

Research Article

Endoscopic Retrograde Cholangiopancreatography with Intraductal Ultrasound in Pregnancy without the Use of Radiation

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Abstract

Goals and background: Biliary disease in pregnancy presents unique challenges. Conservative treatment is associated with recurrent symptoms, and the use of radiographic imaging is limited because of the possibility of fetal exposure. The aim of our study was to evaluate the use of intraductal ultrasound (IDUS) in non-radiation ERCP (ERCP-NR) to treat pregnant women with symptomatic choledocholithiasis or gallstone pancreatitis.

Study: From 2008 to 2014, we retrospectively identified ten pregnant patients at our urban safety net teaching hospital who were treated with IDUS-guided ERCP for symptomatic choledocholithiasis or gallstone pancreatitis. The cases were compiled to provide a descriptive review of ERCP with IDUS.

Results: Of 10 pregnant patients who underwent ERCP, eight patients had prior EUS demonstrating common bile duct stones, and two had gallstone pancreatitis. There were no immediate procedure-related adverse events and no patients required a repeat procedure. All ERCP procedures were successful for removing the bile duct stones and providing symptomatic relief. There were no known immediate or long-term procedure-related adverse events in the infants.

Conclusions: IDUS-guided ERCP-NR provides appropriate biliary imaging without fetal radiation exposure and can be safely and successfully performed in pregnancy.

Introduction

Hormonal changes and weight gain are thought to be predisposing factors to gallstone formation in pregnant woman. Gallstones affect one in 1200 pregnant women, one-third of whom may become symptomatic [1]. Cholecystectomy within the first trimester has been associated with a spontaneous abortion rate of 12%, and cholecystectomy with common bile duct (CBD) exploration has been associated with a maternal mortality rate of 15% and fetal loss rate of 60% [2].

Endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy is considered the most ideal intervention to date for management of biliary stone disease; however, the radiation exposure from ERCP with fluoroscopic guidance may present a risk to the developing fetus.

Guidelines state that radiation exposure should not exceed 1 mSv in the first trimester and 5 mSv over the entire gestation [1,3].

An attempt to quantify fetal radiation exposure in pregnant patients undergoing ERCP found that in 35 therapeutic ERCPs, the estimated exposure was <0.1-0.5 mSv, which is far less than the 5 mSv maximum, with only two births were complicated by pre-term delivery [4]. The above study concluded that ERCP with modified techniques is safe in pregnancy, but a rebuttal contended that those conclusions lacked adequate support [5].

Few studies of fetal radiation exposure exist in the literature and often have small cohorts. For example, one retrospective study measured mean fluoroscopy time and found that despite a mean of 3.8 minutes, 15 of 16 patients had full-term pregnancies [3].

Adequate experimental evidence to support the use of non-radiation ERCP (ERCP-NR) during pregnancy is also lacking, and

several alternative approaches have been attempted with the goal of reducing radiation exposure to the fetus. Multi-step methods include conservative management followed by intervention in the second trimester [6], a two-step endoscopic approach [1], and pre-procedure ultrasound or magnetic resonance cholangiopancreatography (MRCP) [7,8].

With limited data, it appears that relatively few adverse events are associated with the multi-step approach. Single-step alternatives to ERCP with fluoroscopy have also been attempted and include ultrasound-guided, endoscopic ultrasound (EUS)-guided and per-oral cholangioscopy-guided ERCP. Same-session EUS provides information on size, location, and number of stones to guide ERCP and confirm stone clearance without the use of fluoroscopy. Intraductal ultrasound (IDUS) provides a way of assuring bile duct access and complete stone clearance during ERCP.

Our study evaluates the role of IDUS-guided ERCP-NR with the aid of EUS in the management of pregnant women with symptomatic choledocholithiasis or gallstone pancreatitis. To our knowledge, this is the only study using IDUS and captures one of the larger study populations of pregnant women to date.

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Materials and methods

After obtaining Institutional Review Board approval, the endoscopic procedure database was retrospectively reviewed for pregnant patients 18 years and older undergoing ERCP-NR from January 2008 to August 2014 at our urban safety net hospital. Data on patient demographics, ERCP indications, presenting symptoms, procedural aspects, and maternal and fetal outcomes were collected.

