

# Use of Ureterorenoscope as Choledochoscope

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## ABSTRACT

**Background:** Flexible Choledochoscope is used to remove the stones using accessories during exploration of the common bile duct and its use reduces the incidence of retained stones. The choledochoscope and accessories are expensive and not available in many General Hospitals. In comparison to this, semi-rigid ureterorenoscope is easily available in many minimally invasive centres and accessories are more useful to remove even the impacted stones. We have used this for exploration of the CBD and tried to analyse its efficacy and safety.

**Methods:** All the patients who underwent Ureterorenoscopic intervention by single surgeon for common bile duct stones during 2007-2010 are included. The usefulness, efficacy and safety of the procedure are analysed.

**Results:** There were total 71 patients. Age ranges from 10 years to 69 years. Forty one (57.7%) patients had undergone open procedure where as 30 (42.2%) underwent laparoscopic procedure. Most of them were females (69%) and majority had multiple stones (59%). Twenty five (35%) patients required the use of different accessories like dormia basket, forceps etc. Pneumatic lithotripsy was used in 3 patients to fragment large impacted stones. In one (3%) patient of laparoscopic group scope could not be negotiated. In 4 cases mild common bile duct tear observed and in one patient duodenal laceration occurred. In two patients (2.8%) there were retained small stone fragments which passed spontaneously within two weeks post-operatively.

**Conclusions:** Semirigid Ureterorenoscope is easily available, safe and effective instrument. It is useful even for large impacted stones.

**Key words:** semirigid ureterorenoscope, common bile duct exploration, retained stones, primary closure.

## INTRODUCTION

In the era of Open cholecystectomy, the common bile duct (CBD) was explored in approximately 15% of all cholecystectomies and stones were removed in 65% of them.<sup>1</sup>The incidence of retained stone was 10%.<sup>2</sup> With the use of per-operative cholangiogram and flexible choledochoscope, this incidence is very low.<sup>3</sup> So, the CBD can be closed primarily to avoid T-tube related morbidities. The available flexible choledochoscope and accessories are friable, expensive and not easily available. In comparison, Ureterorenoscope is available

in most of the General minimally invasive centers like ours.

We studied the use semirigid ureterorenoscope to visualize the CBD with stone fragmentation and removal. The efficiency and safety of the technique is evaluated.

## METHODS

A prospective, cross-sectional study was conducted in the department of surgery at the Kathmandu Medical

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College, Sinamangal, Kathmandu from 2007 to 2010. The ethical approval and patient consent was taken. The study included the patients who had undergone trans-choledochal exploration of CBD using ureterorenoscope (URS) by single surgeon. Different parameters including age, sex, no of stones, operative time, different techniques used to remove stones have been used, complications related to ureterorenoscope use had been recorded and analyzed.

The workup protocol for patients undergoing Cholecystectomy include thorough history, meticulous physical examination, routine blood tests, liver function tests, and trans-abdominal ultrasonography (USG). Common bile duct stone are confirmed by repeat ultrasonography in our own centre by dedicated radiologist for those patients who are referred to us for management. Magnetic Resonance Cholangiopancreatogram (MRCP) is done in patients highly suspicious for common bile duct stone but not picked up in routine USG. Endoscopic retrograde cholangiopancreatogram (ERCP) is advised to few selective patients who have co-morbidities, advanced age, contraindication and reluctance to undergo surgery. Other reasons for this are, ERCP is available in only few centers and as it is two stage procedures, it is not favored by many patients. Some patients had undergone trans-cystic exploration also. These patients have not been included in the study.

**Technique:** The procedure is performed under general anaesthesia. For, open common bile duct exploration, laparotomy is done by rt-subcostal incision, cholecystectomy is performed as routine, duodenum is Kocherized common bile duct is opened in between two stay sutures. After the stones are removed by milking and flushing, the choledochoscopy is done using ureterorenoscope. We use 9.5fr/10.5fr semirigid ureterorenoscope (STEMA®) with its accessories and NIDHI® lithoclast. For distal CBD, ureterorenoscope is directed cranio-caudally and negotiated through choledochotomy wound. The long axis of scope is kept in the alignment with the CBD in such a way that there is minimal manipulation of the duct. With continuous irrigation scope is advanced to the papilla, visible and retained stones are removed either by forcep or dormia basket. The impacted, large and hard stones are fragmented using pneumatic lithotripsy. Stone fragments are either flushed out or removed. For proximal visualization, tip of the scope is directed cranially and stones are cleared in the same manner. The choledochotomy was closed over T-tube but in recent days, primary closure is preferred.

