Application of the parkland grading scale in video laparoscopic cholecystectomies

Aplicación de la escala de parkland en colecistectomías videolaparoscópicas

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ABSTRACT

Introduction: The Parkland grading scale is an intraoperative visual scale to prevent complications in video laparoscopic cholecystectomies. **Materials and Methods:** it is an observational, descriptive, cross-sectional, temporarily retrospective study. The Parkland grading scale was applied in patients undergoing video laparoscopic cholecystectomies at the Hospital de Clínicas Surgery Unit (Paraguay) during the year 2021. **Results:** 267 patients were studied who had undergone video laparoscopic cholecystectomy; 29.59% of them showed Grade I classification, 37.83% Grade II, 18.73% Grade III, 10.49% Grade IV, and 3.37% Grade V. The surgery performed was total video laparoscopic cholecystectomy in 95.13% of the cases, with a conversion rate of 4.49%. Having a past medical history obstructive jaundice of lithiasic origin, hyperbilirubinemia, elevated alkaline phosphatase levels, increased BMI, type of surgery (scheduled/emergency), diagnosis of acute cholecystitis, time of surgery, surgery performed, and use of cavity drainage increases the Parkland grades (p < *.05)*. **Conclusion:** The Parkland grading scale makes it possible to decide on the early surgical strategy in the intraoperative period and make comparisons of the results and reports of fairer rates of complications.

Keywords: Parkland, cholecystectomy, minimally invasive, complications.

RESUMEN

Introducción: La escala de Parkland es una escala visual intraoperatoria para intentar prevenir complicaciones en colecistetomías videolaparoscópicas. **Materiales y Métodos:** estudio observacional descriptivo de corte transversal, temporalmente retrospectivo. Se aplico la escala de Parkland en pacientes sometidos a colecistectomía videolaparoscópica en la I Cátedra y Servicio de Clínica Quirúrgica del Hospital de Clínicas durante el año 2021. **Resultados:** Se estudiaron 267 pacientes sometidos a colecistectomía videolaparoscópica. El 29,59% presentó una clasificación de Grado I, el 37,83% Grado II, el 18,73% Grado III, el 10,49% Grado IV y el 3,37% Grado V. La cirugía realizada fue colecistectomía video laparoscópica total en el 95,13% de los casos, con una tasa de conversión del 4,49%. El antecedente de ictericia obstructiva litiásica, la hiperbilirrubinemia, elevación de fosfatasa alcalina, IMC elevado, tipo de cirugía (programada/urgencias), diagnóstico de colecistitis aguda, tiempo de cirugía, cirugía realizada y utilización de drenaje de cavidad vemos que aumentan a mayores grados de Parkland (p<0,05). **Conclusión:** La escala de Parkland permite decidir la estrategia quirúrgica inicial en el intraoperatorio y además realizar comparaciones de resultados e informes de tasas de complicaciones más justos.

Palabras claves: Parkland, colecistectomía, mínimamente invasiva, complicaciones.

INTRODUCTION

Video laparoscopic cholecystectomy is one of the most commonly performed surgical procedures worldwide and it is the treatment of choice for the management of symptomatic vesicular lithiasis.[1] Although it is a very common procedure in surgery units, difficulty can vary from patient to patient due to factors such as comorbidities, anatomical variations or the presence of a significant inflammatory process in the intraoperative period.

Currently, the reported rate of complications of laparoscopic cholecystectomy is uniform, that is, it does not take into account the complexity of the case; therefore, a difficult emergency surgery with multiple adherences with greater chances of complications in the postoperative period is coded the same as a scheduled surgery in a patient without comorbidities, without a significant inflammatory process and whose estimated duration for extraction purposes could be around 30 min.[2]

Several preoperative scales have been developed in an attempt to predict both the intra- and postoperative results; however, few of these scales take into account intraoperative anatomical differences.[3-5] Also, they are not used much in the routine daily practice since they are complex, hard to remember, and do not allow effective comparisons of results to be made.

In view of these problems, the Parkland grading scale[6] emerges as a five-level grading system based on anatomical and intraoperative inflammatory changes. It is easy to implement and highly reproducible (Table 1). The characteristic trait of this classification is that it makes it possible to classify the degree of severity with an early vision when surgery begins, which is useful to change the early surgical strategy intraoperatively.[7,8]

Our objective is to use this scale and apply it to patients undergoing video laparoscopic cholecystectomy at Hospital de Clínicas, Paraguay during 2021, taking into account that many of the patients that come to our service lack healthcare access and knowledge on the disease, which leads to late medical consultation eventually leading to surgery with greater risk of complications and conversion.

We believe that, if it is determined that this scale is based on gallbladder anatomy and the degree of inflammation is valid and reliable, it will facilitate making result comparisons and reports on the rates of complications that are fairer.

