Interventional radiology-operated endoscopy using the LithoVue disposable endoscope: Approach, technical success, clinical outcomes, and complications

Nishant Patel, Jeffrey Forris Beecham Chick, Joseph Gemmete, Rudra Pampati, Evan Johnson, Ravi Srinivasa

Department of Radiology, Division of Vascular and Interventional Radiology, University of Michigan Health System, Ann Arbor, Michigan, USA

Correspondence: Dr. Jeffrey Forris Beecham Chick, Department of Radiology, Division of Vascular and Interventional Radiology, University of Michigan Health System, 1500 East Medical Center Drive, Ann Arbor, Michigan, 48109, USA. E-mail: jeffreychick@gmail.com

Abstract

Purpose: To report the approach, technical success, clinical outcomes, and complications of interventional radiology-operated endoscopy using the LithoVue disposable endoscope. **Materials and Methods:** 12 patients, 6 (50%) males and 6 (50%) females, underwent interventional radiology-operated endoscopy using the LithoVue disposable endoscope between April 2016 and August 2017. Presenting complaint, reason for endoscopic evaluation, technical success, clinical success, procedure time, fluoroscopy time, hospital length of stay, and complications were recorded. **Results:** Interventional radiology-operated endoscopy using the LithoVue disposable endoscope was used in 8 (67%) biliary, 2 (16.5%) urologic, and 2 (16.5%) gastrointestinal procedures. Five (42%) patients required endoscopy to locate an ostium that could not be cannulated under fluoroscopy. Five (42%) patients had a biliary-enteric anastomosis with postoperative anatomy of the bowel which precluded endoscopic retrograde cholangiopancreatography and underwent endoscopy for removal of calculi. One (8%) patient underwent treatment of a stricture and one (8%) underwent biopsy. Technical success was 92% (11/12). Clinical success was 83% (10/12). Two complications, a perinephric hematoma and sepsis, occurred. **Conclusion:** Disposable endoscopes, including the LithoVue, may be used in a variety of procedures to improve patient care and limit fluoroscopy.

Key words: Cholangioscopy; choledocholithiasis; choledochoscopy; disposable endoscopy; endoscopy; fistula; interventional endoscopy; laser; LithoVue; nephroscopy

Introduction

Given the increasing number of patients with postsurgical anatomy of the proximal bowel (e.g., Roux-en-Y gastric bypass), interventional radiology-operated choledochoscopy has made a resurgence.[1] Urologists routinely perform endoscopy-guided percutaneous nephrolithotomy,[2,3] and gastrointestinal endoscopy[4,5] has become a mainstay of gastroenterology practice. The endoscopic techniques used by interventional radiologists, in general, rarely differ from those of urologists or

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gastroenterologists. A flexible or rigid endoscope is obtained and used to evaluate and treat disease in a minimally invasive fashion under direct visualization. There are skills, however, unique to interventional radiologists, which are, in part, rooted in diagnostic radiology. The knowledge afforded during diagnostic radiology training, for instance, allows for use of adjunct imaging modalities such as ultrasound and fluoroscopy and expert interpretation. In addition, expertise in percutaneous access allows for a broader use of endoscopy in nearly every organ system. While the purview of endoscopic therapy continues to expand, interventional radiologists may offer additional value by providing endoscopic services for both diagnostic and therapeutic purposes.

A major inhibitor to interventional radiology-operated endoscopy is the capital cost associated with the purchase of endoscopes, equipment, and monitors.[6] A new disposable flexible endoscope (LithoVue; Boston Scientific, Boston, MA, USA), however, may be a cost-effective endoscopy system suitable for the requirements of interventional radiologists.

This report describes the use of an interventional radiology-operated disposable endoscope for the diagnosis and treatment of biliary, urologic, and gastrointestinal conditions.