In laparoscopic CBD exploration, author uses a slightly left hypochondriac port as working port. After the dissection of cystic duct and artery, artery is clipped and

divided. Distal clip is applied in cystic duct so that stones do not slip in CBD during manipulation. Operative setup is shown figure 4. For trans-choledochal approach, Common bile duct is dissected in supra-duodenal area and duct is opened in longitudinal axis on anterior aspect using endoknife. Size of the choledochotomy is determined according the size stone it contains. But choledochotomy larger than 2 cm is usually avoided. Distal and proximal duct is flushed using 8-12 fr suction catheter through right mid-clavicular port with normal saline, CBD milking is also done using graspers to remove stones. Choledochoscopic visualization is done using separate video endoscopic set for ureterorenoscope. For distal visualization of CBD, author makes a port of 3mm in the epigastrium near xiphisternum so that the alignment of scope in an inflated abdomen can be kept along the alignment of the CBD so that the access is easier and excessive manipulation and trauma can be avoided in situation where Kocherization of duodenum is not usually done. Visualized stone is removed using either Dormiabasket or Stone grasping forcep (Figure 2). After the clearance of stone, scope is introduced to visualize the sphincter of Oddi (Figure 3). For proximal visualization, ureterorenoscope is introduced through umbilical port and laparoscope is shifted to left hypochondriac port. Retained stones are retrieved as described earlier. Once the procedure is complete, common bile duct wound is closed using 4-0 polyglactin interrupted suture. Reinforcing sutures of 6-0 polyglactin are applied if bile leak is seen in between suture lines. Cholecystectomy is completed. Drain is kept in sub-hepatic space and ports are closed.

The abdominal drain is removed as soon as the effluent is serous and <20ml/24 hour. T-tube cholangiogram is performed after 7 days. If it is clear, T-tube is clamped. T-tube is removed after 3 weeks. Every case of primary closure undergoes repeat ultrasonogram before discharge and MRCP if confusion arises. The cases are regularly followed up on OPD basis.

The statistical calculation and data analysis were done using statistical package for social sciences (SPSS) version 16 for windows.

## RESULTS

The seventy one cases have been included for study during the study period of 3 years from 2007-2010. Forty-one (57.7%) cases had undergone open surgery whereas 30 (42.3%) underwent laparoscopic exploration. Mean age was 42.9yrs (range: 10-69yrs). Age prevalence is shown in figure 1. Most of cases were females, 49 (69%). Male to female ratio being 1:2.2. Majority had multiple stones (59%) with number of stones range from 1 to 10. Diagnosis of common bile duct stone mostly depended

upon Trans-abdominal ultrasound: 69 (97%) cases. Only in two patients MRCP was done for confirmation (Figure 1-4).

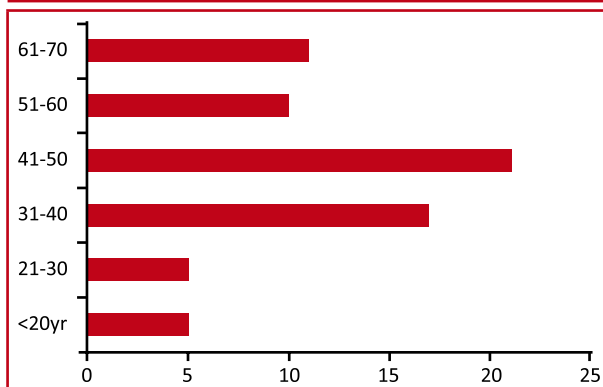


Figure 1. Age incidence.

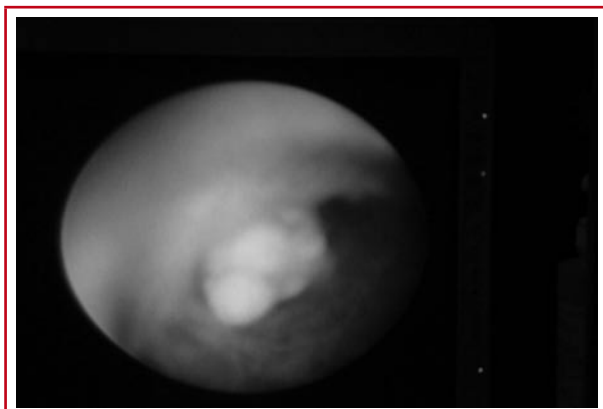


Figure 2. Stone at lower end of CBD.

