

Risk factors associated with conversion from laparoscopic to open cholecystectomy in a Major Outpatient Surgery Unit over a five-year period

Factores de riesgo relacionados con la conversión de colecistectomía laparoscópica a colecistectomía abierta en una Unidad de Cirugía Mayor Ambulatoria en un periodo de cinco años

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Palabras clave:

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ABSTRACT

Laparoscopic cholecystectomy has become the gold standard for the management of calculous cholecystitis, so knowing the risk factors for conversion to open surgery could prepare us for the surgical intervention strategy in a major ambulatory surgery unit. **Objective:** To determine the main risk factors for conversion from laparoscopic to open cholecystectomy. **Material and methods:** Retrospective observational study in 675 patients who underwent surgery; the causes of conversion and characteristics of the patients who required conversion were evaluated; descriptive statistics and statistical analysis using χ^2 and Fisher's test were used. In addition, a logistic regression model for the probability of conversion to open surgery was performed. **Results:** Risk factors for conversion corresponded to men in 20.8%, $p < 0.05$; thickened gallbladder wall in 18.3%, $p < 0.01$; bilirubin level in 52.2%, $p < 0.001$; dilated common bile duct in 37.0%, $p < 0.01$. The first logistic regression model showed men with 1.9 with $p < 0.05$, and in the second model gallbladder wall thickness showed 3.228 and common bile duct size 3.199, both with $p < 0.001$. **Conclusions:** Statistically significant findings for surgical conversion were seen for male gender, thickened gallbladder wall, choledochal dilatation and elevated bilirubin levels. Age, duration of the clinical picture, history of abdominal surgery, obesity, and leukocytosis did not show statistical significance. The conversion rate was 2.6% in the five-year period, like that reported in other studies.

RESUMEN

La colecistectomía laparoscópica se ha convertido en el estándar de oro para el manejo de la colecistitis litiasica, por lo que conocer los factores de riesgo para la conversión a cirugía abierta podría prepararnos para la estrategia de intervención quirúrgica en una unidad de cirugía mayor ambulatoria. **Objetivo:** Determinar los principales factores de riesgo para conversión de colecistectomía laparoscópica a colecistectomía abierta. **Material y métodos:** Estudio retrospectivo observacional en 675 pacientes intervenidos, se evaluaron causas de conversión y características de los pacientes que requirieron la conversión; se describió con estadísticas descriptivas y análisis estadístico tipo prueba de χ^2 y Fisher, además, se realizó un modelo de regresión logística para la probabilidad de conversión a cirugía abierta. **Resultados:** Los factores de riesgo para conversión correspondieron a hombres en 20.8%, $p < 0.05$; pared vesicular engrosada 18.3%, $p < 0.01$; bilirrubinas 52.2%, $p < 0.001$; colédoco con dilatación 37.0%, $p < 0.01$; primer modelo de regresión logística con hombres 1.9 con $p < 0.05$ y en el segundo modelo grosor de pared vesicular 3.228 y tamaño de colédoco 3.199 con $p < 0.001$. **Conclusiones:** Significativo para conversión en el género masculino, pared vesicular engrosada, dilatación de colédoco y bilirrubinas elevadas. La edad, duración del cuadro clínico, antecedentes de cirugía abdominal, obesidad y leucocitosis no mostraron relevancia significativa estadística. La tasa de conversión fue de 2.6% en el periodo de cinco años, similar a la reportada en otros estudios.

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INTRODUCTION

Cholecystectomy is one of the most commonly performed surgical procedures worldwide, and the laparoscopic approach has become the gold standard for the management of calculous cholecystitis.¹ Laparoscopic cholecystectomy has advantages for the patient, so identifying preoperative factors can predict the difficulty of the procedure and will allow discussion of the likelihood of conversion or evaluation of the management strategy in high-risk patients during outpatient management.²

The factors noted by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) to perform a cholecystectomy procedure include: acute cholecystitis, gallbladder wall thickening, advanced age, male gender, obesity, hemorrhage, bile duct injury, and choledocholithiasis.^{3,4} Other studies have included also previous abdominal surgeries, elevated total leukocyte count, Hartmann's pouch stone impaction, pericholecystic collection, stone size and number, anatomy abnormalities, liver fibrosis, and liver function test abnormalities.^{5,6} The decision to convert to an open procedure is based on an intraoperative analysis, noting the clarity of the anatomy, surgeon skills and the comfort to continue with the procedure; all of these with a level II grade A evidence according to SAGES Guidelines 2010.^{2,4}

From 2 to 15% of patients who undergo laparoscopic cholecystectomy require conversion to open surgery, thus changing the course of the patient's evolution. Within the risk factors for conversion, male gender is considered a main factor. One explanation why male gender is a risk factor is that men usually take longer to seek medical attention presenting therefore with greater alteration of their condition when undergoing surgery.^{2,5,7,8}

