Cholelithiasis during pregnancy and postpartum: prevalence, presentation and consequences in a Referral Hospital in Baja California Sur

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Abstract

Introduction: *Pregnancy and the postpartum period are risk factors for developing biliary sludge, gallstones, and any of their complications.* **Objective:** *To determine the prevalence, presentation, and consequences of cholestasis during pregnancy and postpartum in a referral hospital of Baja California Sur.* **Material and Methods:** *This was a retrospective, observational study that enrolled pregnant or postpartum patients diagnosed with gallstones with any presentation.* **Results:** *137 patients were included with 22 ± 4 years of age; 33 were pregnant and 104 in the postpartum period. Only 14% of the group had a history of cholelithiasis, and overweight/obesity was observed in 66.7 and 66.3% of pregnant and postpartum patients, respectively (p = 0.94). Of pregnant patients, 33.3% presented with acute cholecystitis, a condition observed in 16.3% of the postpartum patients (p = 0.04). Pancreatitis and choledocholithiasis were slightly more common in pregnant women (21.23% vs. 19.2%; p = 0.56). There was no maternal mortality and one case of spontaneous abortion was exclusively observed.* **Conclusions:** *It is a priority to diagnose and monitor cholelithiasis in pregnant women because the acute cases observed occurred more frequently, but choledocholithiasis and pancreatitis occurred similarly in both groups.*

KEY WORDS: *Acute cholecystitis. Chronic cholecystitis. Cholelithiasis. Choledocholithiasis. Pancreatitis. Pregnancy. Puerperium.*

Introduction

In Mexico, the prevalence of cholelithiasis in the general population is 14.3%[1]. This prevalence tends to increase with age by up to 25% after 60 years and 33% after 70 years of age[2]. Choledocholithiasis occurs more commonly in females, and even more in young people with obesity or who consume lithogenic medications such as contraceptives[3].

Gallbladder inflammation, or cholecystitis, has mostly a lithiasic etiology, and it occurs in 90%-95% of acute episodes, generally by obstruction of the cystic duct when a gallstone impacts on it or on the gallbladder neck. Bacterial colonization is present the bile in more than 75% of acute episodes: bacteria come from the duodenum by the ascending route, or through arterial, portal or lymphatic circulation[4].

Pregnancy and the postpartum period are physiological conditions that favor the development of gallbladder lithiasis due to an increase in serum cholesterol and triglycerides, an increase in their elimination through the bile and increase of biliary pigments owing to continuous hemolysis and to weight gain itself during gestation, as well as rapid loss during the puerperium or postpartum period[5,6].

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Estrogen plays an important role in lithogenesis, mainly by increasing cholesterol synthesis. The cholesterol secretion rate is proportional to the secretion of biliary acids and phospholipids, and as a result, the bile becomes saturated and causes de formation of calculi. An increase in estrogen receptors caused by pregnancy has been also described, specifically alpha-type estrogen receptors present in the liver and gallbladder[7].

Together with the above, pregnancy creates a state of gallbladder dyskinesia caused by relaxation of the gastrointestinal tract hollow viscera soft muscle by progesterone, which also increases sphincter of Oddi's tone[7-9].

Pregnancy and puerperium are with no doubt factors that increase the risk for the development of biliary sludge, gallbladder lithiasis and any of their complications, such as acute cholecystitis, gallbladder hydrops, empyema of gallbladder, gallbladder necrosis, choledocholithiasis, cholangitis or pancreatitis.

The main cause of non-obstetric abdominal surgical pain during pregnancy is acute appendicitis, which occurs in one out of every 1200-1500 pregnancies. The second place is for cholelithiasis. Around 10% of pregnant women have ultrasound-demonstrable gallbladder lithiasis, and most these cases are asymptomatic; only one in every 1600-10,000 pregnant women requires cholecystectomy during pregnancy. In addition to acute gallbladder inflammation, during pregnancy or postpartum, patients can suffer other complications such as choledocholithiasis, cholangitis and biliary pancreatitis[8,10-13].

Asymptomatic gallbladder lithiasis treatment is conservative, as it also is for mild pancreatitis or non-complicated acute cholecystitis episodes, although some evidences suggest a deleterious effect of this type of management on the maternal-fetal dyad[14]. However, cholecystectomy may be required (open or laparoscopic, according to gestational age) and even an endoscopic retrograde cholangiopancreatography (ERCP) for the treatment of obstructive choledocholithiasis, cholangitis and biliary pancreatitis[15].