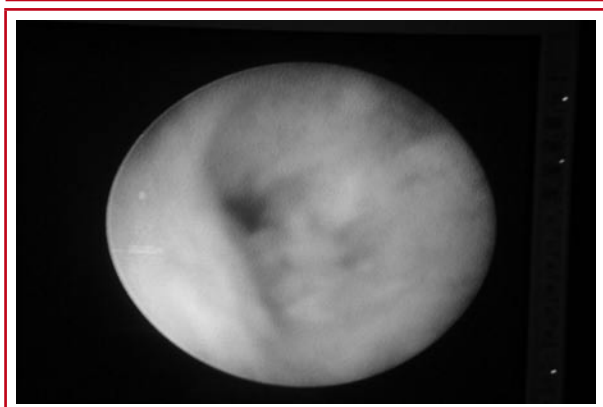


Figure 3. Visualization of papilla.

Average operating time in open group is approx 80 minute whereas in laparoscopic group 156 minutes. The use of ureterorenoscope was required in most of the cases only for completion choledochoscopy after removing all stones by other means like milking and irrigation. Twenty five (35%) cases required the use of accessories like dormia basket or forceps and in 3 cases

pneumatic lithotripsy was applied to fragment and remove the impacted large stones. Seventeen patients (24%) underwent T-tube closure and 24 primary closure in open group whereas all patients of laparoscopic group underwent primary closure (76%).



Figure 4. Operative set up.

One patient (3%) of laparoscopic group had to be converted to open due to failure to negotiate the scope through the distal common bile duct. Slight common bile duct tear and elongation of the choledochotomy wound occurred in 4 (5%) cases due to manipulation of CBD while negotiating ureterorenoscope. In one patient there was mucosal laceration of posterior wall of duodenum due to jerky movement of scope while negotiating. Retained Small stone or fragment of stones was seen in follow-up Ultrasonography (USG) in two cases (2.8%), one in laparoscopic group and one in open group, in early post-operative period. Both did not require any intervention.

## DISCUSSION

The pioneers of the biliary surgery, William Halsted and Thornton did not practice the T-tube drainage.<sup>4</sup> Halsted described the primary closure after open Common bile duct closure in 1917.<sup>5</sup> There had been many changes in the management of common bile duct stone from single stage open Common bile duct exploration to two stage Endoscopic sphincterotomy with laparoscopic cholecystectomy followed by single stage laparoscopic CBD exploration. The closure of the common bile duct after the exploration also has undergone revolutionary changes from primary closure to T-tube drainage and now again to primary closure. T-tube drainage had been used for post-operative decompression of common bile duct, post-operative X-ray visualization of common bile duct and T-tube tract extraction of retained stones with Burhene steerable catheter.<sup>6</sup> This procedure not only is associated with T-tube related complications rather it is associated with prolonged morbidity till the T-tube is in situ.<sup>7</sup> One of the major concerns of common bile duct exploration is stone clearance and post-operative

retained stones. The routine application of completion choledochoscopy and availability of Endoscopic retrograde cholangiopancreatography (ERCP) stone extraction has made this indication least important.<sup>8</sup>

<sup>12</sup>The two stage management protocol in the form of ERCP±Sphincterotomy and laparoscopic cholecystectomy is now a days turned back to one stage laparoscopic cholecystectomy with exploration of common bile duct at the centres with significant expertise. Randomized studies have shown equal success rate and patient morbidity between these two management options.<sup>13,14</sup>

The common bile duct exploration can be performed either tran-cystic or trans-choledochal approach. Trans-cystic approach is preferred wherever possible as it is associated with minimal morbidity and fewer complications as compared to trans-choledochal approach because its post-operative course is just like cholecystectomy. But it has got limitations. It has got high failure rate as visualization of proximal CBD is mostly not possible, stones larger than 6mm are difficult to retrieve and sometimes cystic duct has tortuous course and cannot be negotiated.<sup>15,16</sup>