MATERIAL AND METHODS

This was an observational, descriptive, cross-sectional, temporarily retrospective study, which sought to apply the Parkland grading scale on video laparoscopic cholecystectomies performed at the Hospital de Clínicas Surgery Unit (Paraguay) during 2021. The inclusion criteria were patients > 18 years who had undergone video laparoscopic cholecystectomy at the Hospital de Clínicas Surgery during 2021. And the exclusion criteria were health records with a state of conservation that made them difficult to read. Data curation was conducted at Hospital de Clínicas General Archive Unit, where the records from all the patients who met the inclusion criteria were requested, so that later on, the records showing exclusion criteria could be discarded.

The variables considered were sex, age, BMI, comorbidities, evolution hours prior to surgery, type of surgery, prior history of acute biliary pancreatitis (ABP) or jaundice, white cell count, neutrophil count, liver profile, Parkland classification,[6] the surgery performed, conversion to open surgery, surgical time, postoperative complications, perioperative cholangiography, postoperative diagnosis, and hospitalization time.

The statistical software package SPSS 21® was used for data study and tables were made on Microsoft Excel 365®. The descriptive analysis used absolute frequencies, percentages, means, standard deviations, and medians. To evaluate the distribution of quantitative variables, the Kolgomorov-Smirnov test was used, considering $P > .05$ as significant values. The chi-square test was used to compare proportions, and the Mann Whitney U test was used to compare ranges, in both cases P values > .05 were considered statistically significant.

During the casuistry of the present study, bioethical principles were observed at all times. The mechanism by which the patients were given guarantees are listed below; the principle of Beneficence was respected when results were shown to the corresponding authorities so that eventually decisions could be made; the principle of Non-Maleficence, by not publishing or presenting each patient's results nominally, thus safeguarding the confidentiality of the data included in each patient's medical history; and ultimately, the principle of Justice, by giving all patients the opportunity to participate without discriminating anyone on the basis of race, sex, religion or political ideologies.

We should mention that patients whose records were used for this study came to the hospital free and voluntarily, and they underwent the surgical procedures after giving their corresponding consent, as part of their healthcare.

RESULTS

A total of 267 patients were studied. These patients had undergone a video laparoscopic cholecystectomy during the year 2021 at the San Lorenzo Hospital de Clínicas Clinical Surgery Unit, Paraguay.

A total of 86.2% out of all the patients were women, with an overall mean age of 38.87 +/- 13.52 years; median, 37 years. The average body mass index was 28.19 +/- 6.56 Kg/m^2; median, 26.25 years. The mean evolution before surgery was 41.16 +/- 36.23 hours; median, 24 hours; 68.05% of the surgeries were programmed, 18.18% had a history of ABP and 16.29% a history of obstructive jaundice of lithiasic origin.

A total of 36.88% of the patients had at least one comorbidity, the most common being high blood pressure and obesity, 54.64% and 47.42% respectively. Regarding the white cell count, we saw leukocytosis in 24.5% and neutrophil counts > 80% in 13.86% of the cases. Hyperbilirubinemia was present in 9%, elevated transaminase levels in 10.9%, and elevated alkaline phosphatase levels in 15.27%.

Regarding the Parkland classification, 29.59% had Grade I classification, 37.83% Grade II, 18.73% Grade III, 10.49% Grade IV, and 3.37% Grade V (Table 2). The surgery performed was total video laparoscopic cholecystectomy in 95.13% of the cases, conversion to open in 4.49% and opening and closing in 0.37%. Among the main causes for conversion, we can mention failure to identify Calot's triangle structures due to firm adherences in 4 patients and inflammatory adherences attached to other organs such as the colon, the stomach and/or the duodenum in 3 patients.

The mean surgery time was 88.61 +/- 42.5 min; median, 75 min. Cavity drainage was performed in 6.79%, there were complications in 3%, POC was performed in 12.86%, the postoperative diagnosis was acute cholecystitis in 34.7%, and hospitalization stay until discharge was 2.28 +/- 4.89 days; median, 1 day.

Regarding variable comparison, we should mention that all quantitative variables had a non-normal distribution; therefore, only non-parametric tests were performed. No significant differences were observed in the different Parkland classifications regarding proportions of sex or the presence of a history of ABP, or elevated transaminase levels or the presence of complications ($P > .05$). No differences were observed among the ranges of age distributions either or in the days of evolution or in the hospitalization stay time ($P > .05$) (Table 3).

