ORIGINAL ARTICLE

Factors associated with conversion to open technique in laparoscopic cholecystectomy

Factores asociados con la conversión a técnica abierta en la colecistectomía laparoscópica

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Abstract

Introduction. Laparoscopic cholecystectomy is the gold standard for the management of gallbladder pathology with surgical indication. During its execution, there is a group of patients who may require conversion to the open technique. This study evaluated perioperative factors associated with conversion at the OHL Central Clinic in Montería, Colombia.

Methods. Observational analytical case-control study nested in a retrospective cohort between 2018 and 2021, in a 1:3 case/control ratio, 95% confidence level and 90% power. The study population was characterized and the associations were evaluated according to the nature of the variables, then the OR were estimated by bivariate and multivariate analysis, with their 95% CI, considering a value of $p<0.05$ significant, controlling for confounding variables.

Results. The study included 332 patients, 83 cases and 249 controls, showing in the multivariate model that the variables most strongly associated with conversion were: the surgeon's experience ($p=0.001$), obesity ($p=0.036$), thickening of the gallbladder on ultrasonography ($p=0.011$), and a higher score in the Parkland classification ($p<0.001$).

Conclusions. Early identification and individual analysis of the perioperative risk factors for conversion in the planning of laparoscopic cholecystectomy could define which patients are exposed, and which could benefit from a minimally invasive approach, in search of making safe, cost-effective, and appropriate decisions.

Keywords: laparoscopic cholecystectomy; cholelithiasis; acute cholecystitis; risk factors; postoperative complications; conversion to open surgery.

Resumen

Introducción. La colecistectomía laparoscópica es el estándar de oro para el manejo de la patología de la vesícula biliar con indicación quirúrgica. Durante su ejecución existe un grupo de pacientes que podrían requerir conversión a técnica abierta. Este estudio evaluó factores perioperatorios asociados a la conversión en la Clínica Central OHL en Montería, Colombia.

Métodos. Estudio observacional analítico de casos y controles anidado a una cohorte retrospectiva entre 2018 y 2021, en una relación de 1:3 casos/controles, nivel de confianza 95 % y una potencia del 90 %. Se caracterizó la población de estudio y se evaluaron las asociaciones según la naturaleza de las variables, luego por análisis bivariado y multivariado se estimaron los OR, con sus $IC_{95\%}$, considerando significativo un valor de p<0,05, controlando variables de confusión.

Resultados. El estudio incluyó 332 pacientes, 83 casos y 249 controles, mostrando en el modelo multivariado que las variables más fuertemente asociadas con la conversión fueron: la experiencia del cirujano (p=0,001), la obesidad (p=0,036), engrosamiento de la pared de la vesícula biliar en la ecografía (p=0,011) y un mayor puntaje en la clasificación de Parkland (p<0,001).

Conclusión. La identificación temprana y análisis individual de los factores perioperatorios de riesgo a conversión en la planeación de la colecistectomía laparoscópica podría definir qué pacientes se encuentran expuestos y cuáles podrían beneficiarse de un abordaje mínimamente invasivo, en búsqueda de toma de decisiones adecuadas, seguras y costo-efectivas.

Palabras clave: colecistectomía laparoscópica; colelitiasis; colecistitis aguda; factores de riesgo; complicaciones postoperatorias; conversión a cirugía abierta.

Introduction

The first laparoscopic cholecystectomy was performed in 1985 in Germany by Dr. Erich Mühe, and since then it has become the gold standard for the management of surgical biliary pathology [1]. This procedure has been shown to be safe, with a morbidity of less than 3%, a mortality of 0.2%, and all the benefits of minimally invasive Surgery, such as better cosmetic results, less postoperative pain, possibility of outpatient management or early discharge, and an early return to work [2].

There is a group of patients who may require conversion to the open approach during surgery, considering this a decision of good judgment for the benefit and safety of the patient, based on the experience and good judgment of the surgeon [3]. The main indications for conversion include severe inflammatory processes, fibrotic and dense adhesions, both peritoneal and visceral, which hinder the adequate dissection of Calot's triangle, limiting Strasberg's critical view of safety, intraoperative findings of anatomical variants, and difficult-to-control intraoperative bleeding [4].