The indication for therapeutic ERCP was symptomatic choledocholithiasis in eight patients and gallstone pancreatitis in two patients. Same-session EUS was performed with a radial array echoendoscope (Olympus Inc., UME160) prior to ERCP in eight of the ten patients to determine the presence or absence of extrahepatic duct stones. The remaining two patients had undergone laparoscopic cholecystectomy with intraoperative cholangiography significant for common bile duct stones. Deep selective biliary cannulation was accomplished with a sphincterotome and bile duct access was confirmed by aspiration of bile. IDUS 20 MHz mini-EUS probe (Olympus, Inc., UMG2029R) was then introduced over the wire into the duct in order to confirm wire position in the CBD and estimate the distance needed for balloon advancement above the stone. When a guidewire was needed, a 0.035 inch numerically scored wire via an Ultratome (Boston Scientific, Boston, MA, USA) or a 0.025 inch numerically scored wire via a Jag 39 (Boston Scientific, Boston, MA, USA) was used to monitor the length of the wire advancement into the bile duct. Biliary sphincterotomy using ERBE endocut (ERBE USA Inc., Marietta, GA, USA) was performed, followed by stone extraction using a balloon catheter. The IDUS probe was then reintroduced to confirm stone clearance. A biliary stent was placed when indicated. No fluoroscopy was used in any patients.

Results

Patient characteristics are shown in Table 1. The mean age of the patients was 25.8 years old (range 19-37). Four were Hispanic, four were white, and two were black. The average gestational age was 12 weeks (range 4-33 weeks), with six patients in the first trimester of pregnancy, three in the second, and one in the third. Eight of the patients had symptomatic choledocholithiasis, and two had gallstone pancreatitis. All of the patients presented with abdominal pain, and five presented with nausea and vomiting. All of patients had abnormal laboratory

values including elevated AST and total bilirubin. In addition, nine of ten had elevated ALT, eight had elevated alkaline phosphatase, one had elevated white count, and one had elevated lipase (Table 2).

Of the eight patients who underwent pre-procedure EUS, six were found to have a dilated CBD. Six were also found to have a bile duct stone on EUS, and one was found to have a gallbladder in situ with stones.

Based on the ASGE practice standards, seven patients were classified as high risk and three as intermediate risk for choledocholithiasis [9]. 70% had a high suspicion for bile duct stone, and 30% had intermediate suspicion. Procedural outcomes are shown in Table 3. Sphincterotomy was performed in all patients except one who had a previous biliary sphincterotomy. Stenting was performed in two patients. The average procedure time was 74.9 minutes, ranging from 23 to 196 minutes.

There were no immediate or long-term procedure-related adverse events and no patients required a repeat procedure. All procedures were successful for removing the bile duct stones and providing symptomatic relief; jaundice resolved in all cases.

With regard to fetal outcomes, two patients electively terminated their pregnancies. One infant was born via pre-term Cesarean section at 36 weeks with no further adverse events. One infant was delivered at full term without adverse events, and one infant was delivered at 40 weeks. Four patients were lost to follow-up, and one is pending delivery; the outcomes of their pregnancies are unknown. There were no known immediate or long-term procedure-related adverse events in the infants. No known fetal adverse events were reported.

Discussion

All patients in our study presented symptomatically for choledocholithiasis or gallstone pancreatitis with corresponding laboratory abnormalities and had high clinical suspicion for bile duct stones, confirmed by pre-procedure imaging. All patients subsequently underwent IDUS-guided ERCP-NR with sphincterotomy and/or stenting with no procedural or post-procedural adverse events.

The use of IDUS allowed for visualization of the CBD, confirmation of wire position within the CBD vs. cystic duct, and estimation of the

Table 1. Patient characteristics.

Patients	Age	Gestation (weeks)	Symptoms	Suspicion for bile duct stone	Indication
1	21	6	Abdominal pain, Nausea/Vomiting	Intermediate	s/p lap cholecystectomy with +IOC
2	25	10	Abdominal pain	High	Gallstone pancreatitis
3	27	6	Abdominal pain, Nausea/Vomiting	High	Choledocholithiasis
4	21	14	Abdominal pain	Intermediate	Choledocholithiasis
5	21	16	Abdominal pain, Nausea/Vomiting	High	Choledocholithiasis
6	19	4	Abdominal pain	High	Choledocholithiasis
7	37	8	Abdominal pain, Nausea/Vomiting	Intermediate	s/p lap cholecystectomy with +IOC
8	27	13	Abdominal pain	High	s/p lap cholecystectomy with +IOC
9	33	33	Abdominal pain	High	Gallstone pancreatitis, Cholecystitis
10	27	6	Abdominal pain, Nausea/Vomiting	High	Choledocholithiasis
Summary	Median 25.8 years old (range 19-37)	12 weeks (range 4-33)		High 70% Intermediate 30%	

Table 2. Laboratory values.

