

# Endoscopic retrograde cholangiopancreatography

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Cone-beam computed tomography—adding a new dimension to ERCP

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Endoscopic retrograde cholangiopancreatography (ERCP) has revolutionized the diagnosis and treatment of various biliary and pancreatic disorders. However, with advancement in the magnetic resonance imaging technology and availability of magnetic resonance cholangiopancreatography (MRCP), the role of diagnostic ERCP has diminished, and ERCP is now mainly used for therapeutic purposes. Even during therapeutic ERCP, limited visualization of the pancreatic and biliary ducts due to two-dimensional (2D) visualization on current fluoroscopy imaging systems is an important limitation. The newer fluoroscopy systems that have flat detectors can provide three-dimensional (3D) images as well as create multi-planar as well as curved reconstructions and this imaging is known as cone-beam computed tomography (CBCT), flat-detector computed tomography (CT), or C-arm CT. CBCT has been shown to be useful in percutaneous biliary interventions, transjugular intrahepatic portosystemic shunt, percutaneous needle biopsy, and gastrostomy tube insertion as well as abscess drainage by providing improved guidance. Moreover, it has been shown that the total radiation exposure by this technique is lower as it gives better visualization and guidance of interventions.<sup>[1,2]</sup> In this retrospective, single arm, and Tertiary Care Centre study, the authors describe the clinical applications of 3D-ERCP in six patients who underwent various biliary interventions. Six consecutive patients (four males; mean age 69, range 56–80 years) underwent 3D ERCP, and these patients had inconclusive anatomy of the biliary tract, leakage or strictures.

## Technique

After cannulation of the bile duct and opacification by a nondiluted contrast (Peritrist 60%; Dr. Franz Köhler Chemie, Bernsheim, Germany), the area of interest was centered in the fluoroscopy C-arm (Phillips Eleva Multi-Purpose System; Philips Healthcare, Hamburg, Germany). After confirmation of the position, the C-arm was rotated 180° around the patient for 6 s and in the process acquiring 15 images/s. Thereafter, software on a dedicated 3D workstation was used to create the 3D images (Multi-Diagnost Eleva 3D-RX-Option; Philips Healthcare), and this process took approximately 2 min. The ERCP was then continued using the 3D images obtained. The

3D data obtained was used in various ways to guide therapeutic ERCP. The rotational scan provided an overview of the 3D positioning of the anatomic structures and provided 3D images similar to MRCP as well as CT and with these images exact measurements could be taken and the nonbiliary structures could also be visualized.

The median total radiation exposure during the 3D ERCP was 3238  $\mu\text{Gym}^2$  (range 1666–6033  $\mu\text{Gym}^2$ ). The authors found that the 3D image helped in clinical decision-making for all of the patients. Two patients had hilar cholangiocarcinoma and the exact dimensions of the tumor correlated well with the measured stricture length in 3D-ERCP whereas the measurement during the standard ERCP underestimated the size of the tumor. One of the patients had an unclear hilar lesion on standard ERCP that was identified as a ruptured cyst on 3D-ERCP. Another patient had dilated intrahepatic ducts, the cause of which was thought to be Klatskin tumor Bismuth type I on standard ERCP but 3D ERCP revealed a Klatskin type IV tumor with the right hepatic duct originating from the stricture. Two patients had postoperative bile duct leak that was diagnosed on 3D ERCP with one patient having a biliary duct variant with segment 5 draining into the stump of the remnant left hepatic duct. Thus, the authors concluded that diagnosis on the basis of the 2D-ERCP images was changed by the 3D ERCP in two patients and in four patients, the localization of any stenosis or leakage was more precise on 3D ERCP.

## Commentary

The authors need to be complimented for this study that has described novel application of 3D fluoroscopy. They have found that 3D ERCP provide clearer and better visualization of bile duct that provided useful information to guide interventional ERCP. Although, because of increased image acquisition, the radiation exposure with 3D ERCP is more, because of better visualization leading on to quicker procedures, the overall radiation exposure could be decreased. Another advantage of 3D ERCP is its ability to visualize nonbiliary structures on multi-planar constructions. The possible respiratory artifacts due to strong respiratory movements leading on to poor quality images are one of the potential limitations of 3D ERCP.<sup>[1,2]</sup> The initial results of this pilot study are encouraging, and further large sample and multicenter studies in various clinical situations will only determine whether this new ERCP technique is the technique of the procedure.

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## Inamdar S, Berzin TM, Sejpal DV, Pleskow DK, Chuttani R, Sawhney MS, Trindade AJ. Pregnancy is a Risk Factor for Pancreatitis after Endoscopic Retrograde Cholangiopancreatography in a National Cohort Study.

