UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

FACULTAD DE MEDICINA

DIVISIÓN DE ESTUDIO DE POSGRADO E INVESTIGACIÓN

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TÍTULO DE LA TESIS
IS THE PARKLAND GRADING SCALE RELATED TO SURGICAL DIFFICULTY   IN LAPAROSCOPIC CHOLECYSTECTOMY?

TRABAJO DE INVESTIGACIÓN QUE PRESENTA:
GLORIA MARÍA GUZMÁN ARGÜELLO

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ASESOR DE TESIS:
JAVIER BENÍTEZ BELTRÁN

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RESUMEN

Background: Acute cholecystitis is one of the most frequent surgical pathologies, accounting for 6–11% of patients with symptomatic gallstone disease. The gold-standard treatment for this disease is laparoscopic cholecystectomy because the minimally invasive surgery significantly benefits the patient in terms of less pain and early recovery. The Parkland grading scale (PGS) is a grading system based solely on intraoperative images, which stratifies gallbladder inflammation in five degrees based on anatomy and gallbladder inflammation. This grading system is useful and helps predict the outcome of the surgery.

Methods: This study correlated the PGS with surgical difficulty based on factors such as open conversion and subtotal cholecystectomy. We included 105 patients in this study who, over a seven-month period, underwent a laparoscopic cholecystectomy and were graded by the PGS.

Results: We enrolled a total of 105 patients in our study, in which 74 patients were female and 31 were male. Of the 105 patients, 94 had a laparoscopic cholecystectomy, 3 underwent an open conversion (meaning the conversion rate was 2.9%), and 8 had a subtotal cholecystectomy (a rate of 7.6%).

Conclusions: The PGS is an easy and applicable grading scale for surgeons, and its application could help predict the complexity of gallbladder surgery and the outcomes of each patient. However, additional high-quality studies are needed to asses and validate this scale in patients with acute cholecystitis and determine its predictive value. We should also adjust this study depending on the surgeons' level of expertise.

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INTRODUCCIÓN

Gallstone disease is a common pathology and usually presents as acute calculus cholecystitis in approximately 20% of symptomatic patients. Therefore, being the gold-standard treatment in acute cholecystitis or symptomatic gallstone disease, laparoscopic cholecystectomy is one of the most commonly performed procedures. This procedure has a low incidence of morbidity and mortality, but its complexity is affected by the presence and severity of inflammation, age, gender, previous abdominal surgery, BMI, acute cholecystitis grade II or III according to the Tokyo guidelines, gallbladder wall, c-reactive protein, and body temperature [1-3].

Numerous preoperative grading scales have been developed for predicting the difficulty of the surgery, the conversion rate, and the necessity to perform a bailout procedure [4], but the last is impossible to predict because the decision to perform a bailout procedure depends on the transoperative findings.

The Parkland grading scale (PGS) was developed in 2017 at the Parkland Memorial Hospital in Texas, USA. It is an accurate and reliable grading scale that is easy to remember and with a limited number of grades: one to five [4,5]. The PGS is shown in Table 1.

The PGS is a grading system based solely on intraoperative images that stratifies gallbladder inflammation [5] in five degrees, based on anatomy and gallbladder inflammation [4]. This grading system is useful and helps predict the surgical outcome and postoperative complications. The grading scale can also be applied in daily practices.

Table 1 [4]

Cholecystitis Severity Grade	Description of Severity
1	Normal appearing gallbladder ("robin´s egg blue") • No adhesions present • Completely normal gallbladder
2	Minor adhesion at neck, otherwise normal gallbladder • Adhesions restricted to the neck or lower of the gallbladder
3	Presence of ANY of the following: • Hyperemia, pericholecystic fluid, adhesions to the body, distended gallbladder
4	Presence of ANY of the following: • Adhesions obscuring the majority of the gallbladder • Grade I–III with abnormal liver anatomy, intrahepatic gallbladder, or impacted stone
5	Presence of ANY of the following: • Perforation, necrosis, inability to visualize the gallbladder due to adhesions

Few studies have directly correlated the complexity of the surgery with the PGS. For this work, the two most relevant studies were "Utilization of an Intraoperative Grading Scale in Laparoscopic Cholecystectomy: A Nepalese Perspective" [4] and "Does surgical difficulty relate to severity of acute cholecystitis? Validation of the parkland grading scale based on intraoperative findings" [11]. Therefore, further correlation should be realized.