Patients	AST	ALT	Alk Phos	T Bili	WBC	Lipase
1	270	219	92	1.5	8.6	17
2	180	334	251	6.7	9.2	381
3	195	327	374	5.3	6.6	NA
4	63	235	172	3.6	8.1	19
5	58	50	69	1.9	7.4	26
6	270	478	206	5.6	9.5	28
7	249	468	274	3.7	7.3	17
8	63	73	208	3	6.1	28
9	92	353	282	2	10.6	65
10	62	172	204	7.9	9.3	19

Legend: AST: Aspartate Transaminase, ALT: Alanine Transaminase, Alk Phos: Alkaline Phosphatase, T Bili: Total Bilirubin, WBC: White Blood Cell count

Table 3. Procedural outcomes.

Patients	CBD (mm)	Bile Duct Stone	Gallbladder <i>in situ</i> with stones	Procedure	Procedure Duration (EUS + ERCP, min)	Sphincterotomy (Y/N)	Stent (Y/N)	Complications
1	NA	Y	N	ERCP/IDUS	23	Y	N	None
2	NA	N	Y	EUS/ERCP/IDUS	29	Y	N	None
3	6.9	Y	N	EUS/ERCP/IDUS	42	Y	N	None
4	2	N	N	EUS/ERCP/IDUS	40	N	N	None
5	6.4	N	N	EUS/ERCP/IDUS	40	Y	Y	None
6	15	Y	N	EUS/ERCP/IDUS	63	Y	Y	None
7	NA	Y	N	ERCP/IDUS	115	Y	N	None
8	NA	Y	N	EUS/ERCP/IDUS	196	Y	N	None
9	10	Y	N	EUS/ERCP/IDUS	92	Y	N	None
10	9.4	N	N	EUS/ERCP/IDUS	109	Y	N	None

distance needed for balloon advancement above the stone without the use of fluoroscopy. IDUS also allowed for confirmation of stone clearance, with the goal of preventing repeat procedures. IDUS is a safe technique with very few procedure-related complications, and our study also had no known post-procedure complications [10].

A review of 180 patients has shown success rates of up to 90% for ERCP-NR with an overall morbidity of 15.6% and 148 healthy infants, and Vohra and colleagues found that same-session EUS in ten pregnant women resulted in ERCP-NR for the six women who had common bile duct stones on EUS [11,12]. None of the patients had any immediate procedure-related adverse events, none required a repeat procedure, and none had adverse fetal effects or adverse events at birth.

Similarly, no patients in our study required a repeat procedure, and there were no known maternal or fetal adverse events, suggesting that single-session ERCP-NR with IDUS is a safe and effective method for the treatment of obstructive jaundice and gallstone pancreatitis in pregnant women.

Our study includes an urban safety net hospital with a high Hispanic population (39%). This population represents a group of women at relatively high risk for stone burden (prevalence of 26.7% in Mexican Americans and 19.1% in Hispanics) [13]. Similar to previous studies, ours is limited as it is a single-center study without consistent long-term follow-up. Possible explanations include the retrospective nature of this study, elective pregnancy termination, and insurance changes allowing these women to choose other centers for pre- and post-natal care and delivery.

Various approaches to ERCP-NR as management for symptomatic choledocholithiasis and gallstone pancreatitis have been attempted in pregnant women, and our study confirms positive maternal and fetal outcomes with no known procedural or post-procedural complications [14]. IDUS-guided ERCP-NR provides appropriate biliary imaging

without fetal radiation exposure and can be safely and successfully performed in pregnancy.

Authorship and contributorship

Dr. Kelsey Chen, Dr. Ashwin Ashok, and Dr. Anuj Datta collected and analyzed the data and drafted the manuscript. Dr. Inder Singh and Dr. Michael Fleischman supervised the study and revised the manuscript. Dr. Sonya Reicher and Dr. Viktor Eysselein revised the manuscript for important intellectual content.

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