholecystitis severity grade).

Table 1: Parkland grading scale for Cholecystitis

Cholecystitis Severity Grade	Description of Severity
1	Normal appearing gallbladder ("robin's egg blue") <ul style="list-style-type: none"> No Adhesion Present Completely normal gallbladder
2	Minor adhesions at neck, otherwise normal gallbladder <ul style="list-style-type: none"> Adhesions restricted to the neck or lower of the gallbladder
3	Presence of ANY of the following : <ul style="list-style-type: none"> Hyperemia, periocholecystic fluid, adhesions to the body, distended gallbladder
4	Presence of ANY of the following : <ul style="list-style-type: none"> Adhesions obscuring majority of gallbladder Grade 1-3 with abnormal liver anatomy, intrahepatic gallbladder or impacted stone(Mirrizi)
5	Presence of ANY of the following : <ul style="list-style-type: none"> Perforation, necrosis, inability to visualize the gallbladder due to adhesions

3.7.2 Analysis

The clinical, bio-chemical, radiological, aspects are assessed along with the photographs which are taken intraoperatively are analysed and the Parkland grading system is applied which is a gallbladder severity grading system. The Parkland grading system comprises of 5 grades as given below based on which severity and outcome is assessed intraoperatively. The age, gender and bio-chemical aspects are also compared with the Parkland's grading for the particular gallbladder disease. The perioperative aspects such as operating duration, % of injury to the common bile duct, bile leak, % of open conversion and length of the hospital stay post-operatively are assessed based on

the severity of gallbladder disease. The results are tabulated accordingly.

3.7.4 Statistical analysis

Data were collected and mean of each data were calculated and one-way ANOVA was used to assess the association of grade with continuous pre and peri-operative clinical measures, were presented in the form of tables, graphs, figures, and diagrams wherever necessary.

4. Results

Table 2: Demographic characteristics of the 110 patients across grades

Demographic characteristics	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	p value
Age	46.5(25-70)	36.81(24-58)	46.1(19-70)	45.8(30-55)	41.2(34-57)	0.0001
Male (%)	8	18	3	6	2	0.0001
Female (%)	25	26	14	3	5	0.0001

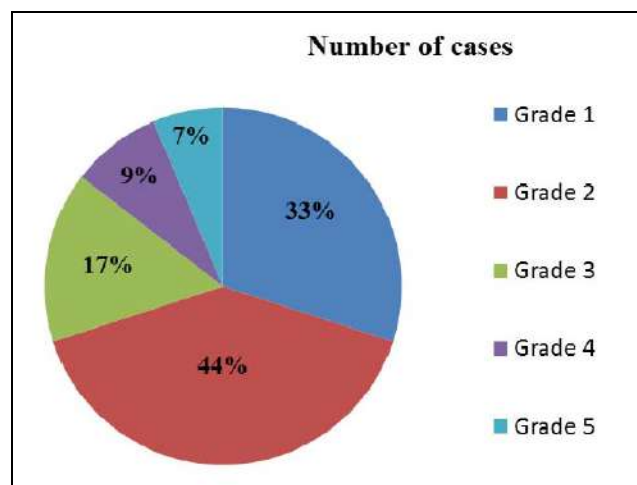


Fig 2: PGS for total number of cases.

Table 3: Preoperative clinical characteristics of the 110 patients across grades.

Preoperative Measures	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	p value
Symptomatic	0	0	0	2	3	0.0001
Asymptomatic	33	44	17	7	4	0.0001

Table 4: Preoperative bio-chemical characteristics of the 110 patients across grades.

Preoperative Measures	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	p value
HB	12.4 (11.1-14.7)	12.4 (10.6-15.8)	12.14 (11.3-12.8)	13.8(12.1-14.8)	11.17 (10-12.4)	0.0001
WBC	8.47(6.2-11.8)	9.44(6.3-15.4)	8.93(7.3-13.1)	10.72(8.6-13.2)	11.4(10-14.2)	0.0001
TB	0.51(0.2-1)	0.62(0.2-1.2)	0.61(0.3-1)	0.66(0.5-0.9)	1.18(0.8-1.6)	0.0001
DB	0.15(0-0.3)	0.16(0-0.3)	0.15(0.1-0.2)	0.31(0.1-0.4)	0.28(0.1-0.4)	0.0001
IB	0.35(0.1-0.7)	0.46(0.1-0.9)	0.46(0.2-0.8)	0.35(0.1-0.5)	0.9(0.5-1.4)	0.0001
AST	29.39(19-39)	22.5(10-40)	18.64(13-28)	29.7(22-38)	25.14(18-34)	0.0001
ALT	31.96(19-55)	31.06(4-52)	19.64(10-40)	49.6(26-64)	30.42(20-44)	0.0001
ALP	88.15(55-141)	91.72(55-145)	110.7(62-175)	112.4(79-140)	103.7(84-12.6)	0.0001
ALBUMIN	4.05(3.4-4.7)	4.2(3.6-5.3)	4.15(3.5-4.8)	4.15(3.8-4.6)	3.87(3.2-5.4)	0.0001

