

Cholelithiasis and associated complications in pediatric patients

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ABSTRACT

Objective. To review the clinical characteristics and complications associated with cholelithiasis in pediatric patients by identifying risk factors and assessing surgical management and results.

Methods. Retrospective study in patients under 18 years of age undergoing cholelithiasis surgery. The following data were analyzed: age, sex, body mass index (BMI), associated comorbidities, clinical presentation, symptom duration, surgical treatment, pathological report, postoperative complications, and hospital stay.

Results. 135 cholelithiasis patients underwent surgery from 2013 to 2018, with an increasing trend in the annual number of cholecystectomies. Most patients were adolescents (86.7%) and female (72.6%), and they had cholesterol gallstones (86.6%) and >85 BMI (33%). Mean symptom duration was 85 days (SD: 148). Symptomatic cholelithiasis was present in 131 cases (97%). CL associated complications were recorded in 64.4% of patients, with cholecystitis, pancreatitis, and choledocholithiasis being the most frequent ones. All patients underwent laparoscopic cholecystectomy; 4 (2.9%) required conversion to open surgery, and 6 (4.4%) had postoperative complications. Mean hospital stay and postoperative follow-up were 5.7 days (SD: 4) and 2.3 months (SD: 1.9), respectively.

Conclusions. Non-hemolytic cholelithiasis in the pediatric population is more frequent in female overweight and obese adolescents. Symptomatic cholelithiasis is associated with higher risk of complications such as cholecystitis, pancreatitis, or choledocholithiasis, which supports early surgical management.

KEY WORDS: Gallstones; Pediatrics; Complications; Cholecystectomy; Risk factors.

COLELITIASIS Y COMPLICACIONES ASOCIADAS EN PACIENTES PEDIÁTRICOS

RESUMEN

Objetivo. Revisión de las características clínicas y complicaciones asociadas de los pacientes pediátricos con colelitiasis, mediante la identificación de factores de riesgo, la evaluación del manejo quirúrgico y sus resultados.

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Métodos. Estudio retrospectivo en pacientes menores de 18 años, intervenidos quirúrgicamente por colelitiasis. Se analizaron datos como edad, género, índice de masa corporal (IMC), comorbilidades asociadas, presentación clínica, tiempo de los síntomas, tratamiento quirúrgico, reporte de patología, complicaciones posoperatorias y estancia hospitalaria.

Resultados. Se intervinieron quirúrgicamente 135 pacientes con colelitiasis entre los años 2013 a 2018, con una tendencia ascendente en el número de colecistectomías realizadas anualmente. La mayoría fueron pacientes adolescentes (86,7%), con cálculos de colesterol (86,6%), de género femenino (72,6%) y con IMC > 85 (33%). El tiempo de los síntomas en promedio fue de 85 días (DE 148). Colelitiasis sintomática se presentó en 131 casos (97%). Complicaciones asociadas a CL se registraron en 64,4% pacientes, siendo las más frecuentes colecistitis, pancreatitis y coledocolitiasis. En todos los pacientes se realizó colecistectomía laparoscópica, 4 (2,9%) requirieron conversión a cirugía abierta y 6 (4,4%) presentaron complicaciones postoperatorias. La estancia hospitalaria y el seguimiento posoperatorio fueron en promedio 5,7 días (DE 4) y 2,3 meses (DE 1,9), respectivamente.

Conclusiones. La colelitiasis no hemolítica en la población pediátrica, es más frecuente en pacientes adolescentes de género femenino con sobrepeso u obesidad. La colelitiasis sintomática está asociada con mayor riesgo de complicaciones como colecistitis, pancreatitis o coledocolitiasis, en consecuencia, se justifica una intervención quirúrgica temprana.

PALABRAS CLAVE: Cálculos biliares; Pediatría; Complicaciones; Colecistectomía; Factores de riesgo.

INTRODUCTION

Cholelithiasis (CL) in the pediatric population has typically been considered a rare pathology mostly associated with hemolytic conditions, prematurity, and prolonged parenteral nutrition^(1,2). However, in the last 20 years, a significant increase in non-hemolytic CL prevalence, from 1.9 to 4%, has been reported, with epidemic obesity standing out as one of the main causes⁽¹⁻⁴⁾. Cholecystectomies performed by pediatric surgeons have skyrocketed by up to 700% as a result of technological advances in early ultrasound CL diagnosis and minimally invasive surgical management^(2,5).

The objective of this study was to describe the clinical characteristics, surgical management, and CL associated complications in pediatric patients from a tertiary hospital.