In patients with acute cholecystitis, preoperative risk factors associated with conversion to the open technique have been determined, such as male gender, older age, obesity, duration of symptoms, fever, anesthetic risk, leukocytosis, elevated PCR, hypoalbuminemia, elevated transaminase, presence of perivesicular fluid and impacted calculus [5]. The conversion percentage can vary between 1-74%, with an average of 20%, or be 4% in elective surgery and 8% in emergency surgery [6]. In Latin America, it varies from 10-20%, and in Colombia, for non-elective procedures, 15% has been reported [7,8].

The objective of this research was to determine the frequency of conversion from laparoscopic cholecystectomy to open technique in a referral center in the Colombian Caribbean and to identify the associated factors.

Methodos

A case-control study nested in a retrospective cohort of patients who underwent cholecystectomy was performed. Patients aged 18 years or older, who underwent laparoscopic cholecystectomy in a third-level complexity institution in Montería, Colombia, between January 2018 and June 2021, were included. Pregnant women, as well as patients with malignant pathology of gallbladder or peri-ampulla and/or subtotal cholecystectomy were excluded.

Using random stratified sampling, the control group was selected, defined as those patients in whom surgery was completed by laparoscopic approach. It was taken into account to maintain a case/control ratio of 1:3 and that the number of controls selected was proportional to the number of cases per year of surgery, performing a group matching, achieving a power of 90%, to detect at least an average of 20% exposure in controls and an OR of 2.5 for a 95% confidence level.

The sociodemographic variables were collected: age (which was dichotomized considering the increased prevalence of bile duct pathologies over 40 years of age), sex, socioeconomic status, place of residence, and health regimen. Clinical variables such as time to onset of symptoms in months, history of abdominal and pelvic surgery, jaundice, arterial hypertension, diabetes, obesity, temperature, presence of Murphy's sign on physical examination, classification according to Tokyo criteria [9], pre-surgical American Society of Anesthesiology (ASA) classification, serum variables such as leukocyte count, C-reactive protein (CRP), imaging variables of ultrasound findings suggestive of inflammation, thickening of the gallbladder wall, operative variables such as the Parkland scale and presence of calculi, hours of surgery, surgeon experience, type of surgery, duration of surgery, and other variables such as hospital stay.

Regarding the statistical analysis, the qualitative variables were expressed in absolute and relative frequencies, and the quantitative ones in median with their interquartile range (p25-p75) due to non-compliance with the assumption of normality evaluated by the Kolmogorov-Smirnov test. For the comparison of the qualitative variables between the group of cases and controls, the chi-square test and Fisher's exact test or the likelihood test were used, if necessary. Crude odds ratios (ORs) were estimated, with their respective 95% confidence intervals (95% CI). To compare the quantitative variables, the Mann-Whitney U test was used given that the assumption of normality of the data was not met.

For the multivariate analysis, logistic regression was performed, using a p-value < 0.25 as criteria for entering the variables (Hosmer and Lemeshow criterion) and those that, although in the bivariate analysis were not statistically significant, were entered into the model by its clinical importance. Two multivariate analysis models were carried out separately, the first taking into account the association of sociodemographic and clinical risk factors and the second including the Parkland scale. Adjusted ORs were estimated with their respective 95% CI; a p-value < 0.05 was considered statistically significant. To assess the discriminative capacity of the model, the Receiver Operating Characteristics (ROC) analysis was performed, estimating the area under the curve and its respective confidence intervals.

The PCR variables, leukocyte count, ultrasonographic findings and intraoperative bleeding were not included in the bivariate and multivariate analysis due to the loss of more than 20% of their data. All data were analyzed in the IBM Corp. Released 2020 statistical package (IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp).

Results

During the study period, 571 patients underwent cholecystectomy, of whom 564 met the eligibility criteria. The frequency of conversion to open surgery in this group was 14.7% (n=83). Of those, 249 controls were selected (Figure 1).

A higher frequency of male patients (42.2% vs 25.7%, p<0.01) and older than 40 years (79.5% vs 55.4%, p<0.0001) was observed in the cases compared to the controls. The other sociodemographic and clinical characteristics are presented on Table 1.

The median surgical time for the cases that required conversion was 70 minutes (IQR: 50-95), whereas it was 60 minutes for the controls in which the procedure was completed laparoscopically (IQR: 50-70, p <0.0001). The median hospital stay for the cases was four days (IQR: 2-11), in contrast to the length of stay for the controls (IQR: 0-1, p<0.0001).

Regarding the paraclinical and imaging findings, there was lack of data on these variables. Only 18 patients (14 cases and four controls) underwent the PCR test, of these a high frequency (92.9%) of cases with PCR values greater than 6 mg/l was observed (Table 2).