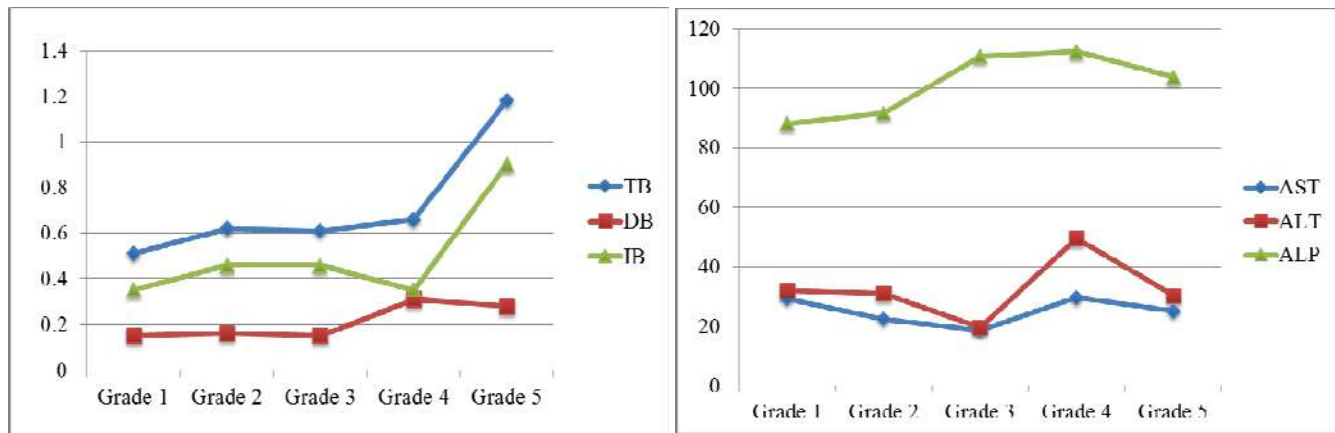


Fig 3, 4: PGS of LFT.

Table 5: Preoperative radiological characteristics of the 110 patients across grades.

Preoperative Measures	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	p value
% GB thickened wall (US)	2.6(2-5)	2.93(2-6)	3.84(2-7)	5.8(3-8)	6.78(3.5-9)	0.0001
% Pericholecystic fluid / edema (US)	0	0	Mild(3)	Mild(2)	Mod(5)	0.0001
Presence/absence of stones	33/0	14/0	17/0	9/0	7/0	0.0001
Single/Multiple stones	9/24	6/38	0/17	1/8	2/5	0.0001
Maximum Stone Size (In MM)	6.6(4-13)	11.27(7-16)	9.4(3-15)	10(6-13)	7.8(5-10)	0.0001

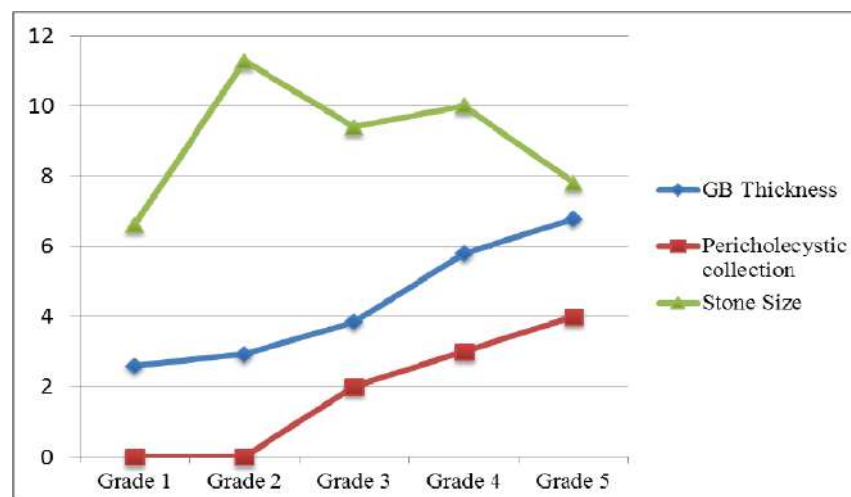


Fig 5: PGS of preoperative radiological characteristics of the cases.

Table 6: Perioperative clinical characteristics of the 110 patients across grades.