Materials and Methods

Patient selection and defined variables

Institutional review board approval was obtained for this report. Six (50%) females and 6 (50%) male patients presented between April 2016 and August 2017 for diagnosis and treatment. All procedures in which the disposable endoscope (LithoVue; Boston Scientific) was used were included in this report. Patients' age, presenting complaint, reason for endoscopic evaluation, technical success, clinical success, procedure time, fluoroscopy time, hospital length of stay, and complications are summarized in Table 1.

Disposable endoscopy technique

All procedures were performed in an angiography suite (Siemens Healthcare, Erlangen, Germany) under conscious sedation or general anesthesia. Two interventional radiologists, one with 6 years and one with 2 years of interventional radiology fellowship training which included endoscopic training, performed all interventions. A cranial drape with Neptune suction (Stryker Neptune 3 Waste Management System, Kalamazoo, MI, USA) was used to limit contact with instilled fluid. Intraluminal access was gained with the use of fluoroscopy or ultrasound using an 8-MHz curvilinear probe (Philips, Bothell, WA, USA). A 3-L pressurized saline bag was connected through a UroLok adapter (UroLok II; Boston Scientific; Marlborough, MA, USA) and connector tubing to the endoscope. The endoscope (LithoVue; Boston Scientific) was connected to its proprietary digital monitor (Boston Scientific; Figure 1). A 12-French or 14-French × 13 cm (Cook Medical, Bloomington, IN, USA) Peel-Away Sheath was placed into the access tract. The LithoVue endoscope was inserted and endoluminal evaluation was performed to facilitate the procedure [Figures 1 and 2]. Patients were admitted for observation or discharged after the procedure and seen in follow-up at 8–10 weeks.

Technical success was defined as the ability of endoscopic evaluation to achieve the intended outcome. Clinical success was defined as relief of the patient's presenting complaint after treatment.

The cases are described in detail with the reasons for endoscopic evaluation grouped together.

Results

The results are summarized in Table 1.

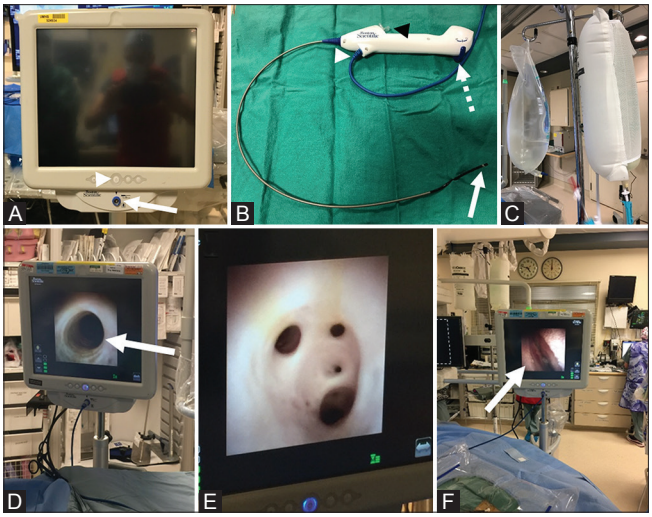

Figure 1 (A-F): LithoVue disposable endoscope. (A) The proprietary digital monitor is the size of a portable ultrasound machine. The monitor may be adjusted to various heights easily and is mobile on wheels for simple transport. There is a single connection port (solid white arrow) which provides the light source and video feed. No white balancing is necessary as this is performed automatically through the all-digital system. The power switch is located in the center of the monitor (white arrowhead); a touch screen interface allows simple control of brightness settings. The current generation cannot store images. (B) LithoVue (Boston Scientific) disposable endoscope. A single connection cable (white arrowhead) exits the endoscope providing light source and video feed. The working channel is 3.6 French (black arrowhead) and a UroLok adapter (Boston Scientific) may be placed for fluid hookup and easy exchange for various devices. The scope tip (solid white arrow) can be flexed up to 270° in two directions through a toggle (dashed white arrow) on the rear of the endoscope. (C) Pressured 3-L saline bags are used to improve visualization during endoscopy. (D and E) Images from disposable endoscopy demonstrating normal bile ducts. (F) Characteristic small intestinal villi may be seen following entry into the bowel