The clinical factors associated with conversion were obesity, arterial hypertension, diabetes, a history of abdominal-pelvic surgery, and positive Murphy' sign on physical examination, which was the most strongly associated factor, with an OR of 4.8 (95% CI: 2.8-8.3, p<0.0001). Regarding the operative factors, a statistically significant association was also observed with the Parkland scale, the type of emergency procedure, the presence of gallstones and the thickening of the gallbladder wall (p<0.0001 in all cases) (Table 3).

When the multivariate analysis was performed taking into account only the sociodemographic and clinical variables, a good fit of the model was obtained, with a coefficient of determination of 35.1% and good discrimination between cases and controls (area under the ROC curve of 0 .82; 95% CI: 0.78-0.87) (Figure 2). Factors such as sex, age over 40 years, obesity, history of previous surgery, positive Murphy' sign, type of procedure, and
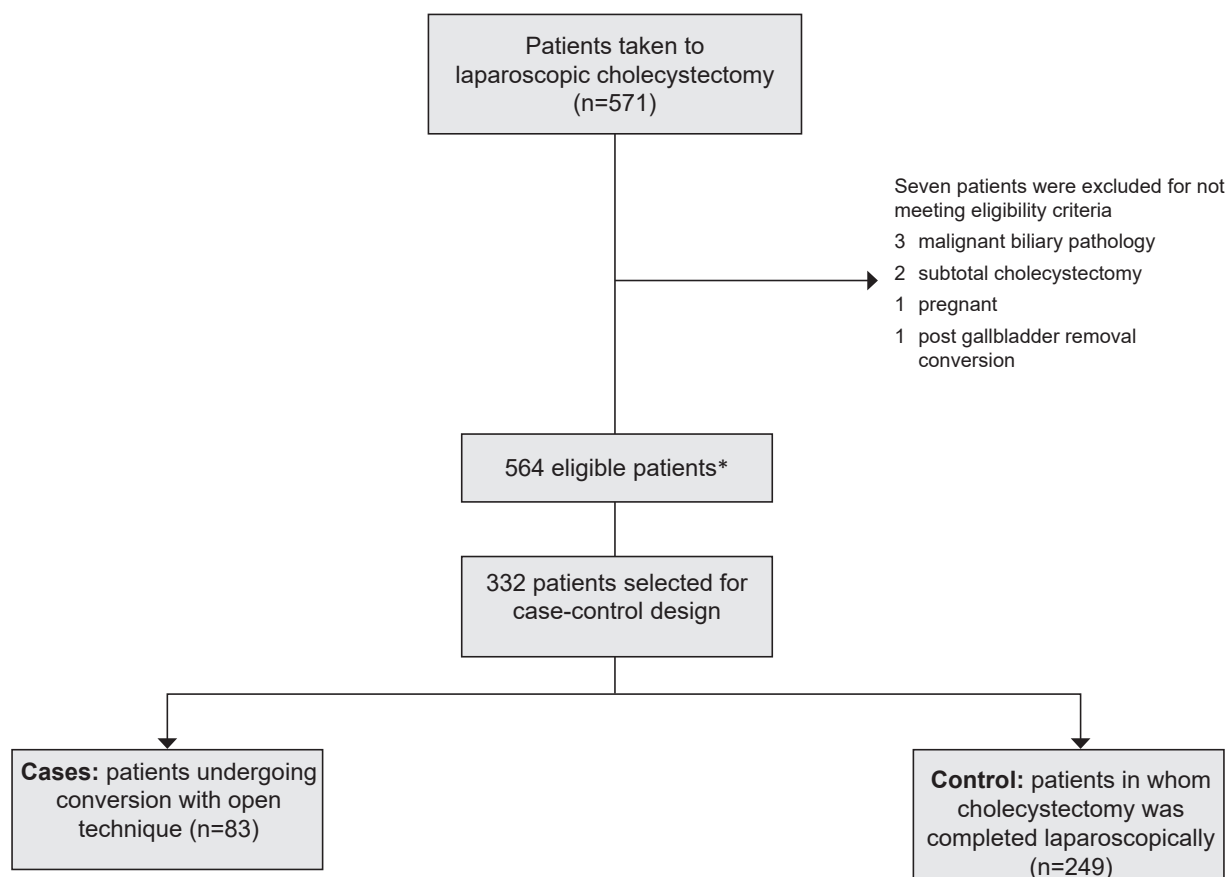

Figure 1. Participant selection process.
* Of the 564 patients, all cases (n=83) and controls (n=249) were selected in a 1:3 ratio. Source: The authors.

