

Comparative analysis of biliary tract injuries: prevalence after laparoscopic or open cholecystectomy at the Hospital General 450 in Durango, Mexico

Análisis comparativo de las lesiones de vía biliar: prevalencia en pacientes con colecistectomía laparoscópica y colecistectomía abierta en el Hospital General 450 en Durango, México

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ABSTRACT

Aim: To determine the prevalence of biliary tract injury after laparoscopic or open cholecystectomy at the Hospital General 450 in Durango, Mexico, and compare it with the national prevalence. **Material and methods:** A descriptive and retrospective analysis of the clinical charts at the hospital's General Surgery Unit was conducted and included patients with the diagnosis of biliary tract injury that had been hospitalized between June 2014 and December 2016. The study variables were the prevalence of biliary tract injury (according to the Strasberg's classification), age and gender. **Results:** In two years and six months, 855 cholecystectomies were performed in patients of both sexes between the ages of 21 and 75; 341 cholecystectomies were laparoscopic and 514 were conventional. A total of 11 biliary tract injuries were reported, 10 were repaired by biliodigestive bypass (Roux-en-Y hepaticojejunal anastomosis) and one by terminoterminal anastomosis of the common bile duct and placement of a T-tube. Three deaths were reported, yielding a mortality rate of 27%. **Conclusions:** At the Hospital General 450, the frequency of biliary tract injury is 0.87% after laparoscopic cholecystectomy and 0.58% after open cholecystectomy. This is in contrast with the results obtained in studies on central and southern Mexico by Gutiérrez et al., in South America by Hoyos and his group, and in the U.S.A. by Chuang et al. we conclude that the prevalence of biliary tract injury at this hospital is high, perhaps due to factors such as patient body mass index and the duration of symptoms from the condition appearance until surgical resolution, which have been identified as important causes of surgical complications.

RESUMEN

Objetivo: Determinar la prevalencia de lesión de la vía biliar por colecistectomía laparoscópica y colecistectomía abierta en el Hospital General 450 de Durango, México y compararla con la prevalencia nacional. **Material y métodos:** Se realizó un análisis de tipo descriptivo y retrospectivo de los registros clínicos de la Unidad de Cirugía General del hospital mencionado con diagnóstico de lesión de vía biliar atendidos de junio de 2014 a diciembre de 2016. Las variables a estudiar fueron la prevalencia de lesión de la vía biliar (clasificándola de acuerdo a Strasberg), edad y género. **Resultados:** En dos años y seis meses se realizaron 855 colecistectomías a pacientes de ambos géneros de 21 a 75 años de edad; 341 colecistectomías fueron laparoscópicas y 514 convencionales. Se reportaron un total de 11 lesiones de la vía biliar, 10 fueron reparadas con derivación biliodigestiva (hepatoyeyunoanastomosis en Y de Roux) y una con anastomosis de colédoco término-terminal y colocación de sonda en T. Se reportaron tres defunciones, con una mortalidad de 27%. **Conclusiones:** En el Hospital General 450, la frecuencia de lesión de la vía biliar en pacientes con colecistectomía laparoscópica es de 0.87%, y en pacientes con colecistectomía abierta, de 0.58%. Esto contrasta con los resultados obtenidos en estudios realizados en el centro y sur de México por Gutiérrez y sus colaboradores, en Sudamérica por Hoyos y su grupo, y en Estados Unidos por Chuang y sus colegas. Concluimos que la prevalencia de lesión de la vía biliar en el hospital mencionado es alta probablemente debido a factores como el índice de masa corporal y el tiempo de evolución de la presentación del cuadro hasta la resolución quirúrgica del padecimiento, los cuales han sido identificados como causas importantes de complicaciones quirúrgicas.

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INTRODUCTION

Cholecystectomy is one of the most frequently performed intraabdominal surgical procedures worldwide.¹ Biliary tract injuries (BTI) are some of the most feared and potentially deadly complications of this procedure.² They can result from several causes, but a iatrogenic origin is the most frequent,³ leading to significant morbidity and mortality in spite of their low incidence. These not only affect overall survival but also the patient's quality of life, even if the injury is properly repaired.⁴ The frequency of BTI varies between 0.18% and 0.5%, depending on the reports,⁵ but they are twice as frequent after laparoscopic cholecystectomy (0.3% open vs 0.6%, laparoscopic).^{3,4,6}

The advent of laparoscopic cholecystectomy in 1987 by Philippe Mouret in France has increased the number of gall bladder surgeries throughout the world.² Despite their benefits, the incidence of biliary tract injury has significantly increased over time,^{7,8} ranging from 0.1 and 0.2% during the era of open cholecystectomies (OC) to 0.4-0.6% in the era of laparoscopic cholecystectomies (LC); this has had clinical, work-related, economic, and legal effects.⁹ In studies conducted in our country by Mercado, Pérez-Morales and their collaborators, BTI incidences of 0.4% and 0.6% have been respectively reported, within the international ranges described.