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Endoscopic retrograde cholangiopancreatography (ERCP) is the standard of care of various pancreatic and biliary disorders. It is a minimally invasive procedure that has potential of serious complications such as pancreatitis, bleeding, and perforation. Pregnancy is associated with increased risk of gallbladder and common bile duct stones, and the issue of safety of ERCP in pregnancy has not been adequately addressed.<sup>[3,4]</sup> Most of the studies on this topic are small sample size retrospective studies, and the general consensus is that the risks of ERCP in pregnant females are comparable to those in nonpregnant patients.<sup>[5]</sup> Therefore, the authors evaluated the large database (Nationwide inpatient sample database) of the years 2008 and 2009 of pregnant patients who underwent ERCP and compared the results and complications with age-matched nonpregnant controls. The controls were selected using stratified sampling using SAS 9.2 (SAS Institute, Inc., Cary, NC) whereby 3 nonpregnant control females were selected randomly for each pregnant female drawn from the same 5-year age group. The primary outcomes evaluated in this study were ERCP-related complications (pancreatitis, bleeding, infection, perforation, and mortality) and obstetric complications (premature delivery, fetal complications/distress, and fetal mortality). The secondary outcomes which are evaluated were the length of hospital stay and ERCP failure rate that was defined as the need for percutaneous or surgical drainage.

Nine hundred and seven pregnant females who underwent 4474 ERCP's were compared with 2721 non pregnant controls. The median age of pregnant females who underwent ERCP was 26 years, and this was comparable to that of controls. The most common indication for ERCP among pregnant females was CBD stones, and they were significantly less likely to have ERCP for acute pancreatitis (20% vs. 29% in controls) and biliary stricture (3% vs. 7% in controls). Also, they were less likely to have ERCP for abnormal liver tests and/or jaundice alone. The mean length of hospital stay was 4.7 days in pregnant females, and this was comparable to the hospital stay in nonpregnant females (4.6 days;  $P = 0.83$ ). On subgroup analysis, it was found that there was a nonsignificant trend toward longer length of stay in a teaching hospital (mean: 4.9 days) compared to a nonteaching hospital (mean, 4.4 days). The total cost of hospitalization was also similar in both pregnant as well as nonpregnant females as well as between teaching and nonteaching hospitals.

Post ERCP pancreatitis (PEP) occurred in 12% of pregnant females, and this was significantly higher than the controls (5%;  $P < 0.001$ ). Also, pregnant females (4.1%) were less

likely ( $P = 0.01$ ) to have a pancreatic stent placed for PEP prophylaxis compared with controls (6.4%). The factors associated with risk for PEP were age, hospital size, presence of co-morbid conditions, and sepsis and after adjustment for age, race, hospital size, co-morbidities, teaching hospital status, pancreatic stent placement, and presence of sepsis, the adjusted odds ratio for PEP among pregnant females versus controls was 2.8 (95% confidence interval, 2.1–3.8) with risk being higher in nonteaching hospitals. In contrast to 3 deaths in the nonpregnant patients, there were no deaths in the pregnant females undergoing ERCP, and the mortality rates were comparable to the national average. The risk of preterm labor was lower (1.87%) than the national average (11.5%) whereas the fetal distress (0.33%) or fetal loss (0.67%) were similar to the national average rates. The authors concluded that pregnancy is an independent risk factor for PEP with PEP being more common in community hospitals than teaching centers. Therefore, they suggested that proper precautions should be undertaken for pregnant females undergoing ERCP, including referral to a Tertiary Care Center if appropriate.

### Commentary

The authors of the current study reported a large series examining the complications and outcome of ERCP in pregnancy and reported that ERCP is overall safe in pregnancy with low rates of bleeding, infection, perforation, and maternal-fetal complications that were comparable to controls. However, the frequency of PEP was higher in pregnant females (12% vs. 5%;  $P < 0.001$ ). The reason for higher frequency of PEP in pregnant females is not clear; however, the authors hypothesize that this could be due to significantly lower frequency of usage of prophylactic pancreatic stents. But even after adjustment for pancreatic stent placement, pregnancy was still found to be an independent risk factor for PEP, and hence there could be a physiologic mechanism that predisposes pregnant females to PEP. The data on fluoroscopy time were not reported in this study and more safety data on this topic are needed. Also retrospective nature, absence of data of specifics of the clinical presentation and management as well as of patients who developed PEP after they are discharged from the hospital is important limitations of the study. In spite of these limitations, a large sample size is an important strength of the study. An important message emanates from this study that pregnant females undergoing ERCP are at increased risk for PEP and therefore all precautions should be in place for preventing as well as treating early the PEP.

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