Table 1. Sociodemographic, clinical and intraoperative characteristics of patients undergoing laparoscopic cholecystectomy.

Characteristics	Cases n=83 (%)	Control n=249 (%)	p-value †
Male	35 (42.2)	64 (25.7)	0.005
Age (years)*	55 (43-70)	44 (31-58)	<0.0001 ‡
Over age 40	66 (79.5)	138 (55.4)	<0.0001
Socioeconomic status			
High	61 (73.5)	191 (77.0)	
Medium	20 (24.1)	38 (15.3)	0.063
Low	2 (2.4)	19 (7.7)	
Schooling level			
None	0 (0)	1 (0.4)	
Primary	14 (16.9)	8 (3.3)	
Secondary	38 (45.8)	170 (71.1)	<0.0001¶
Higher	31 (37.3)	60 (25.1)	
Place of residence			
Urban	63 (75.9)	220 (88.4)	
Rural	20 (24.1)	29 (11.6)	0.006
Health regimen			
Contributory	58 (69.9)	192 (77.1)	
Subsidized	25 (30.1)	57 (22.9)	0.118
ASA Classification			
I	38 (45.8)	184 (73.9)	
II	42 (50.6)	60 (24.1)	<0.0001¶
Greater than III	3 (3.6)	5 (2.0)	
Tokyo Classification			
Mild	72 (86.7)	202 (81.5)	
Moderate	11 (13.3)	46 (18.5)	0.269
Temperature Above than 38 ºC	6 (7.2)	1 (0.4)	<0.0001**
Onset of symptoms Greater than 6 months	8 (10.1)	9 (3.6)	0.038**
Jaundice	11 (13.3)	6 (2.4)	<0.0001**

* Median (p25-p75), † Chi square test, ‡ Mann-Whitney test, ¶ Likelihood ratio ASA: American Society of Anesthesiology, ** Fisher exact test. Source: The authors.

Table 2. Paraclinical and imaging findings of patients who underwent cholecystectomy.

Characteristics	Cases n/N (%)	Control n/N (%)
White blood cell Greater than 10000/mm^3	37/65 (56.9)	22/108 (20.4)
C-reactive protein Greater than 6 mg/l	13/14 (92.9)	1/4 (25)
Ultrasound findings		
Inflammatory	70/82 (85.4)	40/50 (80)
Normal	12/82 (14.6)	10/50 (20)

Source: The authors.

Table 3. Clinical and intraoperative factors and their relationship with the conversion to open surgery.

Characteristics	Cases (n=83)	Control (n=249)	OR (95% CI)	p-value
	n (%)	n (%)		
Obesity	38 (45.8)	51 (20.5)	3.3 (1.9-5.6)	<0.0001
Arterial hypertension	32 (38.6)	43 (17.3)	3.0 (1.7-5.2)	<0.0001
Diabetes	11 (13.3)	10 (4.0)	3.7 (1.4-8.945)	0.005
Previous abdominopelvic surgery	64 (77.1)	140 (56.2)	2.6 (1.5-4.6)	<0.001
Murphy's sign	39 (47)	39 (15.7)	4.8 (2.8-8.3)	<0.0001
Parkland scale				
1	2 (2.4)	138 (55.4)	Ref*.	
2	11 (13.3)	88 (35.3)	8.6 (1.9-39.8)	<0.0001
3	31 (37.3)	8 (3.2)	267.4 (54.1-1321.3)	<0.0001
4	28 (33.7)	11 (4.4)	175.6 (36.9-836.2)	<0.0001
5	11 (13.3)	4 (1.6)	189.8 (31.2-1153.7)	<0.0001
Surgeon experience				
Greater than 20 years	73 (88.0)	213 (85.5)	1.2 (0.6-2.6)	0.582
Type of surgery				
Urgent	52 (62.7)	69 (27.7)	5.0 (2.5-10.0)	<0.0001
Thickening of the gallbladder wall	77 (92.8)	179 (71.9)	5.0 (2.1-12.0)	<0.0001
Presence of gallstones	83 (100)	191 (76.7)	51.0 (3.1-835.1)	<0.0001

* Ref: Reference variable. Source: The authors.

gallbladder thickening remained significant in the presence of the other variables (Table 4).