In 2005 at the ABC Medical Center in Mexico City, 1,843 patients undergoing laparoscopic cholecystectomy were studied. They had a conversion rate of 2.7% of which 12 cases were due to intraoperative bleeding (> 600 cm³), and in the remaining 39 cases the main cause of conversion was the presence of surgical adhesions and the impossibility to identify the anatomical

structures. The second cause was technical difficulty (inability to explore the biliary tract laparoscopically). The only significant variable was advanced age.⁹ In 2016, in a review article, an analysis was made on the factors that influence the intervention of ambulatory laparoscopic cholecystectomy; the authors analyzed 25 years since its implementation. The preoperative predictive factors they found were: age older than 65 years predicted a higher probability of failure; increases surgical time due to intraoperative complications; acute cholecystitis presenting with thickened wall on ultrasound which increased three times the number of postsurgical hospitalizations; and a history of biliary pathology complicated by choledocholithiasis, which required another type of intervention such as an endoscopic retrograde cholangiopancreatography.¹⁰ In 2016, Roman Kidwai published that patients older than 50 years had a 50% conversion rate compared to those younger than 50 years.¹¹

Conversion from laparoscopic to open surgery does not necessarily means a failure of the surgeon, but a success when facing technical difficulties in the visualization of anatomical structures or the need to control bleeding.¹²

Therefore, the general objective was to determine the main risk factors in our unit for conversion from laparoscopic to open cholecystectomy performed over a five-year period. In addition, by knowing the preoperative risk factors for conversion in those requiring cholecystectomy may help us to better identify those high-risk patients and propose management strategies to be offered.

MATERIAL AND METHODS

This is a retrospective, observational and descriptive study conducted in a major ambulatory surgery unit (UNEME) over a five-year period, from January 2013 to December 2017. All patients were electively scheduled for ambulatory laparoscopic cholecystectomy. Those with complete medical records, complete laboratory tests, ultrasound scans, and post-surgical note were included. After exclusion of records, the

analysis was performed in 675 patients out of a total of 3,317 operated for laparoscopic cholecystectomy.

The variables evaluated were age, gender, body mass index (BMI), comorbidities, history of abdominal surgery, time of evolution, ultrasonographic parameters, preoperative laboratory results, causes of conversion, diagnosis of conversion, and year of surgery.

For analysis, descriptive statistics were performed for frequencies and averages. χ^2 and Fisher's exact tests were used for cross-tabulations of risk factors associated with conversion to open surgery. Logistic regression models were estimated for the probability of conversion to open surgery. The SPSS Statistics software program 24 was used to perform the statistical analysis.

RESULTS

Of the 675 patients 85.8% were women and 14.2% men; 83.4% were younger than 55 years and 16.6% older than 55 years; 9.8% had diabetes, 53.5% a history of abdominal surgery, 43.4% obesity and 55.8% a clinical picture of at least six months. Among the ultrasound parameters, 66.3% had normal gallbladder wall thickness and 33.7% had a thickened wall (> 3 mm was considered as thickening of the gallbladder wall); 94% had a dilated common bile duct (> 6 mm were used as the measure to consider a dilated common bile duct by ultrasound); 98.1% had the presence of gallstones on ultrasound. Among laboratory parameters, 96% had normal bilirubin levels and 4.0% had elevated bilirubin levels; white

blood cell counts were normal in 89.2% and elevated in 10.8%.

The conversion rate per year remained constant over the study period and corresponded to 2.6% from January 2013 through December 2017. There was a small increase in the conversion rate in 2014 to 3.7%. This 2.6% conversion rate falls within the global parameters of conversion to open surgery.^{1,2}

The variables studied with respect to the converted patients were analyzed by means of cross tables. The results are shown in *Figure 1*.

Surgery conversion was required in 20.8% of men and 11.7% of women ($p < 0.05$). Of these, 8.0% had normal vesicular wall on ultrasound and 18.3% had thickened wall with a $p < 0.001$). Regarding bilirubin levels 10.7% had normal levels and in 52.2% these levels were elevated with a $p < 0.001$)⁹; 37% had common bile duct dilatation while 3% did not show it ($p < 0.01$). Of the total of patients 11.6% had a history of abdominal surgery, 17% were older than 55 years, 13.6% had a history of diabetes, 16.7% show increased white blood cell counts, 14% had a clinical picture lasting between one and two years, and 14.9% had obesity (*Tables 1 through 3*).

Two logistic regression models to assess the probability of conversion to open surgery were performed. In the first model, demographic variables were used, and male gender showed a 1.9 higher probability ($p < 0.05$) of converting from laparoscopic to open cholecystectomy. The second model added ultrasound variables of wall thickness which gave a 3.228 higher conversion rate probability and a common bile duct dilatation that showed a 3.199 higher conversion rate probability (both $p < 0.001$) (*Table 4*).

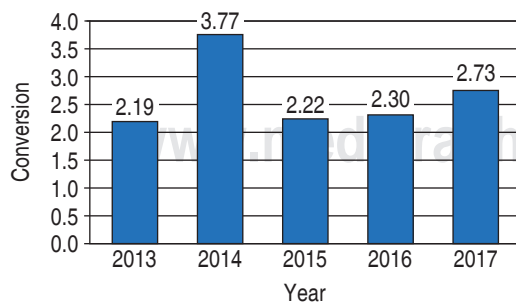


Figure 1: Conversion rate per year. Own elaboration according to data consulted.