Locating an ostium

Five (42%) patients required endoscopy to locate an ostium that could not be cannulated under fluoroscopy [Table 1]. In both urologic cases (patients 1 and 2), endoscopic assistance was used to facilitate visualization of a distal ureteral orifice. Patient 1 was a patient status post cystectomy with an ileal conduit and distal ureteral stricture with a dislodged retrograde urinary diversion catheter. Loop ileoscopy was performed to find ureteroileal anastomosis; however, the ostium could not be located. Patient 2 was previously reported.[7] In patient 6, choledochoscopy was used to cannulate a severe choledochojejunostomy stricture in a patient status post Whipple procedure who presented with fever. Initial attempts at cannulation of the ostium were unsuccessful under fluoroscopy; however, with endoscopy, the ostium was easily found and cannulated.

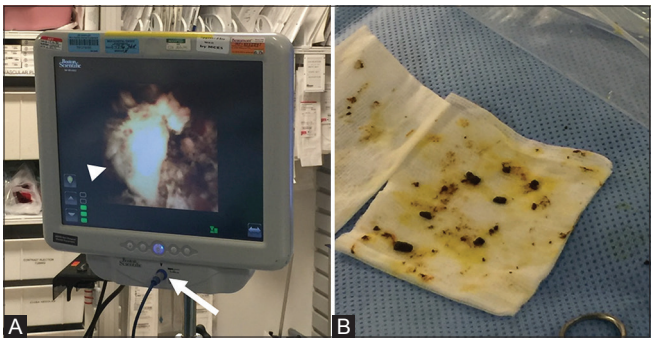

Figure 2 (A and B): Endoscope applications. (A) A large stone is seen within the biliary tree (white arrowhead). The single connection point to the monitor is again seen (solid white arrow). (B) Fragments of biliary stones successfully removed from the biliary tree following disposable endoscopy

Patients 8 and 11 were both patients with chronic fluid drainage from anterior abdominal wall enterocutaneous fistulae. Endoscopic evaluation was performed to facilitate treatment of the fistulae. One of these patients (patient 8) had a cecal volvulus requiring hemicolectomy after a complication from Roux-en-Y gastric bypass; she developed a chronic enterocutaneous fistula. A large intraabdominal phlegmon interposed between the small bowel fistula and the anterior abdominal wall created difficulty in visualization of the exact fistula site for closure. Therefore, an endoscope was inserted to cannulate the fistula and find the ostium of the small bowel which was marked with fluoroscopy.

Clearance of calculi, stricture, and biopsy

Five (42%) patients had a biliary-enteric anastomosis with postoperative anatomy of the bowel which precluded endoscopic retrograde cholangiopancreatography. Choledochoscopy was used to retrieve biliary calculi [Figure 2] using various baskets and forceps (Zero-Tip Basket; Grasp-It Nitinol Forceps; Boston Scientific), perform endoscopic hydraulic lithotripsy (EHL) (Gyrus ACMI; Olympus Medical; Center Valley, PA, USA), or utilize a Holmium laser (Lumenis VersaPulse; Boston Scientific) to fragment large calculi. EHL was noted to cause significant interference with the digital signal of the LithoVue disposable scope for 5 s after activation and was not used in future procedures. After fragmentation or retrieval of large calculi, all patients underwent cholangioplasty and balloon sweeping of the remaining calculi into the small bowel. Four (80%) patients had successful removal of their biliary drains after calculi removal. One (20%) patient died

Table 1: Demographic and clinical data of patients in whom disposable endoscopy was utilized