The purpose of this work is to know the prevalence of symptomatic cholelithiasis and its complications during pregnancy, the puerperium and late postpartum period, as well as its possible impact on maternal and fetal or infant mortality in a population from a reference hospital in Baja California Sur.

Methods

This was a retrospective, observational study of all hospital discharges classified, according to the ICD-10, as gallstone with cholecystitis or without complications in pregnant patients during the puerperium or late postpartum period up to 1 year, during the period encompassed between January 1, 2009 and December 31, 2013, at the Juan María de Salvatierra Hospital. Baseline demographic variables were captured, including age, occupation, socioeconomic status and history of cholecystitis, as well as gestation weeks, number of days of puerperium and follow-up up to one year postpartum. The presence of cholecystitis was also captured, which was divided into chronic lithiasic cholecystitis (CLC) and acute lithiasic cholecystitis (ALC); the first case, in women with symptoms of the postprandial pain-type at the right hypochondrium, irradiating to the scapular region, constant or colicky, associated with the ingestion of cholecystokinetic foods; in the second case, manifestations were acute, associated with nausea, vomiting, signs of peritoneal irritation and tachycardia, with or without low-grade fever or fever (temperature of 37.2-37.9 °C or > 38 °C, respectively). In either case, the diagnosis required ultrasound confirmation, with acute episodes being differentiated by the presence of gallbladder wall thickening (more than 3.5-mm thickness) with distension or "sandwich" appearance of the wall and presence of gallstones with acoustic shadow. Choledocholithiasis was defined as the presence of gallstones in the bile duct demonstrated by imaging and common bile duct dilatation greater than 8 mm, or extrahepatic bile duct dilatation or observation of a gallstone associated with posterior acoustic shadow and obstructive symptoms (jaundice) with CLC or ALC. Pancreatitis was defined as epigastric, sharp, stabbing abdominal pain associated with nausea and vomiting, with ALC or CLC, and amylase and lipase enzymes elevation 3-fold above the reference values. Treatment of the disease was divided in open or laparoscopic cholecystectomy, with or without bile ducts' exploration and assessment thereof by endoscopy (ERCP) associated with open or laparoscopic cholecystectomy.

Morbidity was classified according to the specific type of medical or surgical complication, and if there was abortion, perinatal or maternal death as a consequence of the pancreatobiliary condition.

The descriptive analysis was made by means of mean and standard deviation calculation for quantitative variables and by means of crude numbers and percentages for qualitative variables. Statistical inference was made with Student´s parametric t-test for independent samples and the chi-square test or Fisher's exact test (or both), respectively. To establish the

Table 1. General characteristics of the studied patients (n = 137)

		n	%
Occupation	Homemaker	70	51.1
	Merchant	6	4.4
	Employee	23	16.8
	Professional	4	2.9
	Student	34	24.8
BMI level	Normal	45	32.8
	Overweight	50	36.5
	Obesity	42	30.7
Socioeconomic status	Low	83	60.6
	Middle-low	54	39.4
History of gallbladder disease	Yes	19	13.9
	No	118	86.1
Diagnosis	CLC	109	79.6
	CLC and choledocholithiasis	11	10.0
	CLC and pancreatitis	3	2.8
	ALC	28	20.4
	ALC and choledocholithiasis	7	25.0
	ALC and pancreatitis	6	21.4
Treatment	Open cholecystectomy	93	67.9
	Laparoscopic cholecystectomy	23	16.8
	Open cholecystectomy + BDE	16	11.7
	ERCP + open cholecystectomy	3	2.2
	ERCP + laparoscopic cholecystectomy	2	1.5
	Total	137	100

ALC: acute lithiasic cholecystitis; BDE: bile duct exploration; BMI: body mass index; CLC: chronic lithiasic cholecystitis.

association and risk between the state of pregnancy and postpartum, odds ratios were established with 95% confidence intervals (ICs). Every p-value < 0.05 was considered to be statistically significant. For the processing of data and statistical analysis, the Microsoft Excel 2007 (Redmond, WA, USA) and SPSS for Windows (version 20, IBM Corp., Armonk, NY, USA) programs were used.

