European Journal of Obstetrics & Gynecology and Reproductive Biology 219 (2017) 35–39

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Review article

Demystifying endoscopic retrograde cholangiopancreatography (ERCP) during pregnancy

Vítor Magno-Pereira[a,*], Pedro Moutinho-Ribeiro[b], Guilherme Macedo[b]

[a] Gastroenterology Department, Hospital Central do Funchal, Madeira, Portugal
[b] Gastroenterology Department, Centro Hospitalar de São João, Faculty of Medicine of Porto University, Porto, Portugal

A R T I C L E I N F O

Article history:
Received 5 August 2017
Received in revised form 30 September 2017
Accepted 4 October 2017
Available online xxx

Keywords:
ERCP
No-radiation
Pregnancy
EUS
Choledocholithiasis

A B S T R A C T

Background: For many years, ERCP was avoided in pregnancy given the concerns regarding the adverse effects that, with special focus on radiation, could occur in the developing fetus. However, the postponement or rejection of ERCP in pregnant women, may lead to a higher risk for mother and fetus, especially when the indication is unequivocal, namely cholangitis, biliary pancreatitis and symptomatic choledocholithiasis.

Summary and key messages: This review aims to summarize the scarce literature on the subject in order to plan ERCP in pregnancy with the highest safety. The use of techniques that reduce radiation and increase the protection of pregnant women allow radiation levels far below the safety limits.

We also discuss the various alternatives of ERCP without radiation. EUS can eliminate the need for ERCP with doubtful choledocholithiasis and plan the best approach in those with previous evidence. The possibility of performing "ERCP" with a linear echoendoscope uniquely under ultrasound control has been described. Conversely, the two-step strategy (initial sphincterotomy with stent placement without fluoroscopy and after delivery, ERCP with lithiasis extraction) proved to be safe obviating fluoroscopy. In conclusion, ERCP can be performed in pregnancy safely and effectively with minimal radiation or even no-radiation at all.

Contents

Introduction . . . 35
Endoscopic retrograde cholangiopancreatography (ERCP): patient selection and indications . . . 36
Risks of radiation exposure and strategies of reduction . . . 36
ERCP complications . . . 37
Non-radiation ERCP . . . 37
ERCP timing . . . 37
Cholecystectomy . . . 38
Conclusion . . . 38
References . . . 38

Introduction

Women are about twice as likely to develop choledocholithiasis compared to men, regardless of the prevalence of cholelithiasis [1]. This discrepancy is more pronounced at younger ages, with a significant reduction in the woman-to-man ratio as the age progresses [2], reflecting the magnitude of the effect of pregnancy and sex hormones.

The litogenicity of female sex hormones is reinforced by studies in which estrogens have been administered to men. In a study with

* Corresponding author at: Department of Gastroenterology, Hospital Central do Funchal Avenida Luís de Camões, nº 57 9004-514 Funchal, Portugal.
E-mail addresses: magnovitorp@gmail.com (V. Magno-Pereira), pmoutinhoribeiro@gmail.com (P. Moutinho-Ribeiro), guilhermemacedo59@gmail.com (G. Macedo).

https://doi.org/10.1016/j.ejogrb.2017.10.008
0301-2115/

patients with prostatic adenocarcinoma, there was an increase in hepatic cholesterol secretion that resulted in an increase in both bile cholesterol saturation and rate of gallstone formation during estrogen treatment [3]. Also, in men with acute myocardial infarction, estrogens increased the risk of biliary lithiasis more than twice [4].

Pregnancy is a major risk factor for biliary lithiasis. The risk increases with frequency and number of pregnancies and reduces with breastfeeding [5]. The risk increases up to 10 times in multiparous compared to nulliparous [6]. During pregnancy there is a decrease in gallbladder motility and a breakdown of cholesterol in bile. These changes are induced by estrogen which increases cholesterol secretion and progesterone which reduces the secretion of bile acids and delays the emptying of the gallbladder. There is also a relative overproduction of hydrophobic bile acids (chenodeoxycholate) which reduces bile's ability to solubilize cholesterol [1,7].

In a prospective ultrasound study with more than 3200 pregnant women without lithiasis (baseline ultrasound), lithiasis or new bile sludge was observed in 7.1% up to the second trimester, 7.9% up to the third trimester and 10.2% up to 6 weeks postpartum. Of the pregnant women with lithiasis or biliary sludge, only 1.2% developed symptoms of biliary pathology [8]. Up to 10% of symptomatic pregnant women develop serious complications such as acute cholecystitis, choledocholithiasis or pancreatitis [9].

Risks of ERCP in pregnancy include risks of sedation, radiation or electrocautery to the fetus, as well as technical difficulties related to the changing maternal anatomy and an increased risk to post-ERCP pancreatitis. Therefore we reviewed each potential risk based on the best available evidence to date.

