

Evaluation of the use of the Ambu_aScope 2TM in laparoscopic common bile duct exploration

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Received 03 September 2018

Accepted 20 September 2018

Journal of Current Medical Research and Practice

May-August 2019, 4:115–120

Introduction

Cholelithiasis is a common disease, occurring in 5–22% people in the western countries. The management of common bile duct stones (CBDS) could be adopted in two main lines. The first line is through laparoscopic cholecystectomy and common bile duct (CBD) exploration in one session, the other is endoscopic retrograde cholangiopancreatography then laparoscopic cholecystectomy. In this study we evaluate a novel device with cases of laparoscopic CBD exploration which is Ambu_aScope 2TM which is mainly used as a bronchoscope in cases of difficult intubation, however we evaluate the capability of such device to perform accurately in CBD exploration.

Aim of the work

This is a prospective randomized study to investigate the outcome of using Ambu_aScope 2TM in laparoscopic CBD exploration in the management of patients with CBDS.

Patients and methods

Equipment: a recent case report described the use of the Ambu_aScope 2TM in an open CBD exploration. They showed that they were able to perform a successful procedure in their patient. **Patient population:** all patients who were scheduled for laparoscopic CBD exploration, in whom Ambu_aScope 2TM was used were included in our study during the period from October 2016 till February 2018.

Results

Eighteen patients underwent laparoscopic CBD exploration. Two patients converted to open due to difficult stone extraction that was distal and impacted and the other was due to severe adhesions from previous acute cholecystitis. All cases were done using the Ambu_aScope through choledotomy in CBD. The Ambu_aScope was used to visualize the CBD and extract the stones either by Fogarty's catheter done in nine cases or dormia basket in the rest of cases.

Conclusion

Laparoscopic CBD exploration is considered one of the corner stones in the CBDS management. The Ambu_aScope 2TM was approved and satisfactory to the operating surgeons as regarding the handling of the instrument, orientation, quality of image, and feasibility of stone extraction through the working port.

Keywords:

common bile duct, common bile duct stones, endoscopic retrograde cholangiopancreatography, laparoscopic cholecystectomy

J Curr Med Res Pract 4:115–120

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2357-0121

Introduction

Cholelithiasis is a common disease, occurring in 5–22% people in the western countries, among 8–20% combined with common bile duct stone (CBDS) [1].

The management of CBDS could be adopted in two main lines. The first line is through laparoscopic cholecystectomy and common bile duct (CBD) exploration in one session, the other is endoscopic retrograde cholangiopancreatography (ERCP) then laparoscopic cholecystectomy. However, the differences in the outcomes of both lines have not been that significant regarding the efficacy of stone clearance and major risks [2].

A choledochoscope is frequently used in CBD explorations to allow direct visualization of the bile duct and its contents and to facilitate the removal of stones under vision. It can, however, be difficult to introduce a choledochoscope transcystically (via the cystic duct), because the cystic duct often is narrow, making it necessary to use a small-caliber choledochoscope to make this possible. The choledochoscope preferentially passes into the CBD

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after introduction and visualizing the common hepatic and intrahepatic bile ducts with transcystic choledochoscopy is technically difficult. It is clearly desirable to enter the common hepatic duct if possible to identify and remove any intrahepatic stones seen on cholangiography and to ensure complete duct clearance at the end of the procedure. The frequency of achieving intrahepatic duct visualization has been quantified in only one study identified in a literature search, and the authors estimated that this was possible in ~ 10% transcystic explorations [3].

In this study we evaluate a novel device with cases of laparoscopic CBD exploration which is Ambu_aScope 2TM which is mainly used as a bronchoscope in cases of difficult intubation, however we evaluate the capability of such device to perform accurately in CBD exploration.

The disposable bronchoscope was used for 2 years in our facility in laparoscopic CBD exploration. There is one case report showed successful use of this kit for this procedure [4]. Also the feasibility of using disposable bronchoscope for laparoscopic CBD exploration has been presented in case series that was published in the UK [5].

Aim of the work

This is a prospective randomized study to investigate the outcome of using Ambu_aScope 2TM in laparoscopic CBD exploration in the management of patients with CBDS.

Outcome

- (1) Failure/success rate.
- (2) Morbidity and mortality.
- (3) Costs, hospital stay, procedural time.
- (4) Optimum time of laparoscopic CBD exploration.
- (5) Optimum methods of drainage of CBD after laparoscopic CBD exploration.