When the intraoperative variables were included in the multivariate analysis, the fit of the model was improved, with a determination of 69.1% and excellent discrimination between groups (area under the ROC curve of 0.94; 95% CI: 0.91- 0.98) (Figure 3). The factors that remained associated with conversion regardless of the presence of other variables were the surgeon's experience, thickening of the gallbladder wall, obesity, and the Parkland scale, the latter being the factor most strongly associated with conversion (Table 5).

Discussion

Laparoscopic cholecystectomy is the gold standard for the management of gallbladder pathology and the most practiced laparoscopic intervention in the world [10]. In Colombia, approximately 60,000 laparoscopic cholecystectomies are performed per year, making it the most frequent minimally invasive procedure by laparoscopic approach. The optional need to convert the approach to the open technique, understood as an assertive criterion for the benefit and safety of the patient, shows a valid alternative for the surgical removal of the diseased gallbladder [8]. In our cohort, a conversion frequency of 14.7% was reported, similar to that published in the literature [11].

The Parkland scale was developed to stratify the intraoperative severity of gallbladder disease and discriminate the difficulty of laparoscopic cholecystectomy, through a five-level rating system. It is easy to implement, is reliable and, highly reproducible, and relies on adequate visibility of hepatobiliary anatomy and inflammatory changes [12].
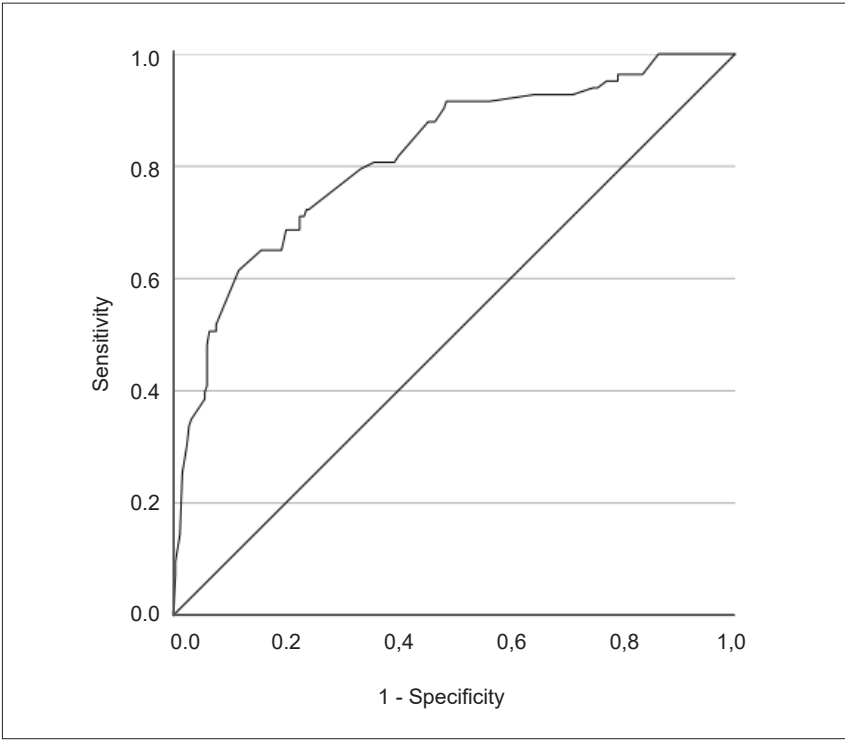
Figure 2. Area under the ROC curve. The graph shows adequate discrimination, with an area under the curve of 0.818 (95% CI: 0.897-0.967). Source: The authors.

Table 4. Multivariate analysis of sociodemographic and clinical factors.

Factors	AORa*	OR (95% CI)	p-value
Over age 40	2.8	(1.5-5.4)	0.002
Male	2.5	(1.3-4.9)	0.008
Obesity	2.3	(1.2-4.2)	0.009
Previous abdominopelvic surgery	3.1	(1.5-6.3)	0.002
Murphy's sign	2.2	(1.1-4.6)	0.037
Type of procedure urgency	2.5	(1.3–5.0)	0.009
Thickening of the gallbladder wall	3.1	(1.2-7.7)	0.022