The present study protocol has the approval of the Local Teaching, Research and Ethics Committee of the Juan María de Salvatierra General Hospital, of La Paz, B.C.S., with registration number R-01-01-2014. According to the Mexican United States General Statute of Health, this study is classified as free of risk, and patient-signed informed consent was therefore not required.

Results

During the development of the study, 1522 pregnant or puerperal women were admitted to the hospital unit, out of which 137 (9%) had any of both aforementioned conditions; out of these, 33 were pregnant and 104 were at postpartum period. Mean age was 22.0 ± 4.0 years. Pregnant patients had prenatal control with an average of 4 medical appointments over the course of gestation. As shown in table 1, most patients were homemakers or students of low or middle-low socioeconomic status. Overweight or obesity was found in 67.1% (92). As to the pregnancy status, the women had an average of 34 weeks of gestation. Those who were in the postpartum period received follow-up for up to 12 months after the event. Only 13.13% of patients were aware of being cholelithiasis carriers. As also shown in table 1, 79.6% (n = 109) of patients had CLC, out of which 12.8% (n = 14) had also choledocholithiasis or biliary pancreatitis. Conversely, only 20.4% of patients had ALC, but 46.4% of these patients (n = 13) had choledocholithiasis or pancreatitis, with the difference being statistically significant (p = 0.01; OR: 3.01; 95% CI: 1.07-8.91).

The most widely used treatment was open cholecystectomy in 67.9% of cases (n = 93), followed by laparoscopic cholecystectomy in 16.7% (n = 23). Bile duct open exploration was carried out in 17 cases, and ERCP was carried only out in 5 patients.

Table 2. Inferential statistics between pregnant status and postpartum status (n = 137)

	Variable	Pregnancy (n = 33)	Postpartum (n = 104)	p-value* (OR; 95% CI)
Occupation	Homemaker	13 (39.4%)	57 (54.8%)	0.18
	Merchant	2 (6.1%)	4 (3.85%)	(0.59; 0.25-1.39)
	Employee	8 (24.2%)	15 (14.4%)	
	Professional	0	4 (3.85%)	
	Student	10 (30.3%)	24 (23.1%)	
BMI level	Normal	11 (33.3%)	34 (32.7%)	0.94
	Overweight	12 (36.4%)	38 (36.5%)	(1.03; 0.41-2.54)
	Obesity	10 (30.3%)	32 (29.8%)	
Socioeconomic status	Low	16 (48.5%)	67 (64.4%)	0.10
	Middle-low	17 (51.5%)	37 (35.6%)	(0.52; 0.22-1.23)
History of gallbladder disease	Yes	3 (9.1%)	16 (15.4%)	0.27
	No	30 (90.9%)	88 (84.6%)	(0.55; 0.21-2.21)
Diagnosis	CLC	22 (66.6%)	87 (83.7%)	0.04
	CLC/choledocholithiasis	2 (6.06%)	9 (8.7%)	(0.40; 0.15-1.08)
	CLC/pancreatitis	1 (3.03%)	2 (1.8%)	
	ALC	11 (33.3%)	17 (16.3%)	
	ALC/choledocholithiasis	1 (3.03%)	6 (5.8%)	
	CLC/pancreatitis	3 (9.09%)	3 (2.9%)	
Treatment	Open chole.	28 (84.8%)	65 (62.5%)	0.03
	Lap. chole.	2 (6.1%)	21 (20.2%)	(4.4; 0.92-28.7)
	Open chole. + BDE	3 (9.1%)	13 (12.5%)	
	ERCP + open chole.	0	3 (2.9%)	
	ERCP + lap. chole.	0	2 (1.9%)	
Complications	Biloma	0	1 (1%)	0.42
	Abortion	1 (3%)	-	(3.22; 0.0-121.8)

*By means of chi-square test or Fisher's exact test.
95% CI: 95% confidence interval; ALC: acute lithiasic cholecystitis; BDE: bile duct exploration; BMI: body mass index; CLC: chronic lithiasic cholecystitis; ERCP: endoscopic retrograde cholangiopancreatography; lap. chole.: laparoscopic cholecystectomy; open chole.: open cholecystectomy; OR: odds ratio.