Perioperative Measures	Grade1	Grade 2	Grade3	Grade4	Grade5	p value
Operating Time(min)	64.09 (30-90)	80.4 (40-150)	104.2 (80-125)	120.4 (95-148)	152.85 (120-180)	0.0001
% of CBD injury	0	0	0	0	0	0.0001
% of Bile Leak	0	0	Min(3)	0	Mod(3)	0.0001
% Open Conversion	0	0	0	0	0	0.0001
Length of stay (days)	5.51(3-8)	6.09(3-14)	5.52(4-7)	11.1(7-17)	12.85 (7-18)	0.0001

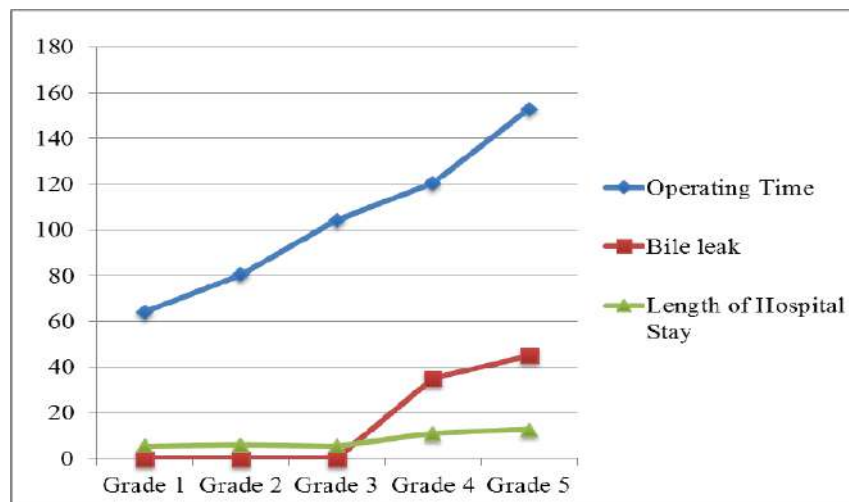


Fig 6: PGS of perioperative clinical characteristics of cases.

5. Discussion

Laparoscopic cholecystectomy was first performed in animal model by Fillipi, Mall and Roosma in 1985. Philip Mouret in 1987 was the first to remove the gall bladder successfully through an unmagnified mechanical rigid pipe without doing laparotomy [7].

Initially, the complication rate with LC was high but with technological advancement and increase in the expertise, it has now reached a remarkably low level at 2.0–6.0%. Conversion rate of 7–35% has been reported in literature [8].

In our study, Laparoscopic Cholecystectomy was performed in 110 patients and different predictive risk factors for difficult Laparoscopic Cholecystectomy were analyzed. Gender, age, symptomatic/asymptomatic, biochemical tests, GB wall thickening, pericholecystic collection, presence/absence of stones, single/multiple stones, maximum stone size were included as risk factors in our study. Along with preoperative risk factors, we added intraoperative factors and these risk factors were graded using PGS accordingly.

Out of 110 gall bladder graded, 33 cases were assessed to be grade 1 (30%), 42 were Grade 2 (38.1%), 17 were grade 3 (15.45%), 9 was grade 4 (8.18%) and 7 was grade 5 (6.36%) on Parkland scale.

Grade 1 Gall bladders are corresponded with the shortest mean surgery time of 64.09 minutes where in grade 2 is of 80.4 minutes, grade 3 of 104.2 minutes, grade 4 of 120.4 minutes, grade 5 of 152.85 minutes. This signifies that operative difficulty is well established as severity grade increases. The cases with bile leak were mainly from cystic duct stump and were tackled with re application of clips and were reassessed for further leaks. None of the patient underwent open conversion from laparoscopy.

Mean length of stay from grade 1 were 5.51, grade 2 were 6.09, grade 3 were 5.52, grade 4 was 11.1 and grade 5 was 12.85 days which is showing that length of stay in the hospital were comparatively higher as the severity grade is increased.

Our study was compared with Tarik *et al.* [6] According to Tarik *et al.* ($p=0.0001$), perioperative Gall Bladder status, mean surgery duration ($p=0.0001$) and mean length of hospital stay ($p=0.0001$) was found to be same as our study results ($p=0.0001$) both were statistically significant.

We also compared our study with Gupta *et al.* [7] who included only preoperative risk factors -Old age, male sex, history of hospitalization, obesity, previous abdominal surgery, palpable

Gall Bladder and Ultrasonographic findings like Gall Bladder wall thickness, pericholecystic fluid collection, impacted stone, which were statistically significant ($P=0.0003$) as that of our study ($p=0.0001$). In addition to these factors we included parameters like single/multiple stones, symptomatic / asymptomatic and also different age groups & gender, which were found to be statically significant ($P=0.0001$) as well.

6. Conclusion

Through this study its clear that increasing grade (PGS) is significantly associated with increased difficulty of surgery, conversion rates, length of the operation and incidence of post-operative bile duct leak. An operative grading scale in which higher scores can predict longer, more difficult surgery and higher complication rates with increased duration of post-operative stay. Comparatively Parkland Grading scale is less complex and covers wider range of difficulty variations. Specifically, the simplicity of such an intraoperative grading scale validated for peri-operative outcome.

This grading system along with pre-operative evaluation for Cholecystectomies may offer a simple and improved means of assessing operative difficulty and post-operative outcome based on Gall Bladder anatomy and inflammation.

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