Patients and methods

Equipment

The Ambu_aScope 2TM (Ambu A/S, Ballerup, Denmark) was launched in 2009 and is now on its third generation. There have been several studies reporting the aScope use in anesthesia for difficult intubation. A recent case report described the use of the Ambu_aScope 2TM in an open CBD exploration. They showed that they were able to perform a successful procedure in their patient [5].

The Ambu_aScope 2TM was used. This is a sterile, single use flexible endoscope. It is currently used in bronchoscopy and in tracheal intubation. It is available in two sizes (3.8 and 5 mm). It is a one-piece unit with a single-dimensional flexible tip manipulated from a hand piece (150 flex in the 5 mm model and 130° in the 3.8 mm model). There is a single instrument channel which has a diameter of 2.2 mm. This will allow the passage of standard endoscopic baskets. The light source comes from a series of LED lights on the tip of the instrument. The image is projected to a high-resolution 6.500 LCD screen with a resolution of 640 × 480 pixels. It can be connected to a larger monitor via a DPI port. There is a suction port on the hand piece for bronchoscopy which is used for connection of water irrigation tubing. This necessitates a standard three-way connector [4].

Patient population

All patients who were scheduled for laparoscopic CBD exploration, in whom Ambu_aScope 2TM was used were included in our study during the period from October 2016 till February 2017.

Type of study

Prospective observational study.

Study center: Al Rajhy Hospital for hepatobiliary disease in Assiut University Hospital.

Ethical approval and consent

Faculty of Medicine, Assiut University Hospital Ethical Board approved the study. We obtain an informed consent from patients before study participation.

Inclusion criteria

- (1) Age 18–65 years.
- (2) Patient with gallbladder stone and concomitant CBDS.
- (3) CBD diameter is more than 10 mm.

Exclusion criteria

- (1) Patients with cholangitis.
- (2) Patients with pancreatitis.
- (3) Previous biliary surgery.
- (4) Pregnancy.

Preoperative work up

Preoperative diagnosis was based on a combination of:

- (1) Patient demographics.
- (2) Clinical assessment:
 - (a) Biliary colic.

- (b) Presence or absence of jaundice.
 - (c) Fever.
 - (d) Right hypochondrial tenderness.
- (3) Liver function tests: AST, ALT, bilirubin, and alkaline phosphatase.
- (4) Abdominal ultrasound delineating biliary anatomy:
- (a) Gall stones.
 - (b) CBD diameter.
 - (c) CBDS (size and diameter).
- (5) Magnetic resonance cholangiopancreatography confirming the sonographic finding.
- (6) Previous trial of ERCP is recorded.

Preoperative preparations

Preoperatively in patient with obstructive jaundice were given vitamin K to correct any clotting defect and cover with prophylactic antibiotic.

Operative techniques

Laparoscopic cholecystectomy is performed using the usual location for the four trocars. Exposure and dissection over the cystic duct and the CBD anteriorly.

Initial cholangiogram

Clipping of the distal cystic duct (close to gall bladder). The cystic duct cannulated using cholangiogram catheter.

In our study laparoscopic CBD exploration is performed through the CBD choledochotomy approach.

Choledochotomy approach

With cephalad retraction of the gallbladder, extension of the dissection over the CBD for about 1–2 cm distal to the junction of the cystic duct. The ductotomy was made vertically by hook with diathermy. Milking of the duct is tried first, then flushing with saline for removal of loose stones.

Common bile duct exploration with the Ambu_aScope 2TM

Connect the Ambu_aScope to a pressurized saline bag. Check to ensure adequate flow through the working channel. Use one hand to advance the Ambu_aScope and control torque, while the other operates the scope flexion dial.

Once the scope is within the CBD, turn on the irrigation and scope light source. Usually the scope can be advanced by manipulating it external to the trocar;

however, if this is not possible, a padded laparoscopic grasper can be used to gently pass it internally. Pass a stone extraction basket through the working channel of the Ambu_aScope.

Advance the closed basket beyond the stone and then have your assistant open it. Slowly trawl the open basket back toward the scope until the stone falls within it slowly close the basket around it. Withdraw the scope from ducts, while keeping the stone pinned against the face of the scope.