The characteristics of the pregnant women and of those who were at postpartum period are shown in table 2. A total of 33 patients were pregnant, with a mean gestational age of 34 weeks. Forty percent of the patients had their first pregnancy, 45% had their second and 15% had had 3 or more gestations. One-hundred and four patients were at postpartum period, 54% of them with less than 100 postpartum days and 46% with up to 365 postpartum days. Of the entire sample, 86.1% of patients had no history of gallbladder disease, and among those who were pregnant, 90.9% were not aware of being cholelithiasis carriers. Of the pregnant patients, 33.4% (n = 11) had ALC and of those in the postpartum period, only 16.4% (n = 17) had an acute presentation, with the difference being statistically significant (p = 0.04; OR: 0.40; 95% CI: 0.15-1.08). The proportion of pregnant and postpartum patients that developed choledocholithiasis or pancreatitis in the presence of CLC was 9.1% and 10.5%, respectively (p = 0.81). In the presence of ALC, the proportion of complications was slightly higher in pregnant patients (12.13% and 8.7%, respectively), but the difference was not statistically significant (p = 0.86).

A larger number of pregnant women underwent open cholecystectomy and, in addition, in the postpartum women subgroup, a larger proportion underwent laparoscopic cholecystectomy, with the difference being statistically significant (p = 0.03; OR: 4.4; 95% CI: 0.92-38.7) and closely related to higher gestational age. Among associated symptoms, more than 40% of patients experienced nausea and epigastric pain, initially attributed to gastritis. There were no maternal or perinatal deaths.

Morbidity included an abortion in a woman with less than 20 weeks' gestation. In postpartum patients, there was one case of bile collection without bile duct lesion in a patient who underwent laparoscopic

cholecystectomy. There were no differences in terms of morbidity or maternal mortality between groups. Minimum hospital length of stay was 3 days, and the maximum was 10 days in the cases with pancreatitis.

Discussion

In the year 2007 alone, 218,490 cholecystitis-related medical consultations were offered and 69,675 cholecystectomies were performed at the IMSS, the largest social security institution in Mexico; in addition, cholecystitis and cholelithiasis were the seventh cause of hospital discharge[16].

At the *Benemérito Hospital General Juan María de Salvatierra*, which is a state reference center and site of the present study, the most widely practiced surgical procedure is cholecystectomy, after obstetric events. In this study, 137 pregnant and puerperal patients were included and received postpartum follow-up for one year, with a gallbladder lithiasis prevalence of 9% being found, which is higher than that reported in the literature[17].

The cohort of patients displayed a very young mean age. Although the prevalence of cholelithiasis is high in this state, average weeks of gestation at the moment of management was 34 weeks, which we attributed to medical management of painful episodes, such as gastritis and spastic colon, either by the patient herself or her physician. This also influences on the variable where the patients refer no history of gallbladder disease, since probably they were not adequately diagnosed. Although epigastric pain during pregnancy has other connotations, it is a sign of alarm for preeclampsia. Observations in this regard have found patients diagnosed with preeclampsia and epigastric pain where pain was associated up to 7% with bile duct pathology[18].

Low and middle-low economic status constantly prevailed in both groups. This factor might influence on self-medication and less medical care-seeking, which entails lithiasic disease exacerbation, as we observed in pregnant women. Another factor commonly associated with poverty is poor health education, and prenatal gallbladder disease intended search might facilitate early detection in case of a history of unspecific abdominal pain over the course of pregnancy. The above premise includes health professionals, who should bear in mind the cholelithiasis diagnosis in order to facilitate its early detection.

Overweight and obesity, which were present in 69.7% of pregnant women and in 66.3% of those who were in the postpartum period, deserve special comment. Obesity is a predisposing factor for the development of cholelithiasis and cholecystitis, with their corresponding complications. In Mexico, 33.1% of women older than 18 years suffer from obesity[19]; according to the 2012 National Survey on Health and Nutrition (ENSANUT – *Encuesta Nacional de Salud y Nutrición*), the prevalence of overweight and obesity in the female population of the state of Baja California Sur was 79.9%. Among those older than 20 years, 45.3% had obesity (body mass index > 30 kg/m^2)[20]. In addition, this survey found that, in the period encompassed between 2006 and 2012, there was a decrease in the number of female patients with overweight, together with an increase in the number of those with obesity[21].