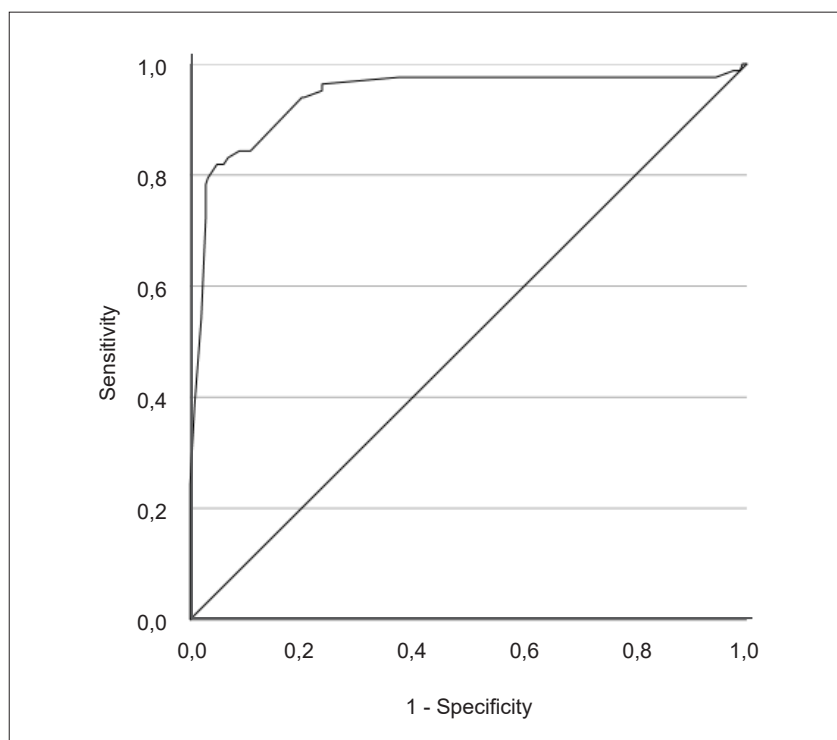* AORa: ajusted OR - Binary logistic regression. Source: The authors.

Figure 3. Area under the ROC curve. The graph shows adequate discrimination, with an area under the curve of 0.941 (95% CI: 0.905–0.976). Source: The authors.

Table 5. Final multivariate model*

Factor studied	AORa**	OR (95% CI)	p-value
Parkland scale			
1	19.2	(3.9-94.09)	<0.001
2	367.2	(68.8-1960.7)	<0.001
3	287.0	(54,2-1520,2)	<0.001
4	1343.3	(134.2-13448.2)	<0.001
Surgeon experience Greater than 20 years	12.4	(2.8-55.0)	<0.0001
Thickening of the gallbladder wall	4.5	(1.4-14.1)	0.008
Obesity	2.5	(1.1-6.0)	0.035

* Clinical, imaging and intraoperative variables, ** AORa: ajustedd OR - Binary logistic regression. Source: The authors.

In this study, it was possible to demonstrate through multivariate analysis a significant association of the Parkland scale variable and the conversion to the open technique, similar to the findings of another study where it was shown that the increase in grade of the Parkland scale is associated with increased difficulty of surgery, conversion rates, duration of operation, and incidence of postoperative bile duct leak [13].

The so-called "difficult cholecystectomy" continues to be one of the most frequent indications for conversion to open surgery, to prevent complications or to continue surgery with greater safety and peace of mind. This is characterized by the

lack of critical vision of the anatomical structures due to the severe inflammatory process, fibrosis with scarring of the hepatobiliary bed, dense, firm, diffuse and extensive adhesions, uncontrollable bleeding, perforations, necrosis or fistulas, which leads to higher rates of conversion [14,15].

The surgeon's work experience was evaluated as a possible factor associated with the reduction in the conversion rate, finding in this study a higher probability of conversion with surgical specialists with over 20 years of experience, which may be related to the fact that that formal training programs for minimally invasive procedures in Colombia were only formally introduced in 2005, so many surgeons did not have this type of training during their training period [6].

Similar results were found in other studies, where the greatest surgical experience in years since obtaining the title of specialist in surgery and the high volume of procedures were associated with a higher risk of conversion [16,17]. It is expected that once the learning curve and formal training that provide adequate preparation in the laparoscopic approach have been overcome, the conversion rate will decrease and remain stable [18].

Acute cholecystitis is an inflammatory process characterized by wall thickening of more than 4 mm identified in diagnostic imaging studies, which is related to a high rate of morbidity and complications if not promptly managed [19]. Among our cases, one of the causes related to conversion was inflammatory thickening of the gallbladder wall, similar to what was found in other studies [20,21].