MÉTODOS

This was a prospective cohort study conducted over a period of seven months, from January 4, 2021 to July 27, 2021, in the Hospital Regional Licenciado Adolfo López Mateos, in which included 105 patients that underwent laparoscopic cholecystectomy for symptomatic cholelithiasis. The PGS was applied to all 105 patients, and outcome factors such as open conversion, subtotal cholecystectomy, and bile leaks were assessed.

We assumed that for a higher Parkland grade, bailout procedures and conversion to open procedures would increase. A faculty surgeon was responsible for all surgeries, and he determined the Parkland grade of the gallbladder. The cholecystectomies were either elective or emergency surgeries depending on previous conditions, such as pancreatitis, cholangitis, choledocholithiasis, and Tokyo classification.

Patients with common bile duct stones or cholangitis underwent endoscopic treatment before surgery, and patients with pancreatitis were treated medically before performing a laparoscopic cholecystectomy.

The following data were retrieved from the prospectively collected database and analyzed: preoperative data (i.e., age, sex, duration of symptoms, and preoperative laboratory findings), intraoperative data (i.e., intraoperative findings and type of surgery), and post-operative data (i.e., bile leaks and wound infection).

According to the Tokyo guidelines, hyperbilirubinemia was when the total bilirubin was > 2 mg/dL, and leukocytosis was when the white blood cell count was >10 x1,000/μL. Also, according to the Tokyo guidelines, we defined a prolonged time of symptoms as >2 days [2].

Inclusion criteria:
1. Patients aged 18–91 years old
2. Patients from both genders: male and female
3. Patients with calculous cholecystitis

Exclusion criteria:
1. Conversion to open surgery due to equipment failure
2. Patients that rejected surgical treatment

For our statics analysis, we used SPSS version 25, and a p value of less than 0.05 was considered significant. A one-way ANOVA was used to evaluate the relationship between the Parkland grade for cholecystitis and the type of surgery performed. Post hoc and Tukey–Kramer tests were applied for all pairwise comparisons of means between the grades.

RESULTADOS

A total of 105 patients were enrolled in our study, of which 74 patients were female and 31 were male. The mean age was 49 years ± 15.73 for both groups, either female or male. According to the PGS, 21 patients were grade I, 12 patients were grade II, 43 patients were grade III, 13 patients were grade IV, and 16 patients were grade V. The mean level of leucocytes was 10.027 ± 3.9, the mean level of total bilirubin was 1.84 ± 4.05.

Thirteen of our patients had acute pancreatitis, and all of them had mild pancreatitis. Twenty-one of our patients had choledocholithiasis. Eleven of our patients presented with cholangitis, in which seven had mild cholangitis, two had moderate, and two had severe cholangitis, according to Tokyo Guidelines 2018.

From the 105 patients, 94 had a laparoscopic cholecystectomy, 3 underwent an open conversion (meaning the conversion rate was 2.9%), and 8 had a subtotal laparoscopic cholecystectomy (a rate of 7.6%). Among the 3 patients that had an open cholecystectomy, 1 (0.95%) was grade I, and 2 (1.9%) were grade V according to the PGS. Among the 8 patients who had a subtotal laparoscopic cholecystectomy, 2 (1.9%) were grade V, 4 (3.8%) were grade IV, and 2 (1.9%) were grade III. Postoperatively, only 1 (0.95) of our patients had a biliary leak, and his Parkland grade was IV; he was treated with an endoscopy with no further complications. Table 2 shows our patient characteristics and the type of surgery.

Subtotal cholecystectomy, conversion to open surgery, and bile leak increased with the increasing grades of the Parkland scale, age, white blood cell count, elevation of bilirubin, choledocholithiasis, and cholangitis. Table 3 shows the correlation between the PGS and the type of surgery.