Similarly, it is important to point out out that maternal mortality is a subject of vital importance for the Observatory of Maternal Mortality of Mexico, since, in 2014, 893 maternal deaths were reported in the country, and this number has not been able to be decreased this year, in spite of efforts made by the authorities, since, by the 26th week of the year 2015, there were already 342 maternal deaths recorded in the country[22,23], after a decrease in maternal mortality had been observed in the 2012-2013 period in Baja California Sur[24].

The most common treatment in our hospital continues to be open cholecystectomy. This is attributed to the fact that most were emergency surgeries, as well as to the limitation of staff availability for laparoscopic procedures in all shifts; however, there is a marked trend towards laparoscopic cholecystectomy in the puerperium and during follow-up, with the procedure being regarded as elective surgery.

On the other hand, the incidence of mild pancreatitis was higher in pregnant women in comparison with those who were in the postpartum period, with no statistical difference and without maternal or perinatal mortality ocurring. Biliary-origin pancreatitis non-serious evolution has been also reported in other series[25].

The evolution in the management of pancreatitis during pregnancy has shown better results over the years, which results from diagnostic and therapeutic techniques improvement and specialized human resources development for the care of the obstetric patient, as well as for neonatal care[26,27].

Pancreatitis was of biliary origin in the entire cohort, which was demonstrated by ultrasound studies or during surgery by using cholangiography. The use of preoperative ERCP was limited, and the trend is still

towards open cholecystectomy with bile duct exploration if required. Even when safety of this procedure has been demonstrated, the main limitations in these cases are lack of infrastructure and insufficient medical staff. Success of this procedure depends on the experience of those who perform it, in order to avoid multiple cannulation attempts and to decrease patient time of exposure to sedation and radiation[28]. To avoid complications due to delays and lack of adequate infrastructure, the open surgical approach is preferred. According to experience in our hospital center with this type of procedures, durgical time is on average shorter than 90 minutes, and hospital stay is no longer than 3 days. Even when we know that that with laparoscopic surgery hospital length of stay is shorter, the hospital administrative process for such a procedure is an important factor that equates the days of hospital stay for an open surgery.

We should mention that, in general, all pregnant patients have access to medical services at any trimester of pregnancy, a situation that offers the opportunity to identify the presence of biliary pathology and, in addition, to introduce its knowledge in the health education sessions that are offered to patients, as well as to review cases in the obstetrics and gynecology department, so that examinations are conducted more thoroughly in order to detect any biliary pathology, especially considering that more than 40% of patients in our hospital are diagnosed late, in addition to the lack of non-typical symptoms of biliary colic. Clinicians should have the astuteness to suspect the presence of biliary duct pathology, bearing in mind the anatomical and physiological changes that are characteristic of pregnancy[29].

Ultrasound is a diagnostic auxiliary test that is available in most medical units. As standard procedure, patients undergo at least 2 obstetric ultrasounds throughout pregnancy, a situation that may be taken advantage of to examine the bile duct. In addition, it remains an auxiliary first-line imaging test in pregnant women with abdominal pain[30], which gives the opportunity to offer early, elective surgery if required, with the least possible morbidity. Surgery by the laparoscopic route has been shown to be safe during pregnancy, since it doesn't increase maternal and perinatal mortality with regard to the standard procedure[17,31,32], as well as pregnancy and cholecystectomy resolution, if that were the case[33]. Choledocholithiasis resolution in a single event with ERCP and laparoscopic cholecystectomy in a pregnant woman with satisfactory results has also been reported[34].

Our series of patients experienced pain exacerbation and had to be hospitalized for cholecystectomy in the postpartum period. As a general rule, all patients diagnosed with cholelithiasis have a more complex presentation 90 days after delivery, which warrants surgery. Therefore, it is important identifying those mothers who present with gallstones, with or without symptoms, during pregnancy. There is a series of 56 patients, analyzed by Veerappan et al.[35], who only underwent prepartum ERCP and presented with symptoms 3 months after delivery, requiring emergency cholecystectomy and thus increasing morbidity.