As demonstrated in the multivariate analysis of the cohort studied in this research, obese patients are more prone to conversion, a finding similar to a study conducted in 2006 [22], where participants with a higher body mass index (BMI) had a higher risk of developing severe inflammatory or complex fibrotic processes of the hepatobiliary bed, which associated with the technical difficulties typical of obese patients, made dissection even more difficult. Thus, some strategies have been proposed to reduce the risk of conversion [23], when added to the increase in experience in training, laparoscopic surgical training, continuous improvement of tech-nologies and advent of new approach instruments, have decreased the risk factor for conversion related to obesity [24].

Within the limitations, the underreporting of some laboratory variables is recognized and in some cases the lack of adequate ultrasound reports. Due to missing data greater than 20%, it was necessary to dismiss variables of interest in relation to the conversion to the open technique.

Conclusion

Factors associated with a higher risk of conversion included the surgeon having over 20 years of work experience, obesity, the ultrasound finding of thickening of the gallbladder wall, and a high Parkland scale. In planning laparoscopic cholecystectomy, risk factors for conversion must be identified early.

Compliance with ethical standards

Author's contributions

- Conception and design of the study: César Rafael Ensuncho-Hoyos, Carolina Isabel Negrete-Spath, Libia María Rodríguez-Padilla.

- Acquisition of data: César Rafael Ensuncho-Hoyos, Carolina Isabel Negrete-Spath, Libia María Rodríguez-Padilla.

- Data analysis and interpretation: César Rafael Ensuncho-Hoyos, Carolina Isabel Negrete-Spath, Libia María Rodríguez-Padilla.

- Drafting the manuscript: César Rafael Ensuncho-Hoyos, Carolina Isabel Negrete-Spath, Libia María Rodríguez-Padilla.

- Critical review: César Rafael Ensuncho-Hoyos, Carolina Isabel Negrete-Spath, Libia María Rodríguez-Padilla.

References

1. Martínez-Salas AJ, Cázares-García V, Martínez-Oñate AJ. Colecistectomía laparoscópica por puerto único. Estudio prospectivo no aleatorizado de 106 casos. Cir Gen. 2021;43:86-96. https://doi.org/10.35366/106719

2. Balciscueta I, Barbera F, Lorenzo J, Martínez S, Sebastián M, Balciscueta Z. Ambulatory laparoscopic cholecystectomy: Systematic review and meta-analysis of predictors of failure. Surgery. 2021;170:373-82. https://doi.org/10.1016/j.surg.2020.12.029

3. Chama-Naranjo A, Farell J, Cuevas VJ. Colecistectomía Segura: ¿qué es y cómo hacerla? ¿cómo Lo hacemos nosotros? Rev Colomb Cir. 2021;36:324-33. https://doi.org/10.30944/20117582.733

4. Buhavac M, Elsaadi A, Dissanaike S. The Bad Gallbladder. Surg Clin N Am. 2021;101:1053-65. https://doi.org/10.1016/j.suc.2021.06.004

5. Sanford DE. An update on technical aspects of cholecystectomy. Surg Clin N Am. 2019;99:245-58. https://doi.org/10.1016/j.suc.2018.11.005

6. Chinchilla PA, Baquero DR, Ruiz JE. Factores preoperatorios de riesgo asociados a conversión a técnica abierta en colecistectomía laparoscópica de urgencia. Rev Colomb Cir. 2018;33:145-53. https://doi.org/10.30944/20117582.56

7. Álvarez LF, Rivera D, Esmeral ME, García MC, Toro DF, Roja OL. Colecistectomía laparoscópica difícil, estrategias de manejo. Rev Colomb Cir. 2013;28:186-95.

8. Vargas L, Agudelo M, Lizcano R, Martínez M, Velandia L, Sánchez S, et al. Factores asociados con la conversión de la colecistectomía laparoscópica a colecistectomía abierta. Rev Colomb Gastroenterol. 2017;32:20-3. https://doi.org/10.22516/25007440.125

9. Yokoe M, Hata J, Takada T, Strasberg S, Asbun H, Wakabayashi G, et al. Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholecystitis. J Hepatobiliary Pancreat Sci. 2018;25:41-54. https://doi.org/10.1002/jhbp.515

