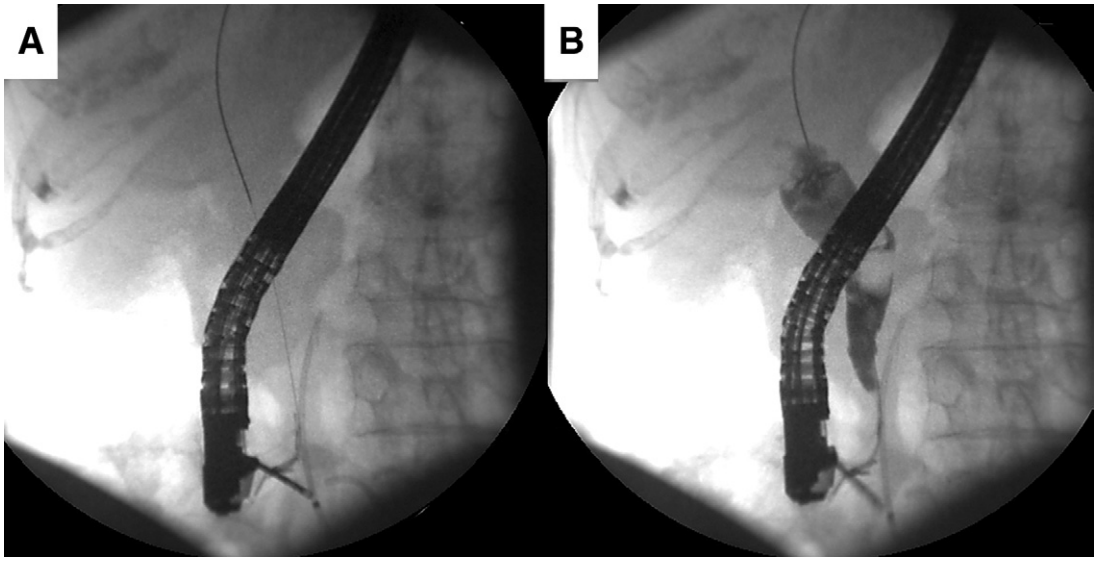

Figure 3. A, Fluoroscopic image showing successful biliary guidewire cannulation over the pancreatic stent while the forceps is anchoring the papilla. **B,** Cholangiogram showing multiple large common bile duct stones.

noscope would alter the angle of the pulled papilla. With minor adjustments, cannulation can be achieved. In conclusion, when a hooded major papilla is encountered at ERCP, traction of the papilla by the use of forceps may be useful.

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REFERENCES

1. Horiguchi S, Kamisawa T. Major duodenal papilla and its normal anatomy. Dig Surg 2010;27:90-3.
2. Bae WY, Yoo BM, Lee KJ, et al. Application of clips during ERCP: a new anchoring method for redundant Kerckring's fold covering the duodenal papilla. Endoscopy 1998;30:S5-6.
3. Mallery S, Matlock J, Freeman ML. EUS-guided rendezvous drainage of obstructed biliary and pancreatic ducts: report of 6 cases. Gastrointest Endosc 2004;59:100-7.
4. Fujita N, Noda Y, Kobayashi G, et al. ERCP for intradiverticular papilla: two-devices-in-one-channel method. Gastrointest Endosc 1998;48: 517-20.

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Novel approach for colonic insufflation via an untethered capsule (with video)

To the Editor:

Capsule endoscopy has quickly become a cornerstone for evaluation of the small intestine. Implementing this technology successfully for evaluation of the human colon has been challenging because of numerous factors. One factor is the need for safe, controlled, reliable insufflation. Carbon dioxide (CO_2) for the purpose of colonic insufflation has been advantageous over traditional air insufflation because it is readily absorbed through the colon, thereby reducing patient discomfort caused by the effect of colonic distention. Our team has developed a novel approach for untethered controlled CO_2 insufflation for use in colon capsule endoscopy.

To create CO_2 for wireless untethered colon insufflation, a safe and controlled chemical reaction was developed. This reaction uses sodium bicarbonate ($NaHCO_3$) and citric acid ($C_6H_8O_7$) in the presence of water (H_2O) to yield the products of sodium citrate ($Na_3C_6H_5O_7$), carbon dioxide (CO_2), and water. All the reactants and products are described as safe for human use/consumption by the US Food and Drug Administration.[1]

Although the required amount of water can be found within the intestine in physiologic conditions, sodium bicarbonate and citric acid, in solid state, can be loaded inside a swallowable capsule with a magnetic controlled drug release system (internal volume 2 mL).[2]

To quantify the quantity of gas generated and the dynamics of the proposed reactions under ideal conditions, bench-top tests were performed under conditions similar to those in vivo (T = 37°C). Ten trials at 37°C yielded a mean CO_2 volume of 455.30 ± 10.17 mL at 4 minutes (t_{50}). The pH of the reaction was 6.5.

Ex-vivo trials were then performed by use of a fresh porcine colon that was submerged in a tank of 9 L water maintained at 37°C. No animals were killed specifically for the purpose of obtaining tissues. A total of 9 fiducials were spaced at 2-cm intervals along the colon wall and sutured in place. The reactants were then loaded into the swallowable capsule, which was activated inside the colon. The reaction was then observed under endoscopic direct

visualization (the endoscope was disconnected from air insufflation and suction), and ability to visualize the fiducials was recorded. Activation of the capsule in the porcine colon was successful, and the volume of CO_2 generated adequately distended the colon lumen, resulting in complete visualization of all fiducial markers (Video 1, available online at www.giejournal.org).

Our results demonstrate that CO_2 insufflation of the colon can be achieved in a controlled manner by use of an untethered capsule system. The ability to successfully insufflate the colon for use in colon capsule endoscopy is key to adequate mucosal visualization. The untethered insufflation capsule can be introduced either by mouth or by rectum (in the latter case the chemicals can be embedded into a suppository) and used as a single capsule or with multiple capsules to achieve the desired insufflation. Studies evaluating the novel system in vivo are currently under way.

DISCLOSURE

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REFERENCES

1. US Food and Drug Administration (US FDA) website, available online at http://www.accessdata.fda.gov/scripts/fcn/fcnNavigation.cfm?rpt=scogsListing. Accessed January 10, 2013.
2. Dietzel CT, Richert H, Abert S, et al. Magnetic Active Agent Release System (MAARS): evaluation of a new way for a reproducible, externally controlled drug release into the small intestine. J Control Release 2012;161:722-7.

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