In view of all the above, the presence gallbladder lithiasis should be intentionally searched for in pregnant patients' prenatal control, and health education with regard to this condition should be increased; therefore, we suggest for liver and bile duct ultrasound to be performed at second trimester of pregnancy as screening in search for gallbladder lithiasis, or sooner if the patient has suspicious symptoms. There was an association between pregnancy and cholelithiasis complications, although only one abortion was observed in the group of pregnant women, with no maternal mortality in both women's groups.

References

1. Méndez Sánchez N, Uribe Esquivel M, Jessurun Solomou J, Cervera Ceballos E, Bosques Padilla F. Epidemiology of gallstone disease in Mexico. Rev Invest Clin. 1990;42(Suppl):48-52.
2. Méndez-Sánchez N, Jessurun J, Ponciano-Rodríguez G, Alonso-de-Ruiz P, Uribe M, Hernández-Avila M. Prevalence of gallstone disease in Mexico. A necropsy study. Dig Dis Sci. 1993;38:680-3.
3. Ambriz-González G, Bañuelos CD, Gómez-Hermosillo L, Gutiérrez-Jiméminez T, Balderas-Peña LM, González-Ojeda A. Pediatric laparoscopic cholecystectomy. Cir Cir. 2007;75:275-9.
4. Margenthaler J, Schuerer D, Whinney R. Acute cholecystitis. Clin Evid. 2004;(12):571-80.
5. Méndez-Sánchez N, Chávez-Tapia NC, Uribe M. Obesidad y litiasis. Gac Med Mex. 2004;140(Suppl 2):S59-66.
6. Pérez-Ramírez M, Pérez-Ramírez R, Hartmann-Guilarte A. Enfermedad litiásica biliar en pacientes embarazadas. Estudio ecográfico. Rev Cubana Obstet Ginecol. 2001;27:124-8.
7. de Bari O, Wang TY, Liu M, Paik CN, Portincasa P, Wang DQ. Cholesterol cholelithiasis in pregnant women: pathogenesis, prevention and treatment. Ann Hepatol. 2014;13:728-45.
8. De-Madaria E. Litiasis biliar, pancreatitis aguda y CPRE en el embarazo. Gastroenterol Hepatol. 2008;31(Supl 5):36-8.
9. Méndez-Sánchez N, Chávez-Tapia NC, Uribe M. Pregnancy and gallbladder disease. Ann Hepatol. 2006;5:227-30.
10. Maringhini A, Lankisch MR, Zinsmeister AR, Melton LJ, III, DiMagno EP. Acute pancreatitis in the postpartum period: a population-based case-control study. Mayo Clin Proc. 2000;75:361-4.
11. Valdivieso V, Covarrubias C, Siegel F, Cruz F. Pregnancy and cholelithiasis: pathogenesis and natural course of gallstones diagnosed in early puerperium. Hepatology. 1993;17:1-4.
12. Hernández A, Petrov MS, Brooks DC, Banks PA, Ashley SW, Tavakkolizadeh A. Acute pancreatitis and pregnancy: a 10-year single center experience. J Gastrointest Surg. 2007;11:1623-7.
13. Robertson KW, Stewart IS, Imrie CW. Severe acute pancreatitis and pregnancy. Pancreatology. 2006;6:309-15.
14. Jackson H, Granger S, Price R, Rollins M, Earle D, Richardson W, et al. Diagnosis and laparoscopic treatment of surgical diseases during pregnancy: an evidence-based review. Surg Endosc. 2008;22:1917-27.
15. Hammarstrom LE, Stridbeck H, Ihse I. Effect of endoscopic sphincterotomy and interval cholecystectomy on late outcome after gallstone pancreatitis. Br J Surg. 1998;85:333-6.
16. Guía de Práctica Clínica Diagnóstico y Tratamiento de Colecistitis y Colelitiasis. México: Instituto Mexicano del Seguro Social; 2009. Disponible en: http://www.imss.gob.mx/profesionales/guiasclinicas/Pages/guias.aspx