MATERIALS AND METHODS

An observational, descriptive study of pediatric patients undergoing CL surgery within the Pediatric Surgery Department of Los Angeles Pediatric Hospital Foundation (a tertiary hospital located in Pasto, Colombia) from January 2013 to December 2019 was carried out.

The information recorded by the researchers was gathered from systematized clinical records and the Pediatric Surgery Department's database. The clinical and socio-demographic variables analyzed were age (years), sex, weight (kg), size (cm), and body mass index (BMI) (kg/m²). Patients were classified according to BMI as low weight, healthy weight, overweight, and obese, with <5, 5-85, 85-95, and >95 percentiles, respectively, in accordance with the American Centers for Disease Control and Prevention's indications.

In terms of age, patients under 12 years old were categorized as children, and patients between 12 and 18 years old were categorized as adolescents. Comorbidities such as hemolytic anemia and prolonged parenteral nutrition history, previous pregnancies, and use of contraceptives were recorded. Patients were classified into two background groups – urban background (Pasto-Nariño, Colombia) and rural background.

CL's clinical presentation was categorized as biliary colic, chronic abdominal pain (over 2 months according to Rome IV criteria), biliary pancreatitis (BP), choledocholithiasis (CDL), and asymptomatic cholelithiasis (AC).

CDL risk was classified as high, medium, and low according to American Society for Gastrointestinal Endoscopy 2010 guidelines. CDL was defined as the presence of gallstone(s) in the common bile duct (CBD), identified at hepatobiliary ultrasound (HBU) imaging, magnetic resonance cholangiopancreatography (MRCP), or endoscopic retrograde cholangiopancreatography (ERCP)⁽³⁾.

Other criteria including surgical approach, elective or urgent surgery, surgical findings, postoperative hospital stay, postoperative complications, pathological report, and postoperative outpatient follow-up (months) were reviewed.

Selection biases were controlled by establishing the following inclusion criteria: male and female patients under 18 years old undergoing CL surgery with associated complications. Patients with incomplete clinical record information and patients with congenital biliary malformation were excluded.

The software used for data collection, processing, and analysis included Excel for data filtering and processing, and SPSS® software, version 21 (IBM Corp. Released

2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) for information analysis and tabulation. Absolute and relative frequencies were used for qualitative variables, and mean, median, and standard deviation were used for quantitative variables.

The study was approved by Los Angeles Pediatric Hospital's Ethics Committee on July 1, 2019, and it was classified as "minimum risk" according to article 11 of Colombian Resolution 8430 from 1993.

RESULTS

In this study, 135 CL patients underwent surgery. Most were female (n = 98, 72.6%), with a male/female ratio of 0.37. Mean age was 14 years, with a standard deviation (SD) of 3. 13.3% of patients were classified as children, while 86.7% were classified as adolescents. According to BMI, 45 patients (33.3%) were overweight or obese. 75 patients (55.5%) came from an urban background, and 60 patients (44.5%) came from a rural background. The most important clinical history features were use of contraceptives (n=11, 8.14%), previous pregnancies (n = 10, 7.4%), and hemolytic anemia (n = 8, 5.9%) (Table 1).

In 131 cases (97%), CL was symptomatic. The most frequent clinical presentations were biliary colic (n = 114, 84.4%) and chronic abdominal pain (n = 17, 12.6%). Mean evolution time until surgery in CL patients was 85 days (SD: 148). 87 cases (64.4%) had CL associated complications (n = 87, 64.4%), which included cholecystitis (CC) (n = 54, 40%), BP (n = 26, 19.2%), and CDL (n = 7, 5.2%). CL and CC imaging diagnosis was achieved using HBU. 28 patients required MRCP for the study of the associated choledocholithiasis (CLD). 6 CLD patients underwent ERCP prior to cholecystectomy (Table 2).

The number of cholecystectomies performed during the study period followed an increasing trend (Fig. 1). All patients underwent minimally invasive surgery; 54 (40%) underwent elective surgery and 81 (60%) underwent urgent surgery. CL was the most frequent surgical finding (n = 76, 56.3%), followed by CC (n = 56, 41.5%) and CDL (n = 3, 2.2%). In 4 patients (2.9%), conversion to open surgery was required – three cases for CBD exploration purposes, and one case as a result of CC plus biliary peritonitis. Acute and chronic CC pathological reports were 62 (45.9%) and 32 (23.7%), respectively, with 117 (86.6%) cholesterol gallstones, 8 (5.9%) pigment gallstones, and 10 (7.4%) mixed gallstones. 6 postoperative complications (4.4%) were recorded: 2 ERCP managed residual CDLs, 2 surgical site infections (SSIs), and 2 CBD lesions treated through bile duct reconstruction (hepatojejunostomy plus Roux-en-Y). Mortality rate during the study period was 0. Mean hospital stay was 5.7 days (SD: 4.0), and postoperative outpatient clinical follow-up was 2.3 months (SD: 1.9) (Table 3).