Once the stone is delivered out of the cystic ductotomy, it can be deposited in the peritoneal cavity and removed using a stone grasper or with the gallbladder in an endoscopic bag after completion of the cholecystectomy.

If multiple stones were present on cholangiogram, reintroduce the scope through the ductotomy and repeat the process of capture and extraction.

Final cholangiography

Duct clearance was confirmed by routine completion cholangiography proximally and distally, using Folley's catheter to occlude the choledochotomy gently.

Criteria of successful cholangiogram:

- (1) Visualization of intrahepatic and extrahepatic biliary system.
- (2) Free passage of dye to the duodenum.
- (3) No filling defect.

Following ductal clearance, either

- (1) Primary duct closure was performed using interrupted 3-0 or 4/0 vicryl sutures.
- (2) T-tube (size 14/16 Fr) was inserted.

The choice is left to the operating surgeon.

A 18–20 Fr drain was placed routinely in the subhepatic space.

Results

From the period October 2016 till February 2018, 18 patients were admitted in Al Rajhy Hospital for hepatobiliary disease in Assiut University Hospital for a planned laparoscopic CBD exploration with the aid of Ambu_aScope.

Preoperative data are shown in Table 1.

Operative data

Eighteen patients underwent laparoscopic CBD exploration. Two patients converted to open due to difficult stone extraction that was distal and impacted and the other was due to sever adhesions from previous acute cholecystitis. Initial cholangiogram was done in all cases to reveal a single stone in seven cases and multiple stones in 11 cases. All cases were done using the Ambu_aScope through choledotomy in CBD. The Ambu_aScope was used to visualize the CBD and extract the stones either by Fogarty's catheter done in nine cases or dormia basket in the rest of cases. Final cholangiogram revealed free biliary channels in 17 cases with only one case to reveal a residual stone in the right intrahepatic biliary channel. Closure of the CBD was done by T-tube in six cases and primary closure in 12 cases. Mean operative time was 116.8 min as shown Table 2.

Postoperative data

All patients was discharged to the ward after surgery, all patients showed immediate improvement in the bilirubin level with mean 33.4 U/ml of total level. Mean hospital stay 3 days (range, 2–8 days), the longest hospital stay was 8 days in the case that developed complications.

There were no deaths or long-term complications.

One patient developed postoperative bleeding that stopped spontaneously after 12 h, and another patient developed bile leakage managed conservatively without the need of neither tube drainage nor ERCP.

Only one patient presented with residual stones in CBD during follow up T-tube cholangiogram who was managed by ERCP and extraction of stone/s as shown in Table 3.

Discussion

In our study we evaluate the use of the Ambu_aScope which is basically a single use bronchoscope used by anesthesiologist in cases of difficult intubation.

Traditionally the reusable choledoscope was the standard instrument used to visualize the CBD starting the 1970s era starting by the rigid choledoscope passing by the fiber optic choledoscope used now days.

The reusable choledoscope has been used conventionally for CBD exploration. The cost associated with using the standard reusable choledoscope has limited the number of CBD exploration by many surgical units.

Table 1 Preoperative data

	Study cases (n=18)
Age (years)	45 (23-65)
Sex [n (%)]	
Male	6 (33)
Female	12 (67)
Presentation [n (%)]	
Pain	14 (77)
Jaundice	4 (23)
Associated diseases [n (%)]	10
DM	4 (22)
HTN	6 (27)
Laboratory	
WBC ($\times 10^3$ /ml)	6.6 (4-13.8)
Albumin (g/dl)	3.9 (3-4.8)
Bilirubin (U/ml)	
Total	43.2 (0.5-100.1)
Direct	29.5 (0.2-87.6)
SGPT (U/ml)	55 (20-345)
SGOT (U/ml)	51 (21-358)
INR	1 (1-1.4)
Amylase (IU/l)	55.5 (21-674)
Ultrasound	18 patients
Liver [n (%)]	
Normal	15 (83)
Fatty	3 (17)
CBD size (mm)	12 (10-18)
Stone number [n (%)]	
Single	14 (88)
Multiple	4 (22)
Stone size (mm)	14 (7-22)
MRCP	
CBD size (mm)	15 (10-23)
Stone number	
Single [n (%)]	10 (55)
Multiple [n (%)]	8 (45)
Stone size (mm)	13.5 (7-24)
Preoperative ERCP [n (%)]	
Done and failed	11 (61)
Not done	7 (39)

CBD, common bile duct; DM, diabetes mellitus; ERCP, endoscopic retrograde cholangiopancreatography; HTN, hypertension; INR, international normalized ratio; MRCP, magnetic resonance cholangiopancreatography; SGOT, serum glutamic oxaloacetic transaminase; SGPT, serum glutamic pyruvic transaminase.