However, significant differences were observed in the proportions of the type of surgery in the Parkland grades. It was seen that the greater the grades, the more emergency surgeries performed ($P < .05$). The same is observed in the history of lithiasic obstructive jaundice, hyperbilirubinemia, and elevated levels of alkaline phosphatase, whose proportions grow as the

Table 1. Parkland Grading Scale

Grade	Description of severity
1	Normal appearance of gallbladder -without adherences present
2	Smaller adherences in the neck, other than that, normal gallbladder - Adherence limited to the neck or lower portion of the gallbladder
3	Presence of any of the following: -Hyperemia/ Pericholecystic fluid/Bodily adherences/Gallbladder distension
4	Presence of any of the following: -Adherences covering most of the gallbladder -Grade I-III with abnormal liver anatomy, intrahepatic vesicle or Mirizzi
5	Presence of any of the following: - Perforation/Necrosis/Inability to see the gallbladder due to adherences

Table 2. Intraoperative findings in video laparoscopic cholecystectomies using the Parkland Classification. (n=267)

Parkland's Classification	Frequency	Percentage
I	79	29.59
II	101	37.83
III	50	18.73
IV	28	10.49
V	9	3.37
Total	267	100

Parkland grade increases ($P < .05$) (Table 3).

Regarding the proportions of cavity drainage usage, conversion to open surgery, and the diagnosis of acute cholecystitis, we see that they go up in greater Parkland grades ($P < .05$) (Table 3).

Significant differences were observed in BMI ranges and surgical times with respect to Parkland grades, observing greater indexes and times with greater grades ($P < .05$) (Table 3).

DISCUSSION

Video laparoscopic cholecystectomy is one of the most common surgical procedures worldwide.[1] Although it seems to be a simple procedure especially for beginner surgeons, it is often a delicate, difficult procedure even for the most experienced ones. Anatomical variability and the inflammatory process are factors that play a key role, and are associated with the need for conversion and surgical results.[6]

Several scales with preoperative risk factors have been described and validated so far; however, only a few scales such as that of Randhawa et al.[9] have taken in consideration intraoperative factors; nevertheless, these scales are not very often used in the routine daily practice due to their complexity; in addition, they do not allow effective result comparisons.[10]

The scales that take into account intraoperative factors have the advantage that they make it possible to take the instantaneous decision of converting to open surgery or that the surgery can be performed by a more experienced surgeon to decrease the potential risk of intra- and postoperative complications.[11]

Considering our findings, we observe that most patients were categorized as Grade II within the Parkland Grading Scale, which is consistent with other studies,[12,13] and the least proportion of patients was categorized as Grades IV and V, findings similar to those published by other authors,[10] We believe, however, that when applying this scale surgeries should be subclassified as scheduled and emergency surgeries, since our study showed significant differences in the proportions of the type of surgery (scheduled or emergency) with Parkland grades, and it was observed that the greater the grade, the greater the proportion of emergency surgeries performed.

Also, we verified a significant increase in the time of surgery, conversion to open surgery, and use of cavity drainage associated with greater grading scores. Moreover, Madni et al.,[10] in their prospective validation, showed longer surgical times, difficult surgeries, and need for subtotal cholecystectomies. However, they also found an association with longer hospital stays, which is not consistent with our study. This difference can be due to the fact that in our series of the postoperative complications we had, surgical site infections were confirmed at the outpatient follow-up. There were no reinterventions due to hemorrhage, 1 case of bile duct injury (Strasberg D) associated with Grade V in the Parkland grading scale diagnosed in the intraoperative period and eventually resolved. Also, there was only one case that required reintervention due to biliary peritonitis. The remaining patients were discharged on their first postoperative day with or without oral antibiotics depending on the postoperative diagnosis.

In a recent published study, Baral et al.[13] used the Parkland grading scale in a rural community of a developing country and found a significant increase of conversion to open cholecystectomy and longer surgical times which is consisten with our study. However, they also found an association with postoperative biliary leak with greater grades on the Parkland grading scale. In our series we only had 1 case of diagnosed postoperative biliary leak that required reintervention (a case of Grade I on the Parkland grading scale).

Lee et al.[12] confirmed that the grades on the Parkland grading scale and the degree of severity of acute cholecystitis according to the Tokyo Classification[14] were correlated with statistically significance and they concluded that the Parkland grading scale is useful to determine the severity of acute cholecystitis, and that patients with grade IV or grade V on the Parkland grading scale have a high risk of moderate or severe acute cholecystitis. Although we did not use the Tokyo classification in our study, we did observe significant differences in the proportions of the type of surgery in the Parkland grades, and it was observed that the greater the grade the greater the proportion of emergency surgeries and diagnosis of acute cholecystitis.

Among the limitations of our study, we can mention the small size of the sample and the fact that it is a one-center study. In addition, we did not have a strict follow-up of the patients after they were discharged.

