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Morbidity and Mortality of Open and Laparoscopic Cholecystectomy in Males. Multicenter Study

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ABSTRACT

Introduction: Male gender has been mentioned as a risk factor in open cholecystectomy (OC) or laparoscopic (CL).

Anatomical issues, the inflammatory reaction, obesity, preoperative evolution time, and cholecystitis severity are important factors for the presentation of complications or conversion to open surgery.

Objective: To determine whether the male gender is a factor for higher morbidity and mortality OC and LC

Methods: From 2021 to 2023 an ambispective cohort was carried out to determine the prevalence of complications, morbidity, and mortality in OC and LC in 3 institutions, analyzing bleeding, wound infection, conversion rate, time of surgery and hospital stay. The results were analyzed with the statistical program SPSS-27.0.

Results: Group 1: 1127 patients, 72.49% were female, 27.5% were male. comorbidities 31%: OC was performed in 21.45% and LC in 78.54% of the cases. A total of 6.45% in men were converted to open surgery. Mean surgical time of 2 hours (53.23%); Minimal bleeding in 92.25% of males, with no statistically significant difference with respect to females (p= 0.509482). Complications in 2.57%; Mortality 0.97%. Group 2: 674 cholecystectomies, 71.06% female and 28.93% male; OC 55.93% and LC 44.06%; conversion 1.92%. subtotal cholecystectomy (STC) 2.07%; 3 lesions (2 biliary tract, 1 duodenum); Mean surgical time in LC < 2h. Group 3: of LC, 78.9% female, 21.1% male; mean surgical time of 93 minutes. Conversion of 4.8% and biliary tract lesion in 0.08%.

Conclusion: cholecystitis severity and the time between the beginning of the ailment to surgical resolution are determining factors in postoperative morbidity and mortality, regardless of sex.

Keywords: Morbidity and Mortality; Open Cholecystectomy; Laparoscopic; Male Gender

Abbreviations: OP: Open Cholecystectomy; LC: Laparoscopic Cholecystectomy; STC: Subtotal Cholecystectomy; BMI: Body Mass Index; HUP: Hospital Universitario De Puebla; SAH: Systemic Arterial Hypertension; HGV: Hospital General La Villa

Introduction

Male gender has been mentioned as a risk factor in open or minimally invasive gallbladder surgery. In open surgery, some "anatomical difficulties" in men could be the sharpest right costal angle and greater muscle mass compared to women; It is also mentioned that men seek medical attention late due to work issues [1]; However, in other articles, it is mentioned that men undergo emergency surgery more frequently; in addition to age, which is higher in this group [2]. It is also mentioned that the inflammatory reaction is greater in men, a situation that represents a greater risk in minimally invasive surgery, conditioning a conversion rate of 15% [1-5]; therefore, some authors recommend the need for earlier intervention to reduce the risk of complications [5]. Another risk factor is obesity, which in Mexican population, the male gender represents 73.5% and female gender 76.8%, according to ENSANUT reports from 2022 [6]. According to Tokyo International Consensus classification and other publications, the management to be followed was determined, emphasizing on intervention in the acute phase of cholecystitis to avoid complications, of course, depending on the cholecystitis severity, so they recommend early cholecystectomy (in the first 72 hours after the onset of the disease). Laparoscopic surgery was the modality of choice in 20% of cases that come to be intervened [7].

There is still a debate about whether early intervention should be taken to avoid complications due to the inflammatory process [4,8], arguing that acute gallbladder symptoms usually subside after 2 or 3 days, resolving in 85% of cases within a week [9]; however, as mentioned above, only one-fifth of patients in the acute period are candidates for LC. Other authors have proposed LC at one and a half or three months after the acute phase, due to the risks involved in inflammation, being the most important, the anatomy loss among them, which in addition, we know that the bile ducts are the structures with the most anatomical variants, predominating on the cystic in more than 70% of cases [10], increasing the risk of injury to these structures, including the liver vasculature or even large vessels injury by the laparoscopic procedure itself, such as arteries, vena cava or portal vein; However, it has been seen that performing it in a deferred or interval manner (conservative treatment) is accompanied by 26% of failures, having to be urgently operated, and 28.5% of these patients could present complications such as cholangitis, pancreatitis or a biliary peritonitis [11].