A multidisciplinary approach is required, involving surgeons, radiologists and endoscopists, to offer the patient an appropriate initial diagnosis, the best treatment options, and optimal management and follow-up of complications.^{3,6,10}

The aim of this study was to establish the frequency of biliary tract injury in patients undergoing cholecystectomy in a secondary care hospital in Durango between June 2014 and December 2016, and determine the most relevant causative factors.

MATERIAL AND METHODS

We conducted a retrospective descriptive study in the Department of General Surgery of the *Hospital General 450*, in Durango.

We reviewed the statistical records of all local and referred surgical procedures performed between June 2014 and December 2016. The study population included all patients who underwent emergency or scheduled laparoscopic or open cholecystectomy: among these, 341 were laparoscopic cholecystectomies and 514 were open. Patients were selected based if they had suffered iatrogenic biliary tract injury resulting from the procedure, according to the post-operative dictations and post-surgical notes. There were nine female patients and two males, whose age ranged between 21 and 75, with an average of 43 years. Furthermore, the patients' follow-up after repair of the BTI was analyzed based on clinical parameters (abdominal pain, fever, jaundice, pruritus, nausea, vomiting and the characteristics of the drainage output) as described in the medical progress notes, as well as the laboratory and imaging reports.

There are many scales for the classification of BTI but, for the purposes of our study, we used Strasberg's classification, which is adapted it to the laparoscopic era and is currently the most popular (*Table 1*) according to the Mexican Association of General Surgery A.C. and the Committee for the Elaboration of Clinical Practice Guidelines.¹¹

The BTI was repaired by biliodigestive bypass in ten patients and by terminoterminal anastomosis of the common bile duct and placement of a T-tube in one case, due to total transection of the bile duct detected during surgery and repaired at the time.

From a bioethical viewpoint, this study entailed no risks to the patients, since only their clinical charts were reviewed, with total respect to their confidentiality.

RESULTS

Over a period of two years and six months, out of 855 cholecystectomies that were performed (341 laparoscopic and 514 open), 11 patients suffered biliary tract injury. Most occurred in females, i.e., 9 women (81%) and two men (18%). Their ages ranged between 21 and 75 years, with an average of 43 years. The most frequent condition (in 10 patients) was

Table 1: Strasberg classification.

Type A	Bile leak from the cystic duct or small ducts in the liver bed
Type B	Occlusion of an aberrant right hepatic duct
Type C	Section without ligation of an aberrant right hepatic duct
Type D	Lateral injury of the main biliary tract
Type E1	Distal injury of the common hepatic duct > 2 cm from the confluence
Type E2	Distal injury of the common hepatic duct < 2 cm from the confluence
Type E3	Injury at the hilum with preservation of the hepatic duct's confluence
Type E4	Injury at the hilum with involvement of the confluence and separation of the right and left hepatic ducts
Type E5	Injury of aberrant sectoral right hepatic duct, isolated or associated to a concomitant injury of the common hepatic duct

Source: Mexican Association of General Surgery AC. Clinical practice guidelines in benign biliary tract injury.

Table 2: Main clinical features.

Clinical picture	n	%
Abdominal pain	9	81
Jaundice	8	72
Biliary leak	6	54
Acholia/choluria	5	45
Nausea/vomiting	5	45
Fatigue	3	27
Fever	2	18
Respiratory distress	1	9

Source: Created by the authors. Statistics and clinical charts of the General Surgery Department at the Hospital General 450.

symptomatic biliary gallstones, operated on either by emergency or scheduled surgeries, and one case was secondary to blunt abdominal trauma in an automobile accident that required repair of a liver injury and cholecystectomy. Six of the BTI occurred in our hospital (three after laparoscopic cholecystectomy and three after open cholecystectomy). The remaining five occurred in other primary care hospitals in the state and were referred to our institution.

The main clinical features were abdominal pain in nine patients (81%), jaundice in eight (72%), biliary leakage in six (54%), acholia or choluria in five (45%) and nausea or vomiting in five (45%) (Table 2).

The type of biliary tract injury according to Strasberg's classification was identified at the time of repair: type E1 in four patients, type E2 in five, and type E4 in two. Based on the chi-squared test, no significant relation existed between the type of surgery (laparoscopic versus open) and the type of BTI, with a resulting $p < 0.557$ (Table 3).

Injuries were diagnosed during surgery in two patients: one of the surgeries began laparoscopically but was converted to open to perform a terminoterminal anastomosis of the common bile duct and placement of a T-tube. The other was referred from another center for repair in a second stage, in nine patients (81%), the injury was diagnosed in the postoperative period and was repaired with a biliodigestive bypass (Roux-en-Y hepatojejunal anastomosis) in a second stage, an average of two weeks after cholecystectomy. One case was operated urgently prior to repair, to drain a biloperitoneum secondary to biliary peritonitis, with signs of systemic inflammatory response seven days after cholecystectomy.

Post-surgical complications leading to death occurred in three patients (27%). One had been referred from another hospital with systemic inflammatory response syndrome and hemodynamic instability; she underwent cleaning of the abdominal cavity in a second stage, and a biliodigestive bypass was performed in a third stage. Another patient developed abdominal sepsis secondary to dehiscence of the jejuno-jejunal anastomosis following biliodigestive repair. A third patient died as a result of chronic diseases, among them,

Table 3: Type of injury according to the Strasberg classification.