10. Gallaher JR, Charles A. Acute cholecystitis. A review. JAMA 2022;327:965-75. https://doi.org/10.1001/jama.2022.2350

11. Nassar AH, El Zanati H, Ng HJ, Khan KS, Wood C. Open conversion in laparoscopic cholecystectomy and bile duct exploration: subspecialisation safely reduces the conversion rates. Surg Endosc. 2022;36:550-8. https://doi.org/10.1007/s00464-021-08316-1

12. Lee W, Jang JY, Cho JK, Hong SC, Jeong CY. Does surgical difficulty relate to severity of acute cholecystitis? Validation of the parkland grading scale based on intraoperative findings. Am J Surg. 2020;219:637-41. https://doi.org/10.1016/j.amjsurg.2018.12.005

13. Abdul GS, Avinash K, Manjunath BD, Harindranath HR, Archana CS, Mohammed A., et al. Pre-operative evaluation with parkland grading system in assessing difficult laparoscopic cholecystectomy and expectant operative and post-operative complications. Intern J Sur Scien. 2019;3:20–5. https://doi.org/10.33545/surgery.2019.v3.i3a.141

14. Gupta V, Jain G. Safe laparoscopic cholecystectomy: Adoption of universal culture of safety in cholecystectomy. World J Gastrointest Surg. 2019;11:62-84. https://doi.org/10.4240/wjgs.v11.i2.62

15. Sierra S, Zapata F, Méndez M, Portillo S, Restrepo C. Colecistectomía subtotal: una alternativa en el manejo de la colecistectomía difícil. Rev Colomb Cir. 2020;35:593-600. https://doi.org/10.30944/20117582.565

16. Abraham S, Németh T, Benkő R, Matuz M, Váczi D, Tóth I, et al. Evaluation of the conversion rate as it relates to preoperative risk factors and surgeon experience: a retrospective study of 4013 patients undergoing elective laparoscopic cholecystectomy. BMC Surg. 2021;21:e151. https://doi.org/10.1186/s12893-021-01152-z

17. Zhang WJ, Li JM, Wu GZ, Luo KL, Dong ZT. Risk factors affecting conversion in patients undergoing laparoscopic cholecystectomy. ANZ J Surg. 2008;78:973-6. https://doi.org/10.1111/j.1445-2197.2008.04714.x

18. Falcioni M, Maurette R, Bogetti D, Pirchi D. Conversions in laparoscopic cholecystectomy: experience in a hospital with residence after two decades of learning curve. Acta Gastroenterol Latin. 2018;48:175-80

19. Alemi F, Seiser N, Ayloo S. Gallstone Disease: Cholecystitis, Mirizzi syndrome, Bouveret syndrome, gallstone ileus. Surg Clin North Am. 2019;99:231-44. https://doi.org/10.1016/j.suc.2018.12.006

20. Morales-Maza J, Rodríguez-Quintero JH, Santes O, Aguilar-Frasco JL, Romero-Vélez G, García-Ramos ES, et al. Conversión de colecistectomía laparoscópica a abierta: análisis de factores de riesgo con base en parámetros clínicos, de laboratorio y de ultrasonido. Rev Gastroenterol Méx. 2021;86:363–9. https://doi.org/10.1016/j.rgmx.2020.07.011

21. Panni RZ, Strasberg SM. Preoperative predictors of conversion as indicators of local inflammation in acute cholecystitis: strategies for future studies to develop quantitative predictors. J Hepatobiliary Pancreat Sci. 2018;25:101-8. https://doi.org/10.1002/jhbp.493

22. Giger UF, Michel JM, Opitz I, Th Inderbitzin D, Kocher T, Krähenbühl L; Swiss Association of Laparoscopic and Thoracoscopic Surgery (SALTS) Study Group. Risk

factors for perioperative complications in patients undergoing laparoscopic cholecystectomy: analysis of 22,953 consecutive cases from the Swiss Association of Laparoscopic and Thoracoscopic Surgery database. J Am Coll Surg. 2006;203:723-8.
https://doi.org/10.1016/j.jamcollsurg.2006.07.018

23 Russell TB, Aroori S. How we do it: Laparoscopic chole-cystectomy in patients with severe obesity. Turk J Surg. 2021;37:413-6.
https://doi.org/10.47717/turkjsurg.2021.5452

24 Bernal-Delgado YM, Cargua-Zarria VJ, Villamarin-An-dino JA, Palacios-Castro NF. Factores influyentes en la conversión de colecistectomía vídeo laparoscó-pica a cirugía general. RECIMUNDO. 2021;5:378-86. https://doi.org/10.26820/recimundo/5.(3).sep.2021.378-386