According to literature, in women initially there is a greater inflammatory reaction and greater production of antibodies; However, women offer a greater response to antigens, both innate and adaptive. The immune response basically resides on the X chromosome; In addition, hormonal factors, such as estrogen, stimulate the immune response; on the contrary, androgens inhibit it [12]. Bile duct injury in LC have an incidence between 0.2 and 0.8%; in open surgery, it is less than 0.2% [13]. In relation to sex, Shreenath et al do not consider it as a predictor, but report that conversion secondary to difficult cholecystectomy is frequent in patients with history of hospitalization, previous abdominal surgeries, palpable gallbladder, BMI greater than 27.5 kg/m2 and thickened gallbladder wall. Sex, age, and impact calculation were not identified as predictors [14,15]. In summary, the prevalence of cholelithiasis in Mexico is 14.3%, of which 8.5% are men and 20.5% are women; obesity has been reported to be associated with a cholelithiasis elevated risk [16] and as an important factor in the conversion of LC [17,18]. The most used marker to measure the quality of a surgical procedure is the incidence of complications [19]. Andrade Carbo et al., from Ecuador, reported a higher rate of surgical complications in women compared to men (52% vs. 48% respectively) [20].

Corona DJ y cols., in Mexico on 2006, reported 72% of 111 male patients operated urgently of OC, 55 patients presented complications inherent due to cholecystitis severity [21]. Hospital stay was shorter in LC than OC group with an average of two days vs 4 days in 57% and 34.3% of cases respectively [22]. On the other hand, there is an increase bile duct injury incidence, with the increasing use of LC, although other authors report that they have decreased with the learning curve [23] Most articles mention a conversion rate of 4 to 8%, even up to 20%; the current mortality rate for OC is 0.39% and 0.07% for LC, with an average of 0.016% [24]. Some mention that male sex, obesity, age, wall thickness or stage of the disease are the factors that hinder surgery and therefore, conditioning factors for conversion, so in the absence of consensus to categorize a difficult CL, the scoring scale proposed by Ayón et al. has been used that take into account 7 aspects: adhesions presence, gallbladder wall and size, inadvertent calculus or macrocalculus, Calot's triangle critical view, surgical time, and how vesicular bed hemostasis was achieved [25].