Patients	Age (years)	Sex	Chief Complaint	Procedure	Reason for Endoscopic Evaluation	Procedure Time (min)	Fluoroscopy Time (min)	Technical Success	Clinical Success	Length of Hospital Stay (days)	Complications
1	90	M	Left flank pain	Urologic	Finding Ostium	126	46.5	No	No	3	Perinephric hematoma
2	47	F	Left lower quadrant pain	Urologic	Finding Ostium	71	11.8	Yes	Yes	1	
3	29	M	Fever, right upper quadrant pain	Biliary	Calculi	60	26.2	Yes	Yes	1	
4	54	M	Fever	Biliary	Calculi	153	17.9	Yes	No	0	Candida sepsis
5	45	F	Fever, right upper quadrant pain	Biliary	Calculi	122	6.4	Yes	Yes	1	
6	65	M	Fever	Biliary	Finding Ostium	86	36.1	Yes	Yes	1	
7	67	F	Jaundice	Biliary	Stricture	139	41.7	Yes	Yes	1	
8	54	F	Fluid drainage anterior abdominal wall	Gastrointestinal	Finding Ostium	39	13.9	Yes	Yes	0	
9	50	F	Fever	Biliary	Calculi	168	28.1	Yes	Yes	1	
10	71	M	Right upper quadrant pain	Biliary	Biopsy	76	11.5	Yes	Yes	1	
11	45	M	Fluid drainage anterior abdominal wall	Gastrointestinal	Finding Ostium	44	9.3	Yes	Yes	0	
12	66	F	Fever, right upper quadrant pain	Biliary	Calculi	203	33.8	Yes	Yes	2	

in hospice 1 month after the procedure, before scheduled follow-up appointment for drain removal.

Patient 7 was a patient who presented with jaundice from a hepatic duct stricture secondary to chronic inflammation upstream from a malignant biliary stricture. The disposable endoscope was used to perform Holmium laser ablation of a fibrotic central hepatic duct stricture. A retrievable covered metallic biliary stent (WallFlex RX; Boston Scientific) was placed across the stricture and the biliary drainage catheter was removed 2 weeks later.

Patient 10 was a patient with a mass involving the left hepatic ducts that had failed prior brush biopsies. Endoscopy was performed using the disposable scope to mark the specific position of abnormal duct morphology. After removing the scope, a 5-French cytology brush (Cook Medical, Bloomington, Indiana, USA) was then used to obtain biopsy samples. Pathology showed adenocarcinoma involving the bile duct.

Discussion

In this series, the disposable endoscope was used to locate ostia, aid in the removal of calculi, perform laser ablation of strictures, and facilitate intraluminal biliary biopsy.

Either moderate sedation or general anesthesia may be used during disposable endoscopy. Since saline is infused through the endoscope to augment visualization, care must be taken to avoid hypothermia or electrolyte imbalances. The simple setup and availability of the LithoVue endoscope (Boston Scientific) allow for prompt usage in a procedure. The endoscope is low profile and costs $1,500 for a single use.[6] The company will provide the proprietary digital monitor gratis if a certain usage quota is met. The endoscope is 9.5 French in diameter, tapering to 7.7 French at the tip, and therefore will fit through a 12-French Peel-Away Sheath with enough working room for manipulation of the scope and egress of fluid from the patient. It has a single connection cable which houses the light source and video feed [Figure 1]. A UroLok adapter (Boston Scientific) may be attached to the fluid port to allow devices up to 3.6-French in size to be used through the working channel under direct visualization [Figure 1]. The device may be flexed up to 270° in two directions through a toggle on the rear of the scope [Figure 1]. Fluid is infused through 3-L pressurized saline bags attached to the port. A variety of devices may be used coaxially through the scope including snares, stone baskets, graspers, catheters, wires, and lasers. A limitation of the device is that electrohydraulic lithotripsy devices may cause significant interference in the video feed precluding use; lasers do not have this issue. Furthermore, the current generation cannot store images.

Interventional radiologists interested in learning the skills necessary to perform endoscopy have the option of multiple routes of education such as direct mentorship, workshops, simulation, lectures (traditional forums and online webinars), and expert panels as was available during Society of Interventional Radiology 2018 annual meeting. A combination of these methods for acquiring knowledge and skill should be pursued to perform this type of procedure effectively and safely.

Conclusion

Disposable endoscopes may be used in a variety of procedures to improve patient care and limit fluoroscopy.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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