17. Pinilla-Lizárraga R, Romero E, Rojas L, Claros N. Management of the sintomatic lithiasic gallblader disease during pregnancy. Rev Med La Paz. 2014;20:23-9.
18. Vázquez-Rodríguez JG, Pérez-Rodríguez MJ. Frecuencia y curso clínico de la litiasis biliar en pacientes con preeclampsia severa. Ginecol Obstet Mex. 2010;78:583-9.
19. Global Health Observatory Data Repository: Obesity (body mass index ≥30) (age-standardized estimate). Data by country. World Health Organization. (Consultado el 6/8/2015.) Disponible en: http://apps.who.int/gho/data/view.main.2450A?lang=en
20. Centro Nacional de Programas Preventivos y Control de Enfermedades. Estrategia estatal para la prevención y el control del sobrepeso, la obesidad y la diabetes en Baja California Sur. (Consultado el 6/8/2015.) Disponible en: http://www.cenaprece.salud.gob.mx/programas/interior/adulto/descargas/pdf/EstrategiaSODBajaCaliforniaSur.pdf
21. Encuesta Nacional de Salud y Nutrición. Resultados por Entidad Federativa. 2012. Baja California Sur. Instituto Nacional de Salud Pública. (Consultado el 6/8/2015.) Disponible en: http://ensanut.insp.mx/informes/BajaCaliforniaSur-OCT.pdf
22. Observatorio de mortalidad materna de México. Boletines de mortalidad materna 2014. (Consultado el 6/8/2015.) Disponible en: http://omm.org.mx/index.php/boletines-de-mortalidad-materna-2011/boletines-2014.html
23. Observatorio de mortalidad materna de México. Boletines de mortalidad materna 2015. (Consultado el 6/8/2015.) Disponible en: http://omm.org.mx/index.php/boletines-de-mortalidad-materna-2011/2015.html
24. Observatorio de mortalidad materna de México. Avances y retrocesos por entidad federativa 2013. (Consultado el 6/8/2015.) Disponible en: http://omm.org.mx/index.php/avances-y-retrocesos-de-la-rmm-por-entidad-federativa.html?id=213:avances-y-retrocesos-por-entidad-federativa-2013%20
25. Villalonga R, Calero-Lillo A, Charco R, Balsells J. Pancreatitis aguda durante la gestación, experiencia de 7 años en un centro de tercer nivel. Cir Esp. 2014;92:468-71.
26. Murcia MA, Rojas F, Polanía DF. Acute pancreatitis in pregnancy. Revista Facultad de Salud – RFS. 2012;4:99-108.
27. Nares-Torices MA, Hernández-Pacheco JA, Poblano-Morales M, Estrada-Altamirano A, Flores-Cortés MI. Curso clínico y pronóstico materno-fetal en mujeres embarazadas con pancreatitis aguda. Reporte de 6 casos. Rev Chil Med Inten. 2013;28:135-42.
28. García-Cano J, Pérez-Miranda M, Pérez-Roldán F, et al. ERCP during pregnancy. Rev Esp Enferm Dig. 2012;104:53-8.
29. Diegelmann L. Nonobstetric abdominal pain and surgical emergencies in pregnancy. Emerg Med Clin North Am. 2012;30:885-901.
30. Glanc P, Maxwell C. Acute abdomen in pregnancy. Role of sonography. J Ultrasound Med. 2010;29:1457-68.
31. Date RS, Kaushal M, Ramesh A. A review of the management of gallstone disease and its complications in pregnancy. Am J Surg. 2008;196:599-608.
32. Hernández Estrada AI, Aguirre Osete X, Pedraza González LA. Laparoscopic cholecystectomy in pregnancy. Five years experience at the Spanish Hospital of Mexico and literature review. Ginecol Obstet Mex. 2011;79:200-5.
33. Juárez A, Rivera AM, Alarcón I, Durán MA, Islas LP, Téllez SE. Colecistectomía durante la resolución obstétrica, evento simultáneo. Clin Invest Gin Obst. 2014;41:77-9.
34. Valadez-Caballero D, González-Santamaría R, Soto-Mendoza H, Alberto Blanco-Figueroa J, Flores-Pantoja JM. Choledocholithiasis and pregnancy. Hybrid laparo-endoscopic treatment in one step. Cir Cir. 2014;82:188-94.
35. Veerappan A, Gawron AJ, Soper NJ, Keswani RN. Delaying cholecystectomy for complicated gallstone disease in pregnancy is associated with recurrent postpartum symptoms J Gastrointest Surg. 2013;17:1953-9.