Table 2: **Patients Characteristics and risk analysis between risk factors**

	Complete laparoscopic cholecystectomy (N=94)	Subtotal cholecystectomy and conversión (N=11)	OR	P
Male sex (%)	26% (25)	54 % (6)	3.31	0.06
Age >60 (%)	27% (26)	45 % (5)	2.17	0.22
Time of symptoms in days	50 days (47)	72 days (8)	2.66	0.16
Pancreatitis (%)	11% (11)	18 % (2)	1.67	0.54
Coledocholithiasis (%)	17% (16)	45 % (5)	2.06	0.03*
Cholangitis (%)	7% (7)	36 % (4)	7.1	0.008*
Leukocytosis (%)	27% (26)	63 %(7)	4.57	0.02*
Bilirubin (%)	25%(24)	54 %(6)	3.5	0.05

Table 3: **Correlation Between the Parkland Grading Scale and Type of Surgery**

	Complete laparoscopic cholecystectomy (N=94)	Subtotal cholecystectomy and conversión (N=11)	OR	P
Parkland Grading Scale				
I	21% (20)	9% (1)	0.34	0.32
II	12% (12)	0%(0)	0.28	0.39
III	43%(41)	18%(2)	0.28	0.12
IV	9%(9)	36%(4)	5.39	0.01*
V	12%(12)	36%(4)	3.9	0.05*
Bile leak	1%(1)	0%(0)	2.71	0.54

Table 4: **Relationship between the Parkland Grading Scale and the complexity of the surgery**

	Complete laparoscopic cholecystectomy (N=94)	Subtotal cholecystectomy and conversión (N=11)	RR	OR
Parkland grade I – II	62	1	10	19.3
Parkland grade III – V	32	10		

A one-way ANOVA was used to evaluate the relationship between the PGS and the complexity of the surgery, which was statistically significant in grades IV and V (p=0.01 for grade IV and p=0.05 in grade V). The Tukey–Kramer test for all the comparisons (<p=0.05) revealed that grades I, II, and III were significantly different from grades IV and V.

DISCUSIÓN

Laparoscopic cholecystectomy is one of the most common surgeries performed worldwide and also the gold-standard treatment for Gallstone disease. The timing of this procedure has been classified as "early" cholecystectomy when the surgery is performed within the first seven days of symptoms or "delayed" when it is performed six weeks after the diagnosis [6-7]. The approach to treat this disease is surgery, with laparoscopic treatment being the standard because of its significant benefits to the patient. However, the severity of inflammation will determine the complexity of the surgery. Various factors are associated with determining the type of surgery, especially for a difficult gallbladder, such as the severity of the inflammation, anatomical variability, the fibrosis of the Calot´s triangle, or bleeding, so the surgeon must be prepared to use different techniques, such as subtotal cholecystectomy and conversion to open surgery, to ensure a safe dissection [8-14].

Numerous preoperative grading scales have been described in order to determine the complexity of the surgery, but only a few consider intraoperative factors. The complexity of the surgery depends on multiple variables that do not allow an effective comparison because some patients have other comorbidities, or not all variables are considered in the same study [15-21].

In this study, we considered some preoperative factors such as cholangitis, choledocholithiasis, pancreatitis, duration of symptoms, leukocytosis, bilirubin, age, and sex. We found the presence of choledocholithiasis, cholangitis, and leukocytosis to be risk factors. We also used the PGS to determine at which grade the complexity and need for a bailout procedure was necessary, where grades IV and V were statistically significant and considered a factor for subtotal cholecystectomy or conversion to open surgery.

Our study was limited in that it was only performed in one institution, and we had a limited sample size. Also, because seven different surgeons classified the Parkland grade according to the intraoperative findings, there could have been subjective variation in the grade given to each case. Therefore, more studies should be done to asses and correlate the PGS with the complexity of the surgery.

CONCLUSIÓN

The Parkland grading scale is an easy and applicable grading scale for surgeons, and its application could help predict the complexity of gallbladder surgery and the outcomes of each patient. However, additional high-quality studies are needed to asses and validate this scale in patients with acute cholecystitis and determine its predictive value. We should also adjust this study depending on surgeon experience.

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