Endoscopic retrograde cholangiopancreatography (ERCP): patient selection and indications

ERCP is currently established as an essentially therapeutic technique and, in pregnancy, it becomes even more pressing that it is performed for this purpose alone. In this population, it is indicated, as treatment in biliary pancreatitis, symptomatic choledocholithiasis and cholangitis or in the lesions of the pancreatic or biliary duct [10]. The usual risks associated with ERCP, such as perforation, infection, hemorrhage and pancreatitis can have important consequences to both mother and fetus. The fear of inducing irreversible lesions postponed ERCP use for many years in pregnant women.

Nonetheless, it is also relevant to refer that the conservative approach for some of these indications can also be deleterious. As showed in a retrospective study, the conservative management (versus ERCP and/or surgery) of cholelithiasis and its complications in pregnancy is significantly associated with higher recurrent biliary symptoms, number of emergency department visits, number of hospitalizations and cesarean section operations for childbirth [11].

Risks of radiation exposure and strategies of reduction

Fluoroscopy radiation may have both stochastic effects and deterministic effects. The formers, do not present a dose threshold, the likelihood of developing deleterious effects is proportional to the dose but its severity is dose-independent (e.g. leukemia). In the latters, the dose and severity threshold are proportional to the dose (e.g. cataracts) [12]. Hence the concept "as low as reasonably achievable" radiation has emerged [13]. In fact, the European Society of Digestive Endoscopy (ESGE) recommends in its radiation protection guideline that KAP (kerma-area product) should be monitored, and its cumulative value should be recorded for every ERCP and patient [14].

The American College of Obstetricians and Gynecologists (ACOG) has stated in 2016 diagnostic imaging guidelines that: "Fetal risk of anomalies, growth restriction, or abortion have not been reported with radiation exposure of less than 50 mGy, a level above the range of exposure for the diagnostic procedures."[15] In fact, in a study involving 17 ERCPs in pregnant women with a mean fluoroscopy time of 14 s (range 1–48 s), the estimated fetal radiation exposure was 0.40 mGy (range 0.01–1.8 mGy). There was a correlation between fluoroscopy time and radiation exposure, but there was a wide range of exposure for individual fluoroscopy times [16]. In another study, the estimated fetal radiation was 1.02–5.77 mGy (0.00102–0.00577 Gy) [17]. The International Commission on Radiological Protection (ICRP) recommends monitoring fetal radiation when a dose is expected to exceed 0.01 Gy [18] Studies in clinical practice have estimated fetal radiation induced by ERCP of <0.1–5.77 mGy (0.0001–0.006 Gy). Although measurements show low fetal absorbed dose values (clearly below ICRP radiation cutoff), methodologies also demonstrate that minute variations in the procedure including degree of incidence of fluoroscopy, position of the patient, orientation of the fetus and endoscopist experience can have dramatic effects on the final dose absorbed [19].

The risk to the fetus is also dependent on the gestational age. Based on data from atomic bomb survivors, it appears that the risk to the central nervous system is greatest when the exposure occurs at 8–15 weeks of gestation. It has been suggested that the minimum dose for this adverse effect might be 60–310 mGy but the lowest recorded dose to induce severe intellectual disability was 610mGy. After 16 weeks there is a low risk for intellectual disability. [15]

In a study involving 23 pregnant patients submitted to a total of 29 ERCPS, 3 women did not know that they were pregnant [20]. It is important to confirm with all women of childbearing age if they are pregnant at the time of the procedure due to the risks in early pregnancy. Before implantation (0–2 weeks after conception), with a minimum dose of 50–100 mGy the effect can be "all or none": death of embryo or no consequence. During organogenesis (2–8 weeks) the estimated threshold dose is 200 mGy for congenital anomalies (skeleton, eyes, genitals) and growth restriction [15].

Fetal radiation exposure depends on multiple factors such as size and body composition of the mother, gestational age as discussed, position of the mother and fetus and exposure techniques. The use of a lead apron placed inferiorly to the pelvis and lower abdomen of the pregnant woman is recommended although most of the exposure of fetal radiation comes from radiation diffused by the mother, so it is essential to complement this protection with other strategies [16].

There are several strategies to reduce the radiation exposure to the mother and fetus during fluoroscopy: use as little fluoroscopy time and obtain as few spot exposures as possible; keep the image intensifier as close to the patient as possible; use Boost Mode and Magnification Mode only when necessary; use a modern fluoroscopy equipment; collimate x-ray beam to the area of interest and use a low frame-rate. In manual mode, use higher kV (at least 75) and lower mA settings (decrease in patient dose of 50% can be achieved by increasing voltage from 75 kV to 96 kV). Monitoring and recording the amount of fluoroscopy time is another strategy to increase awareness of the endoscopist and reduce the total exposure time [13].

Amniotic fluid is a possible conductor of current to the fetus. Thus, the uterus should not be between the grounding pad and the electrical catheter. The pad should be placed higher in the posterior thoracic wall (rather than the hip). Bipolar electrocautery should be preferred, to minimize this risk [10].

National Radiological Protection Board advises magnetic resonance imaging (MRI) avoidance during the first trimester