Type of injury	Type of surgery		Total
	Laparoscopic	Open	
E1	1 (33.3%)	3 (37.5%)	4 (36.4%)
E2	2 (66.7%)	3 (37.5%)	5 (45.4%)
E3	0	0	0
E4	0	2 (25.0%)	2 (18.2%)
E5	0	0	0
Pearson's chi squared	p < 0.557		

Source: Created by the authors. Statistics and clinical charts of the General Surgery Department at the *Hospital General 450*.

hemolytic anemia. The course of the remaining patients has been stable to date, with no further complications. None of these eight patients have developed jaundice or required endoscopic therapy due to bile duct stenosis to this date.

DISCUSSION

Biliary tract injury (BTI) is a complication of biliary and hepatic surgery; its treatment is complex and, occasionally, it yields frustrating results.⁴ From the time the first cholecystectomies were performed in the 1880's until the introduction of laparoscopic cholecystectomy in 1985, the incidence of iatrogenic biliary tract injury has increased, from 0.1 to 0.2% during the era of open cholecystectomy to 0.4 to 0.6% in the era of laparoscopic cholecystectomy.^{7,9}

Successful management depends on several factors, including early diagnosis of the injury, care by medical personnel specialized in hepatobiliary surgery, and management by a multidisciplinary team.³ At our center, surgeons, radiologists and gastroenterologists participate in their management.

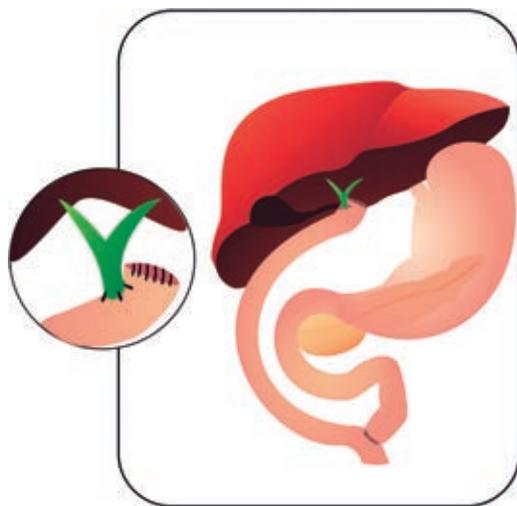
The numbers we obtained are in contrast with those reported in nationwide studies by Gutiérrez (who reported a BTI frequency of 0.56% following laparoscopic cholecystectomy) and Mercado (who reported a frequency of 0.4%), and with the results of an international

study by Chuang, who reported a frequency of 0.10%.

We believe that the results obtained in our study are inconsistent with several national and international protocols that are often used as references because of the intrinsic characteristics of our study population, since the state of Durango has the highest obesity rate in our country, according to the ENSANUT 2012 survey.¹² The patients in our sample had an average BMI of 30.1, which coincides with that reported in the literature as a risk factor for the development of biliary tract injury. As mentioned by Mercado, obese patients are at greater risk of suffering biliary tract injuries, regardless of whether surgery was laparoscopic or open, the institution or the surgeon.¹³ A prolonged waiting period between the first episode of pain and surgery (cholecystectomy) is also considered a risk factor for BTI, as reported by Chuang and his group; in our case, the waiting period ranged between 4 and 12 months, according to the patients' clinical histories and progress notes. This delay in treatment tends to be a constant in our national health system and increases morbidity and mortality in this type of patients.

Although laparoscopic cholecystectomy is the gold standard for the treatment of gallstones, there are hospitals, particularly in developing countries, where open cholecystectomy is the procedure most commonly performed due to a lack of economic resources: such is the case in our hospital.

The technique used as definitive treatment is biliodigestive bypass (Roux-en-Y hepatojejunal anastomosis); it is also the one yielding the best results and the most frequently performed, as shown in *Figure 1*. A study conducted by Hoyos confirms that non-surgical management, either percutaneous or endoscopic, is unsuccessful, which confirms that biliodigestive bypass is the approach of choice in iatrogenic biliary tract injuries.⁴ Likewise, this was reaffirmed in a study conducted in the Department of Surgery of the *Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán*, in Mexico City, by Mercado et al.¹⁴ Only in one patient originally scheduled for a laparoscopic surgery this had to be converted into an open procedure, since the injury was detected during



Source: Created by the authors.

Figure 1: Roux-en-Y biliodigestive bypass.

surgery and reported as the complete section of the common bile duct; it was repaired by terminoterminal choledococholedocal anastomosis and placement of a T-tube.

Prior to reconstructive surgery, it is very important to have images both of the biliary tract and the hepatic vascular bed. All of our patients had a magnetic resonance cholangiography, an abdominal CT scan or a cholangiography via the T-tube to assess the type of injury, its level and hepatic perfusion, as described in the study by Losada and his colleagues.⁵

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