DISCUSSION

The risk factors for conversion from laparoscopic to open cholecystectomy have been shown to be the same as those seen for a difficult cholecystectomy. Therefore, it is very important to have complete patient data, medical history, and laboratory studies including an ultrasound scan of gallbladder and bile ducts

One of the limitations of our study was that ultrasound scans did not have a standardized

way of measurement. Whether they are performed in public or private facilities all of them provided information with non-constant parameters (all the ultrasounds used in our

Table 1: Patient distribution according to conversion of surgery by gallbladder wall thickness. UNEME, Tijuana 2013-2017.

		Vesicular wall thickness* (%)		
		Normal	Thickened	Total (%)
Converted	No	92.00	81.70	88.50
	Yes	8.00	18.30	11.50
Total		100.00	100.00	100.00

* $p < 0.001$, the thickness of the gallbladder wall being significant for conversion. Own elaboration according to data consulted.

Table 2: Distribution of patients according to conversion of surgery for diabetes. UNEME, Tijuana 2013-2017.

		Diabetes (%)		
		No	Yes	Total (%)
Converted	No	87.00	86.40	87.00
	Sí	13.00	13.60	13.00
Total		100.00	100.00	100.00

Own elaboration according to data consulted.

Table 3: Distribution of patients according to surgery conversion by common bile duct diameter. UNEME, Tijuana 2013-2017.

		Common bile duct* (%)		
		Non-dilated	Dilated	Total (%)
Converted	No	90.70	63.00	89.10
	Yes	9.30	37.00	10.90
Total		100.00	100.00	100.00

* $p < 0.001$, being the common bile duct dilatation significant for conversion. Own elaboration according to data consulted.

study were not performed in the unit). So, it is very important to know well the data of the gallbladder wall. Preoperative ultrasound has been used as a method to indicate technical difficulties and predict potential conversion.^{13,14}

In our study, significant gallbladder wall thickness above 3 mm was used as a cut-off value, since it is a radiological sign of acute cholecystitis with inflammatory changes.^{4,15} The range of the common bile duct diameter is from 4-8 mm,^{10,13} and the size of a dilated common bile duct above 6 mm has been reported as a cause for a difficult cholecystectomy.¹⁶ On the other hand, no significance was seen in the number of stones and the risk of conversion.^{1,2} With the above mentioned, it is observed that these are data of an acute picture that include tissue inflammation and induration, which difficult the dissection of Calot's triangle due to the inflammatory process^{7,8} and the other part is the predictive factors of choledocholithiasis adding another issue to the initial picture.¹⁷

Our conversion results are very much alike those found in other series worldwide. The conversion parameters used for our analysis were: male gender (since there has been a higher incidence of conversion to open surgery than in women); gallbladder wall thickness > 3 mm; common bile duct dilatation > 6 mm; and the presence or absence of gallstones by ultrasound. And other factors were increased bilirubin levels > 1.5 mg/dl; leukocytosis > 11,000 mm/dl; history of abdominal surgery; age over 55 years; diabetes; increased body mass index; and clinical symptoms lasting over six months.¹⁸⁻²⁰

Regarding the reasons for conversion, the most prevalent were the following: surgical adhesions, bile duct dilatation and difficulty in obtaining a satisfactory Strasberg's critical view. The results obtained were alike to those of other studies in which difficulty in dissecting Calot's triangle and intraoperative hemorrhage were main reasons since it obscures the operative field impeding the identification of the anatomical safety points.^{1,5,21} The explanation for the incidence of these factors could be that a prolonged course of symptoms leads to a more severe and progressive inflammatory process, which impedes successful completion of laparoscopic surgery.²²

Table 4: Logistic regression models for the probability of conversion to open surgery (odds ratio). UNEME, Tijuana 2013-2017.

Variable		Demography	Ultrasound
		Model 1	Model 2
Gender	Male (Ref. female)	1.9*	1.13
Age	> 55 (Ref. < 55)	1.355	
Wall thickness	> 3 mm (Ref. < 3 mm)		3.228‡
Common bile duct diameter	> 6 mm (Ref. < 6 mm)		3.199‡
Constant		0.241	0.021‡

Model 1: demographic variables, gender had a significant $p < 0.05^*$ in relation to conversion.

Model 2: ultrasonographic variables, had a significant $p < 0.001^\ddagger$ in relation to conversion.

Own elaboration according to data consulted.

We observed that these factors increase the risk of conversion since they lead to other difficulties and issues during the operative act. Therefore, with the continuous evaluation of the efficacy of these diagnostic instruments to identify risk factors, as well as assessing the increased difficulty these factors impose to the surgery, they will help us to continue studying the management options available and in necessary cases to plan the patient's management strategy.

CONCLUSIONS

The results of our study will support the assessment of patients before undergoing laparoscopic cholecystectomy by considering which patients are at risk of being converted from a laparoscopic procedure to an open one thus leading to longer hospitalization time and the use of more health resources for the patient and the hospital units.

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Data privacy. In accordance with the protocols

established at the authors' work center, the authors declare that they have followed the protocols on patient data privacy while preserving their anonymity.

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