Although the Parkland grading scale is made up of reason-

Table 3. Variables studied stratified according to Parkland's classification. n=267

Variable		Parkland's Classification					P
		I	II	III	IV	V	
Sex	Women	74 (93.7%)	87 (86.1%)	41 (82%)	21 (75%)	7 (77.8%)	.095
	Men	5 (6.3%)	14 (13.9%)	9 (18%)	7 (25%)	2 (22.2%)	
Age	Mean	35.63	39.63	41.18	39.50	41.11	.153
	SD	10.71	14.90	14.14	12.03	15.99	
BMI	Mean	27.88	27.43	28.37	28.63	37.01	.001
	SD	4.91	5.22	4.29	9.81	17.70	
Days of evolution	Mean	33.45	47.82	28.41	50.12	56.00	.161
	SD	24.11	42.20	24.21	43.93	36.66	
Type of surgery	Programmed	63 (79.7%)	70 (70.7%)	27 (54%)	14 (50%)	6 (66.7%)	.007
	Emergency	16 (20.3%)	29 (29.3%)	23 (46%)	14 (50%)	3 (33.3%)	
History of APB	Yes	11 (14.1%)	16 (16.2%)	9 (18%)	7 (25.9%)	4 (44.4%)	.166
	No	67 (85.9%)	83 (83.8%)	41 (82%)	20 (74.1%)	5 (55.6%)	
History of lithiasic obstructive jaundice	Yes	7 (8.9%)	14 (14.1%)	6 (12.2%)	12 (44.4%)	3 (33.3%)	.000001
	No	72 (91.1%)	85 (85.9%)	43 (87.8%)	15 (55.6%)	6 (66.7%)	
Hyperbilirubinemia	Yes	6 (7.6%)	5 (5%)	4 (8%)	6 (21.4%)	2 (22.2%)	.044
	No	73 (92.4%)	96 (95%)	-92%	22 (78.6%)	7 (77.8%)	
Elevated transaminase levels	Yes	7 (9%)	10 (10%)	4 (8%)	6 (21.4%)	1 (11.1%)	.394
	No	71 (91%)	90 (90%)	46 (92%)	22 (78.6%)	8 (88.9%)	
Elevated alkaline phosphatase levels	Yes	12 (15.4%)	9 (9.2%)	7 (14.3%)	9 (33.3%)	2 (22.2%)	.038
	No	66 (84.6%)	89 (90.8%)	42 (85.7%)	18 (66.7%)	7 (77.8%)	
Use of cavity drainage	Yes	1 (1.3%)	3 (3%)	4 (8%)	5 (18.5%)	5 (62.5%)	.000001
	No	77 (98.7%)	98 (97%)	46 (92%)	22 (81.5%)	3 (37.5%)	
Conversion to open surgery	Yes	0 (0%)	4 (4%)	2 (4%)	4 (14.3%)	2 (22.2%)	.002
	No	78 (100%)	97 (96%)	48 (96%)	24 (85.7%)	7 (77.8%)	
Surgical time	Mean	75.31	77.14	102.48	117.89	158.57	.0000001
	SD	30.32	36.69	43.63	47.07	49.56	
Complications	Yes	3 (3.8%)	2 (2%)	2 (4%)	1 (3.6%)	1 (11.1%)	.669
	No	76 (96.2%)	99 (98%)	48 (96%)	27 (96.4%)	8 (88.9%)	
Postoperative diagnosis	Acute Cholecystitis	2 (2.5%)	31 (30.7%)	37 (74%)	17 (60.7%)	6 (66.7%)	.000001
	Others	77 (97.5%)	70 (69.3%)	13 (26%)	11 (39.3%)	3 (33.3%)	
Hospitalization stay (time)	Mean	1.95	2.44	2.17	2.46	3.38	.922

able elements, some intraoperative factors have not been considered like Calot's triangle fibrosis, which is the leading cause for conversion to open surgery in our series or the presence of fistulae. These are conditions that complicate surgery and could have an impact on intra- and postoperative complications. If these factors were included in the scale, we believe that a more precise classification of intraoperative severity would be possible.

More validation studies together with multicenter data could outline the potential of the Parkland grading scale and confirm its reliability and applicability worldwide.

CONCLUSION

A total of 86.2% out of 267 patients were women with an average general age of 38.87 years, and a BMI of 28.19. A total of 68.05% of the surgeries were scheduled. The most common comorbidities were high blood pressure (54.64%) and obesity (47.42%).

The surgery performed was total video laparoscopic cholecystectomy in 95.13% of the cases, with a conversion rate of 4.49%.

When applying the Parkland classification, the most frequent grade was grade II with 101 patients. Grades I and II represent more than 2/3 of the patients.

When stratifying according to the Parkland scale grades, there were significant differences in the following variables: BMI, type of surgery (emergency vs scheduled), history of jaundice, hyperbilirubinemia, elevated alkaline phosphatase levels, surgical time, use of cavity drainage, conversion to open surgery, and diagnosis of acute cholecystitis in the operative piece.

All the authors participated equally preparing this study, and they did not declare any conflicts of interests.

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