Table 1. Preoperative variables in cholelithiasis patients.

Characteristics	Variable	Category	Total n = 135 (%)
Demographics	Sex	Male	37 (27.4)
		Female	98 (72.5)
	Age	Children	17 (12.59)
		Adolescents	118 (87.4)
	Background	Urban	75 (55.5)
Rural		60 (44.5)	
	Age (years) (M-SD)		14.3 (3)
Anthropometric measurements	Classification according to BMI percentile	Low weight	3 (2.2)
		Healthy weight	87 (64.4)
		Overweight	27 (20)
		Obese	18 (13.3)
	BMI (M-SD)		21.3 (7)
History	Risk factors	Use of contraceptives	11 (8.14)
		Hemolytic anemia	8 (5.9)
		Previous pregnancies	10 (7.4)
		None	106 (78.5)

BMI: body mass index; M: mean; SD: standard deviation.

Table 2. Clinical presentation of cholelithiasis patients.

Variable	Category	Total n = 135 (%)
Clinical situation	Biliary colic	114 (84.44)
	Chronic abdominal pain	17 (12.59)
	Asymptomatic	4 (2.96)
Complications associated	Cholecystitis	54 (40)
	Pancreatitis	26 (19.2)
	Choledocholithiasis	7 (5.2)
	None	48 (35.5)
Preoperative diagnostic imaging	HBU	135 (100)
	HBU + MRCP	28 (20.7)
	HBU + MRCP + ERCP	7 (5.18)
Evolution time (days) (M-SD)		85 (148)

HBU: hepatobiliary ultrasound imaging; MRCP: magnetic resonance cholangiopancreatography; ERCP: endoscopic retrograde cholangiopancreatography.

DISCUSSION

In the last two decades, CL in the pediatric population has been associated with risk factors similar to those found in adult patients, such as epidemic obesity and endogenous and exogenous estrogens^(1,3,5). Similarly to other series, most patients in this study were adolescents (87.4%),

female (72.5%), and overweight or obese (33.3%), and they had cholesterol stones (86%). Pathogenesis could be explained by cholesterol saturation and subsequent precipitation in the bile, as well as gallbladder dysmotility⁽⁶⁻¹⁰⁾.

In general, approximately 60% of children and adolescents with CL are symptomatic^(2,4,11). The most frequent CL clinical presentation in this study was biliary colic (84.4%).