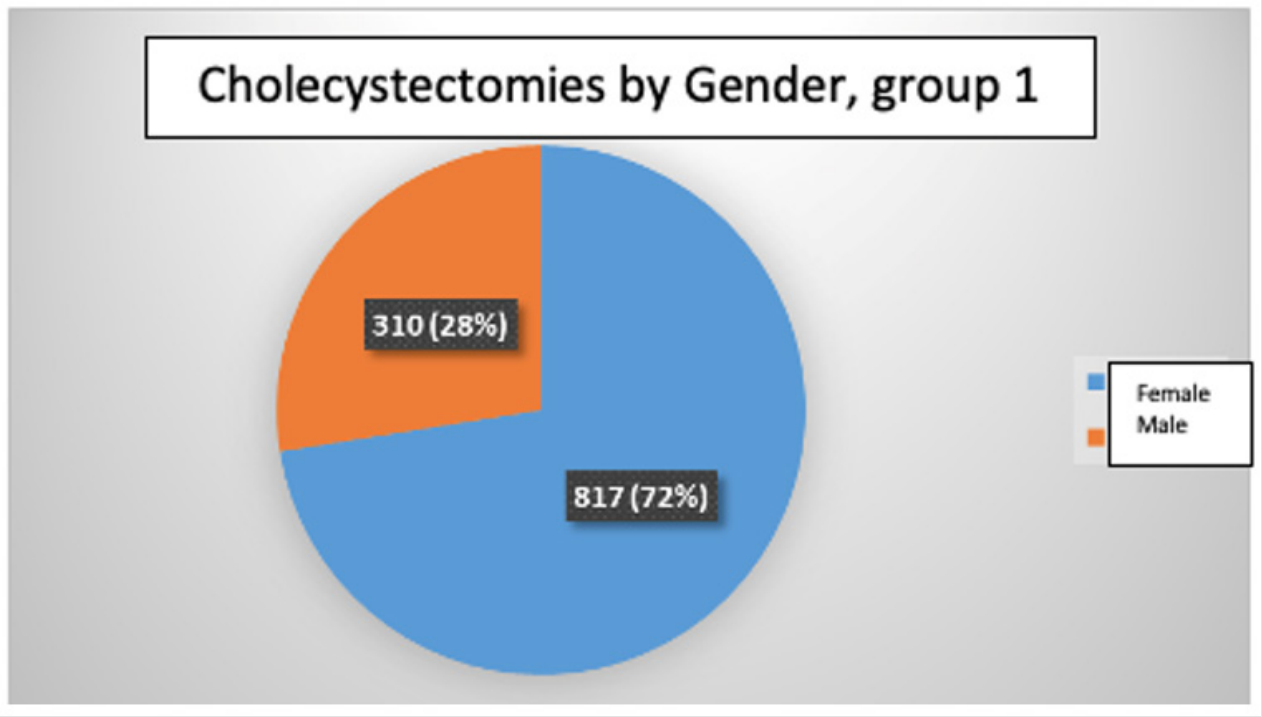
Methods and Materials

From January 2021 to December 2023, an ambispective, descriptive and analytical multicenter study was carried out of the clinical archive from Dr. Darío Fernández Fierro General Hospital (HGDDFF), Hospital General La Villa (HGV), and Hospital Universitario de Puebla (HUP), of the surgeries performed by General Surgery department to determine the morbidity and mortality of OC and LC in men during emergency or scheduled interventions. Data were collected separately by dividing the hospitals into three groups according to the order mentioned above. The following variables were analyzed: sex, age, BMI, time of evolution of the condition before surgery, transoperative bleeding, surgery time, drains presence, postoperative pain, and hospital stay. The statistical analysis was performed with SPSS-27 to perform the univariate analysis of the variables of interest, describing cumulative incidence and prevalence of injuries, relative and absolute frequencies of the categorical variables and measures of central tendency for the quantitative variables according to the data distribution. The study was carried out strictly in accordance with the Ethical principles of patient confidentiality.

Results

HGDDFF (Group 1)

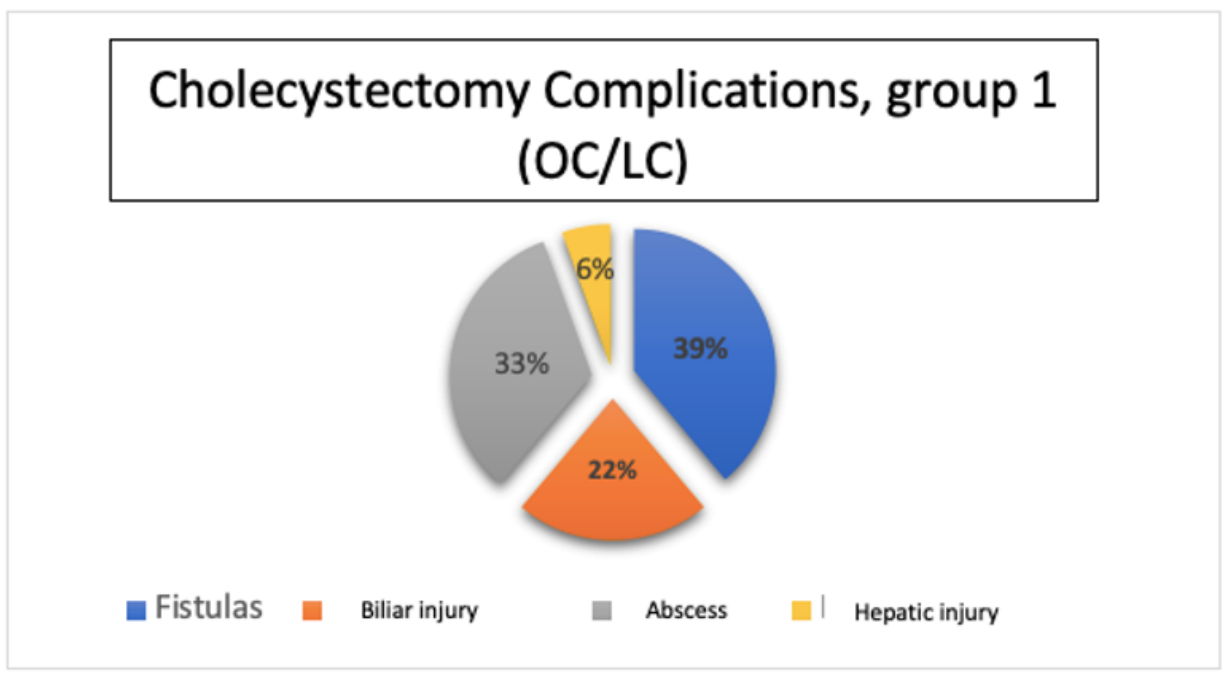
During the 3 years included in the study period, a total of N=1409 cholecystectomies were carried out, 80% (n = 1127) met the selection criteria, of which 72.49% were female (817/1127) with an average age of 54 years (± 16.6), ranging from 18 to 94 years; 27.5% (310/1127) were male (Graph 1), being more frequent between 30 and 50 years, with an average age of 40 years in 65% of the cases; 15% from 51 to 60 and 20% from 71 to 80 years. In 80.9% of all patients (n=912) were between the ages of 36 and 57 years and in 31%, the most common comorbidities were systemic arterial hypertension (SAH) in 55%, diabetes mellitus (DM2) 45%, hypothyroidism 16%; elective surgeries accounted for 50.57% (570/1127) and 49.43% (557/1127) of emergency surgeries; OC in 4.34% (49) and LC in 96.65% (1078/1127). Average time of 2 h in 53.23% (600/1127). In OC, the surgical time was 90 minutes; in LC 70 minutes on average, with an interval of 30 to 180 minutes. Less than one hour 7%; Minimal bleeding (bleeding defined and calculated by the anesthesiology service ≤ 90 ml) in 92.25% of males, with no statistically significant difference with respect to females (p= 0.509482).



