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## Gastroduodenal Reflux of Irrigating Solution during Percutaneous Lithotripsy for Intrahepatic Cholelithiasis

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Percutaneous ultrasonic lithotripsy of renal calculi has been widely accepted by urologists for several years.<sup>1,2</sup> A nephroscope can be introduced into the closed urinary tract system and an ultrasonic probe advanced toward the calculi under direct vision. Once contact is made, the stone can be fragmented and the obstruction relieved. Recently, the concept of ultrasonic fragmentation has been applied to biliary lithiasis. We observed the following unexpected postoperative complication.

### REPORT OF A CASE

A 47-year-old 72-kg female with a long history of biliary disease presented for elective hepatoscopy and ultrasonic intrahepatic lithotripsy. She had been well until 1972, when she presented with cholecystitis. During surgery an 8-inch common duct cyst and generalized common bile duct atrophy was found that was thought to be consistent with Caroli's Disease.<sup>3</sup> Since then she had had multiple surgical procedures involving her biliary tract. During this admission, several attempts at percutaneous stone extraction through an existing T-tube were performed. Because several intrahepatic calculi remained

after manipulation, ultrasonic lithotripsy was scheduled under general anesthesia.

After receiving diazepam 10 mg orally and meperidine 50 mg im, anesthesia was induced with thiopental iv and maintained with nitrous oxide, oxygen, and isoflurane. The previously constructed tract to the right hepatic duct was dilated. A Wolf low-pressure nephroscope was inserted and advanced under direct vision until the calculi were visualized. At the conclusion of the ultrasonic lithotripsy, approximately 7 ls of 0.9% normal saline had been infused for irrigation. During emergence from anesthesia in the operating room, the patient vomited about 1 l of thin, watery gastric contents. She was taken to the recovery room in good condition, where she vomited once more and after a 3-h period of observation was transferred back to her room.

### DISCUSSION

Percutaneous lithotripsy is a relatively new and effective alternative to open lithotomy, which offers a unique opportunity to relieve obstructive intrahepatic and biliary calculi. In endourology, normally the irrigating solution that is not evacuated through the suction of the cystoscope is passed into the ureter and bladder, preventing significant systemic uptake. In contrast, at the conclusion of the present case, irrigating saline remained in the relatively distensible duodenum and proximal jejunum.

A competent pyloric sphincter would prevent duodenal contents from refluxing into the stomach. While much controversy surrounds the issue of whether the pylorus acts as a true sphincter, Fisher *et al.* have studied the effects of intraduodenal saline infusions on barrier pressure and gastroduodenal reflux.<sup>4</sup> Twenty-eight normal subjects, ages 21-76, were fasted overnight, and pressure nanometers were introduced into the duodenum. After recording basal pressures, sphincter pressures were recorded during duodenal infusion of saline and 0.1 N HCl. Phenol red was added to each solution

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to serve as a marker. Sphincter pressure was found to be unchanged during saline infusion, and 34% of the solution refluxed into the stomach. In contrast, duodenal acidification with the HCL resulted in a greater than threefold increase in barrier pressure and only 1.8% reflux.<sup>4</sup> Relating these data to our case, we speculate that up to 2,500 ml saline irrigant could have refluxed into the stomach.

Our patient vomited more than a liter of irrigating saline during the postoperative period. A pH of less than 2.5 and a volume of greater than 0.4 ml/kg generally are associated with the syndrome of acid-aspiration pneumonitis.<sup>5</sup> While our pH was not measured, studies of elective, nonobese inpatients indicate that 80% have a pH of less than 2.5.<sup>5,6</sup> Using worst case estimates (three standard deviations from the means of Stoetling,<sup>5</sup> giving a pH of 1.36 and a volume of 74 ml) and a gastroduodenal reflux equal to the 1 l of vomited volume, pH of the vomitus would have been 2.53. The pH of the vomitus could have been much higher, since 70% of patients have preanesthetic volumes of 25 ml or less, and gastroduodenal reflux could have been as large as 2,500 ml. However, aspiration of large volumes of neutral saline produces a clinical picture with many features of acid-aspiration but without pulmonary necrosis.<sup>7</sup> Thus, while the vomitus of this patient was probably above pH 2.5, its large volume still presented a severe risk for aspiration pneumonitis.

In summary, we describe a case of vomiting on emergence from general anesthesia in a patient who had percutaneous lithotripsy for intrahepatic cholelithiasis. Its cause is presumed to be a large gastric volume of irrigating saline that refluxed retrograde through an "incompetent" pyloric sphincter. We believe that this procedure is associated with an increased risk of vomiting large volumes of gastric contents with the associated possibility of aspiration pneumonitis.

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## Upper Airway Obstruction Following Cyst-to-peritoneal Shunt in a Child with a Dandy-Walker Cyst

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Bilateral vocal paralysis can occur in children with hydrocephalus, meningomyelocele, and the Arnold-Chiari malformation.<sup>1-6</sup> Although paralysis of the left

vocal cord has been associated with cardiovascular and mediastinal malformations, it is rarely found as an isolated lesion.<sup>7</sup> We describe a case of unilateral vocal cord paralysis, resulting in severe upper airway obstruction following insertion of a cyst-to-peritoneal shunt in an infant with a Dandy-Walker cyst.

## REPORT OF A CASE

This patient was the term product of an uncomplicated gestation and vaginal delivery. Apgar Scores were 8 and 9 at 1 and 5 min, respectively. At 4 months of age, a prominent occiput and a head circumference above the 95th percentile was noted. A computerized tomography scan revealed hydrocephalus and a Dandy-Walker cyst.

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