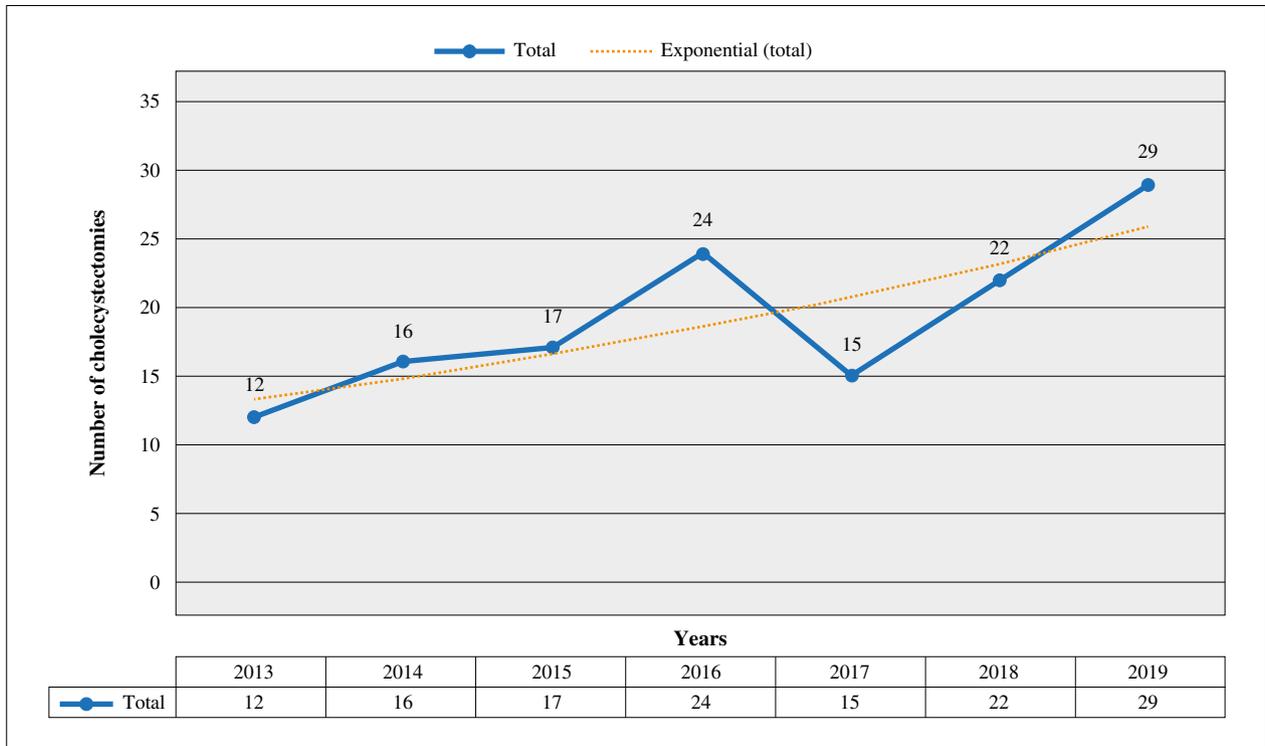


Figure 1. Number of cholecystectomies in the 2013-2019 period.

Table 3. Surgical management of cholelithiasis patients.

Variable	Category	Total n = 135 (%)
Surgical approach	Laparoscopy	131 (97)
	Converted laparoscopy	4 (2.96)
Priority	Urgent	81 (53.8)
	Elective	54 (46.2)
Surgical findings	Cholelithiasis (CL)	76 (56.29)
	Cholecystitis (CC)	56 (41.48)
	CL + CLD	3 (2.22)
Pathological report	CL without cholecystitis	41 (30.4)
	CL + acute cholecystitis	62 (45.9)
	CL + chronic cholecystitis	32 (23.7)
Gallstone type in pathological report	Cholesterol gallstones	117 (86.6)
	Pigment gallstones	8 (5.9)
	Mixed gallstones	10 (7.4)
Postoperative complications	Residual CLD	2 (1.48)
	SSI	2 (1.48)
	CBD lesion	2 (1.48)
	None	129 (95.5)
Hospital stay (days) (M-SD)		5,7 (4)
Postoperative follow-up (months) (M-SD)		2,3 (1.9)

CL: cholelithiasis; CC: cholecystitis; CLD: choledocholithiasis; SSI: surgical site infection; CBD: common bile duct; M: mean; SD: standard deviation.

87 cases (64.4%) of CL complication were recorded. Complications included CC, BP, and CLD, in this order. Symptomatic CL series in adolescents report complication rates of up to 30%, so higher than those found in adults (10-15%)^(3,4,10,12). The reasons why CL complication rate is so high in our study could be long evolution time until surgery (mean: 85 days) – since our healthcare facility is the only highly complex pediatric care center in southwestern Colombia – and the fact a significant proportion of patients (44.5%) come from a rural background.

Figure 1 demonstrates an annual increase in the number of cholecystectomies from January 2014 to December 2019. There is a consensus in international literature that laparoscopic cholecystectomy is recommended for symptomatic CL, regardless of the presence of concomitant complications. In this study, 60% of cholecystectomies were urgent, indicated for symptomatic or complicated CLs, as a result of our healthcare facility's geographic location and patient background, as previously described. The indication for early cholecystectomy is supported by various publications, which report a 5% increase in complication risk for every 10 days surgical treatment is postponed^(3,4,9).

All patients underwent minimally invasive surgery. Postoperative complication rate was 5.3%, and conversion to open surgery rate was 3.7%, similar to those reported in other studies, with 9-15% and 0.5-4% ranges, respectively^(3,6,13,14). In three cases, conversion to open surgery was required for CBD exploration purposes, since CLD had been found intraoperatively. Postoperative hospital stay was long (mean: 5.7 days). This could be explained by patient geographic background and the fact CL complication rates were higher.

The transverse, retrospective review of our study, with a small patient cohort and a short postoperative outpatient follow-up period (mean: 1.8 months), represents a limitation in terms of statistical analysis power. Therefore, this series could be used as a base for future multicenter retrospective and prospective studies, which will help implement the best algorithm for diagnosis and management of CL and CL associated complications in the pediatric population.

CONCLUSIONS

Non-hemolytic cholelithiasis in the pediatric population is more frequent in female overweight or obese adolescent patients.

Symptomatic cholelithiasis is associated with higher risk of complications such as cholecystitis, pancreatitis, or choledocholithiasis, which supports early surgical management.

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