Graph 1: Gender distribution, group 1.

Complications in LC

Cystic artery bleeding occurred in 5%, controlled by laparoscopy; bleeding from the surgical site in 1 case; liver thermal injury due to defects in the thermal insulation of the electrocautery. Mortality in 11 patients (0.97%), with a Porta vein injury, which initially due to the urgency, was managed by a general surgeon and caused a late intervention of the vascular surgeon with disastrous results. (Graph 2). In 0.92% (10/1078) of the LC, STC was performed, especially in acute cases. In OC, 6.12% (3/49). Cystic duct leaks occurred in 3 cases, identified and resolved by ERCP. There were 5 bile duct injuries, 4 referred to a fourth level of medical care; 1 was repaired by a surgical oncologist at the time of injury with open Y Roux's surgery (Strasberg E2 type) (Table 1). In-hospital stay ranged from one to six days; 77% less than 2 days; 3 days in 18%, with the main reason being drainage monitoring. 4 days in 11%, for pain or drainage surveillance in 63%, and in 1 patient, 6 days for choledocholithiasis.



Graph 2: Complications in cholecystectomy, group 1.

Table 1: Transoperative Findings. group 1.

	Hombres	Mujeres		OR (IC 95%)	p estadística
Choledocolitiasis	6	9	15	OR 0.56 (IC 95: 0.19-1.59)	0.2795
Polyp	2	19	21	OR 0.08 (IC 95: 0.02-0.38)	0.0012
Porcelain gallbladder	2	7	9	OR 0.24 (IC 95: 0.05-1.67)	0.0771
Fistulas	2	5	7	OR 0.33 (IC 95: 0.06-1.74)	0.1962
Scleroatrophic gallbladder	2	5	7	OR 0.33 (IC 95: 0.06-1.74)	0.1962
Mirizzi	4	12	16	OR 0.28 (IC 95: 0.09-0.87)	0.0289
Cyst	0	4	4	OR 0.09 (IC 95: 0.005-1.74)	0.113
Bile duct injury	1	3	4	OR 0.63 (IC 95: 0.14-2.88)	0.5525
Abscesses	7	1	8	OR 5.92 (IC 95: 0.72-48.24)	0.0965
Perforation	4	3	7	OR 0.36 (IC 95: 0.9-1.4)	0.1426
Purulent cholecystitis	38	59	255	OR 0.54 (IC 95: 0.35 to 0.82)	0.0001
Hydrocholecyst	18	48	66	OR 0.31 (IC 95: 0.18-0.55)	< 0.0001