The initial average cost of reusable choledoscope about 100 000 LE in addition to sterilization, maintenance, and other extra costs (storage and cleaning). Disposable bronchoscope costs around 4000 LE. The advantage of using Ambu_aScope 2™ over the disposable bronchoscope is the cost effectiveness, sterility, and high-resolution 6.5 LCD screen provided by the company. We also found that the kit is easy to use, lightweight, and good quality image comparable with the image from reusable choledoscope.

In our study we used the Ambu_aScope 2™ in laparoscopic CBD exploration in 18 patients which showed that our results in terms of duct clearance, complication, and hospital stay were in line with

Table 2 Operative data

	Study cases (n=18) [n (%)]
Procedure	
Complete laparoscopic	16 (89)
Conversion to open	2 (11)
Initial intraoperative cholangiogram	18 (100)
CBD size (mm)	
Stone number	15 (8-25)
Single	7 (38)
Multiple	11 (62)
Stone extraction	
Dormia basket	9 (50)
Fogarty's catheter	9 (50)
Final cholangiogram	
Residual stones	1 (6)
Free CBD	17 (94)
Closure of CBD	
Use of T-tube	6 (33.3)
Primary closure	12 (63.3)
Operation time (min)	116.8±45.4

CBD, common bile duct.

Table 3 Postoperative data

	Study cases (n=25) [n (%)]
Lab results	
1 st day bilirubin (U/ml)	
Total	33.4 (0.7-60)
Direct	13.3 (0.4-35)
Hospital stay (days)	3 (2-8)
Postoperative complications	4 (11.2)
Bleeding	1 (5.5)
Bile leak	1 (5.5)
Wound infection	2 (11)
Bleeding	1 (5.5)
Management	
Conservative	1 (5.5)
Wound infection	2 (11)
Management	
Bed side treatment	2 (11)
Bile leakage	1 (5.5)
Management	
Conservative	1 (5.5)
Postoperative T-tube cholangiogram (14 days)	9 (50)
Free	8 (44.5)
Residual stone	1 (5.5)
Management	
ERCP	1 (5.5)

ERCP, endoscopic retrograde cholangiopancreatography.

studies published from different institution using the standard scope 3.

The Ambu_aScope 2TM was introduced through choledotomy to explore the CBD which was easily inserted and feasible to direct and manipulated the device for better imaging and exploration.

Intraoperative cholangiogram was used in all case both initially and before closure of CBD to confirm the findings of the Ambu_aScope and help with stone extraction.

From all the included cases only one showed residual stone in postoperative trans T-tube cholangiogram, who was managed by ERCP with no further complications.

Postoperative follow up showed satisfactory results with smooth recovery for all the patients.

Conclusion

In the laparoscopic era the main goal is to provide solutions with the least possible invasion with most reliable outcomes with the least costs.

Laparoscopic CBD exploration is considered one of the corner stones in the CBDS management and the open technique became limited to certain situations due to the high morbidity and mortality outcomes and associated prolonged hospital stay and postoperative care.

The traditional choledoscope is used on a wide range with laparoscopic CBD exploration and even open method, however the unavailability of such instrument in many centers open the way to discover novel methods and instruments to take over.

The Ambu_aScope 2TM was launched in 2009 and is now on its third generation. There have been several studies reporting the aScope use in anesthesia for difficult intubation.

Based on the close similarity to the choledoscope a new idea to use such device in CBD exploration and evaluate such instrument in that sort of operation.

The Ambu_aScope 2TM is safe and feasible in laparoscopic CBD exploration. It confers significant financial benefits and offers an economical alternative to expensive reusable endoscopes. This may facilitate the wider application of CBD exploration as a surgical procedure.

The Ambu_aScope 2TM was approved and satisfactory to the operating surgeons as regarding the handling of the instrument, orientation, quality of image, and feasibility of stone extraction through the working port. However, since the device have a connected small LCD made it difficult sometimes to have good visual access and always need someone to hold it closer to the operating surgeon.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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