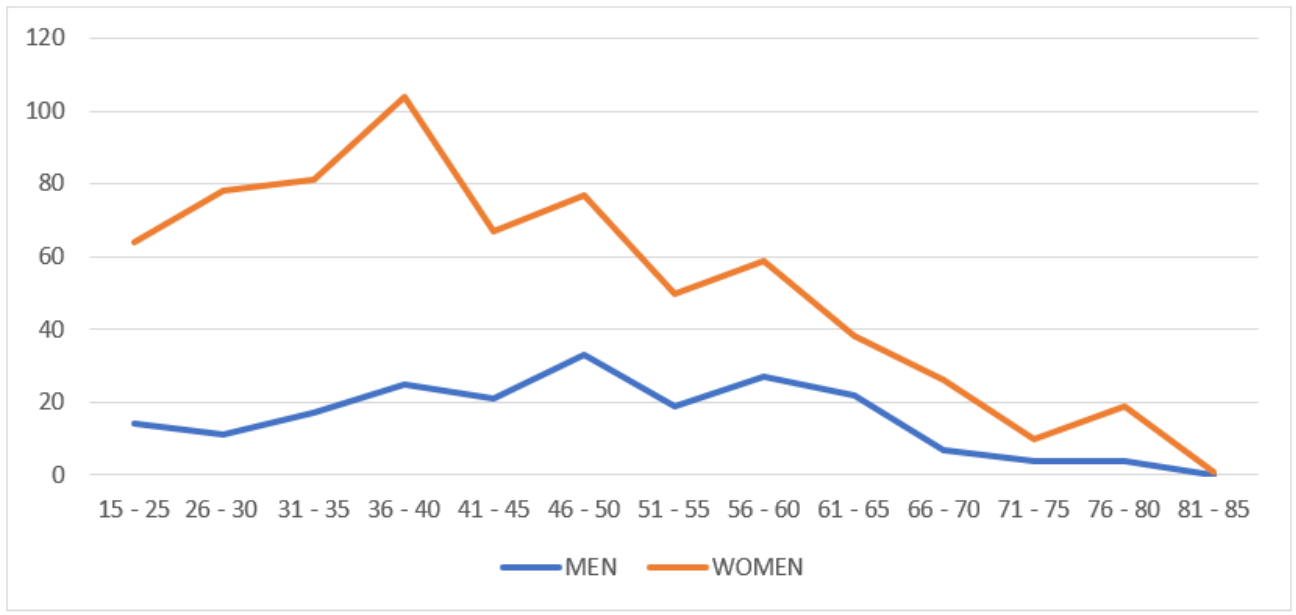
The conversion rate for males was 6.45% (20/310) and 1.83% (15/817) for females. Elective surgeries were dominated by women. Regarding the age group, on 31 patients' conversion predominated between 41 and 55 years old, and a probability of conversion of 3.1 (OR). According to BMI, CL conversion, especially in emergency cases, was more frequent in 28 patients (43.75%) classified as overweight (25.1 to 30 kg/m^2), followed by 16 patients (25%) classified as grade I obesity (30 to 34.9 kg/m^2). (Table 2) There was a predominance in symptomatic Cholecystitis (76.56%); which is the most associated condition to conversion in urgent surgery in 28 cases (43.75%) with an OR= 2.45 conversion probability.

Table 2: Group 1, Conversion and Conversion Factors.

Conversion and Predisposing Conditions to Conversion		
	Men 310	**Women 817**
Conversion Rate	20 (6.45%)	15 (1.83%)
Purulent cholecystitis	38	59
Hydrocholecyst	18	48
Overweight (25 -29.9Kg/m^2)	122	326
Obesity	28	72
Previous surgeries	10	78
Difficult dissection	46	60
Biliary peritonitis	10	5
Other Causes	2	2

HGV (Group 2)

This hospital serves the population without medical services, in which 674 cholecystectomies were performed, 71.06% (479) women and 28.93% (195) men; of the total, 55.93% were OC (377/674) and 44.06% LC (297/674); 92.43% (623/674) were intervened due to emergency and 7.56% (51/674) were an elective procedure, from which 44 were women and 7 men. Minimum and maximum age in women 16 to 86 years, with a maximum peak between 36 and 40 years; In men, minimum and maximum age 18 to 82 years, with two peaks between 46 and 50 and 56 to 60 years (Graph 3). Among the findings we have a 1.92% conversion rate (6 men and 7 women). In 14 patients (2.07%) STC was performed (9 men, 5 women); There were 3 injuries (2 bile duct and 1 duodenum injury); A biliodigestive fistula was evidenced and resolved in the same surgery; in 72 patients (10.68%) a purulent cholecystitis was found (21 men and 51 women); Biliary peritonitis in 9 patients (6 men, 3 women); hydrocholecyst in 35 (11 males, 24 females); cholangitis 5 (2 men, 3 women-one with septic shock) and Mirizzi syndrome in 4 patients (3 women). The average surgery time in 90% of LC was less than 2 hours.



Graph 3: Group 2 by age groups and genders.

HUP (Group 3)

For reasons beyond our control, we do not have current data, only reports from 2009 to 2014 period, in which 78 CL were performed per year, of which the female gender represented more than 70% of the cases with a mean age of 44.4 ±17.2 years, with two conversions (Pérez Ayala, Thesis 2014) and that currently in the ISSSTE Regional Hospital, of the same Federal Entity to transpolate the data, approximately 200 surgeries are performed per year, reported by Dr. Dávila Esparza, a total of 1190 cases, of which 78.9% were female and 21.1% male, with an age range of 18 to 94 years and an average age of 51 years (F:M relation 3.73:1). Average hospital stay was 3.4 days and surgery duration averaged 93 minutes. A conversion rate of 4.8% and bile duct injury at 0.08%. (Dávila Esparza, Thesis 2021)

Discussion

Acute cholecystitis is the second leading cause of consultation in abdominal surgical emergencies; In Mexico, it is estimated that between 200 and 300 thousand LC are performed annually, according to the lecture given at the "12th Mexican Association of Endoscopic Surgery Regional Meeting" at the New Civil Hospital of Guadalajara "Dr. Juan I. Menchaca", by Dr. Adolfo Cuendis, Gea González General Hospital MD of Endoscopic Surgery Division in Mexico City [26]. Gallbladder problems mainly affect young women between the ages of 20 and 40, who are multi-pregnant or overweight. In men is more associated with eating problems and low fluid intake. From all gallbladder surgeries, 80% are due to gallstone problems. In Mexico, 10 to 20% of the population has gallstones and 30% will develop acute cholecystitis [27,28]. LC is currently the first-line technique for the surgical treatment of gallbladder pathology, with less time spent in hospitalization and convalescence; reduced postoperative pain and operative site infection, and better aesthetic results; However, LC is not without disadvantages, such as a higher percentage of iatrogenic bile duct injury and more challenging controlling profuse bleeding difficulty degree [24,29].

In our study, we found an F:M ratio higher than that reported in the international literature with respect to sex, being 3.34:1, in relation to the reports of 2:1 respectively, perhaps due to the place we occupy in obesity, overweight, DM2, and the fact that our female population is larger, which translates on the necessity to investigate an ethnic factor. Either way, the Puebla ISSSTE Hospital with different economic status employees, F:M was 3.73:1 and HGV, which attends low resources population, was similar from the relation reported in international literature (F:M 2.4:1); We insist, this could be associated due to the predominant obesity on bureaucrats. In terms of surgical time, we are in the average time with the report of Jarkín et al. (9), of 71 minutes in boarding with three laparoscopic ports, and above the results of Manoj Kumar et al. 47 minutes [18].

Recent meta-analyses have shown that early urgent LC provides a benefit in terms of hospital stay, but not in terms of conversion rates and perioperative complications [28]. Currently the LC is the election procedure. There is no standardized management of early-stage LC in our institution, and some articles even contraindicate it in the acute phase [28].

According to some publications, there is no statistically significant difference in the complications of an early and delayed LC; It is recommended to perform it in the first 3 days of the onset of the clinical presentation being urgent surgery more common in men [21]. There is the unknown or assertion if surgery in men is more difficult or presents more complications, perhaps because the inflammatory process is greater or because they present themselves to seek medical attention earlier than women, associated to less pain tolerance or due to work reasons, a situation that favors an intervention during the acute process. This increases the risk of injuries and technical difficulties in surgery, and not necessarily because surgery is more difficult in men, which remains to be clarified with larger studies. Zhu et al. proposed the term 72 golden hours from the onset of the disease to perform LC [4]. In addition to the factors mentioned above that can lead to conversion, we have symptomatic gallstones (biliary colic) and DM2 as predominant factors. Elective surgery is more often in female sex [29,30].

In our study, we found that there was no statistically significant difference between men and women in the minimum bleeding present in 95.92% on the male group (p= 0.509482).

1.76% (n=19) were converted to open surgery, in contrast to what has been reported in the international literature, which reaches figures of up to 20%. Surgical time was obviously longer in acute inflammatory processes. Complications with an OR greater than 1.0 were abscesses with 5 cases in men and 1 in women (OR of 4.23, 95 CI: 0.49-36.29) and liver injury in 1 case in men with an OR of 2.53 (95 CI: 0.10 – 62.41). According to the above, it could be said that more than the male sex being a risk factor, obesity, the stage in which patients are intervened, inflammatory grade and age are predominant factors for a difficult cholecystitis, and it would be necessary to clarify if the inflammatory reaction is greater in men as mentioned by some authors and not the stage of the disease in which they are intervened (acute phase). In relation to the inflammatory reaction and antibodies production, it is mentioned that in women, it is initially bigger, with a greater immune innate and adaptative response to antigens, which is described to be reside in the X chromosome and the hormonal factors (estrogens) that stimulate the immune response, as opposed to androgens that inhibit it [12].

Hayama et al. mention that the risk factors for conversion depend on the stage at which surgery is performed in acute cholecystitis (early surgery less than 240 hours vs late surgery after 240 hours). Necrotizing cholecystitis was a difficulty risk factor in early surgery, while higher white blood cell count, and older age are risk factors in late surgery [31]. It is relevant on these situations to know if we have the possibility of predicting the conversion rate as mentioned by Rothman et al., who give importance to the gallbladder wall thickness (>5 mm), contracted gallbladder, > 65 years of age, male sex, and acute cholecystitis [32]. Other publications list DM, chronic kidney disease, choledocholithiasis and Mirizzi syndrome as risk factors for conversion; patients with jaundice, cholangitis, or pancreatitis [33]. However, we must not forget that the conversion to open surgery is considered an alternative resource for resolution and it is necessary to know how to make the decision on time. Percentages range from 0.08% to 18% [34]. Regarding sex, Shreenath et al. mention that conversion in difficult cholecystectomy is frequent in patients with hospitalization history, previous abdominal surgeries, palpable gallbladder, BMI >27.5 kg/m^2 and thickened gallbladder wall.

Variables such as age, sex, and impacted stones were not found to be significant predictors. However, they mention that in the case of

men they may outperform women, due to sociocultural factors that predispose a late attendance to medical centers [35]. In addition, Chávez Segura stated the results of studies in relation to sex should be considered inconclusive, because most of the population that goes to hospitals are mostly female [36], which we take as a reservation because it is more frequent in women. It is stated that male sex is a difficult risk factor for LC, although there are no statistically significant results, as there is a criteria diversity [37]. Age is identified as a risk factor for mortality, postoperative complications, and intraoperative conversions to OC, since the older the age, the greater the number of associated diseases and complications [37]. Obesity is a disease associated with acute cholecystitis and surgical modality conversion and is considered as a significant factor. Campos Guzmán et al. consider that overweight and obesity are a risk factor, not only for conversion, but also for the appearance of postoperative complications, prolonged hospital stay and, therefore, higher economic expenditure [37,38].

García Álvarez et al. also mention that the presence of associated diseases, such as biliary colic, obesity, and SAH, increase the risk of conversion [39]. In our investigation, on group 1, 8 conditions that complicate cholecystectomy were detected, in which the male factor has statistical significance ($p = 0.003685$) when all parameters are compared; when analyzing them individually it can be inferred that the male factor is protective when comparing the same complications in the female gender with a $p < 0.0001$ statistically significant, in cases of hydrocholecyst OR 0.31 (95 CI: 0.18-0.55); biliary peritonitis OR 0.84 (95 CI: 0.24-2.93). It is noteworthy in the Emergency Hospital that serves the general population without medical services, as expected, OC was performed in most cases (55.93%) and F:M ratio 2.4:1. The aim of this study was to determine whether the male sex factor is associated with a higher risk of surgery and complications in OC and LC in emergency or elective procedures and, as such, in LC, associated with conversion. However, perhaps due to the number of cases, we could not give an adequate answer to the research question, although according to our results, when comparing complications in women and men, the male factor was found to be protective. The important thing is to know when convert to open surgery and resort to related specialties.

Conclusion

Obesity, stage of the disease and age aggravate morbidity and mortality in cholecystectomy. According to our study, sex is not a condition of conversion. Bile duct lesions in our study were within the range reported in the universal literature of 0.2 to 0.8%.

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For Your Technical Assistance to Doctors

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Conflicts of Interest

The authors declare that there are no conflicts of interest related to this article. They agree to open access publication in accordance with the journal's policy.

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