Instrumentation alone of the common bile duct for stone removal gives unsatisfactory results as the incidence of retained stone is reported up to 15%.<sup>17-21</sup> Post-exploratory cholangiography can reduce the incidence but the observations are misguided as the air bubbles simulate the stones and sphincter of Oddi may prevent the flow of contrast in the duodenum. Choledochoscopy is considered to reduce the incidence but still there are reports showing occasional retained stones. The reasons considered are the small intra-hepatic stones which are out of site at the time of observation may descend later and the stones might have been lodged in cystic duct stump or common duct diverticula. Probably the most common cause of missed stones is the surgeon might think that the choledochoscope has reached the sphincter of Oddi when in fact it has not and the distal most stones remain retained.<sup>22</sup> Besides the flexible scopes the bent tip rigid choledochoscope are also in use since the era of open surgery. There are reports comparing between two showing similar outcomes. The incidence of retained stone had been found to be the same (3.2%) but the major difference was the cost. Rigid choledochoscope is much cheaper than the flexible one.<sup>23,24</sup> Ureterorenoscope can be considered as the counterpart of rigid choledochoscope except a bent tip. This property is fulfilled by its semirigid nature which makes it handy even for laparoscopic procedures.

Large impacted stones are very difficult to manage with the use of flexible choledochoscope as it has narrow working channel and instruments like graspers cannot be negotiated through it. To break stones through flexible

choledochoscope, it is necessary to apply a holmium laser<sup>25</sup> or an electrohydraulic lithotripter.<sup>26</sup> The accessories of these instruments are very expensive and not available in our center as well as other many centers. Contrast to this, ureterorenoscope is easily available in many minimally invasive centers. And it has working channels for forceps and pneumatic lithotripter probe. Moreover, due to its semi-rigid property it is slightly flexible and this makes it easily negotiable through common bile duct even in obese people. Although it is important to emphasize that maneuvering the ureterorenoscope thorough common bile duct requires some expertise. For visualizing the common bile duct, scope is negotiated through the choledochotomy wound with special care so that the longitudinal axis of the scope is in as far as possible in the alignment of the common bile duct. The ureterorenoscope has to be negotiated with delicacy, as any coarse movement can cause trauma to the CBD leading stricture formation later. For distal visualization, scope is kept cranio-caudally and for proximal duct, in the opposite direction. In laparoscopic common duct exploration, ureterorenoscope is inserted through the umbilical port for proximal duct visualization during this laparoscope is shifted to left hypochondriac port whereas for distal duct visualization, author makes a small 3mm additional port in the epigastrium as high as near xiphisternum. This makes the insertion of ureterorenoscope easy and along the alignment of CBD.

Cholecystectomy and common bile duct surgery had been carried out in our institute since it was established. There had been rapid change from open surgery to minimally invasive surgery even for advanced procedures in recent period. Now laparoscopic cholecystectomy and laparoscopic CBD exploration are routine. In the beginning we had been using flexible bronchoscope, then flexible cystoscope for visualization and clearance of common bile duct as we did not have a proper choledochoscope and per-operative cholangiogram is not routine. Use of ureterorenoscope for visualization and clearance of CBD stone was started by author in 2007 after the endourology set up began functioning in hospital. We have found the ureterorenoscope is much more useful for us even now a day when we have flexible fibreoptic choledochoscope. Since it was started, almost all patients undergo this procedure either for stone extraction or for completion choledochoscopy. In the beginning, it was started for open common bile duct exploration. Now it is being regularly used for laparoscopic procedure. Procedure was successful in all cases of open group whereas in one patient of laparoscopic group scope could not be negotiated, so converted to open. The reason might be the patient was short stature and obese. We found difficulty in putting the scope in alignment. In open surgery there is an extra advantage of Kocherization of duodenum so that the duodenum and common bile duct

can be lifted up which we do not perform in laparoscopic method. Our experience with ureterorenoscope had been quite satisfactory although there had been few minor easily manageable complications like CBD tear and duodenal injury, mentioned above. In two cases (2.8%), small fragment of retained stone was reported in post-operative follow up ultrasonogram done before discharge. Both the cases had undergone pneumatic lithotripsy. These were managed conservatively with antispasmodics and kept under close follow-up. Stones were passed within two weeks. Incidence is comparable with other studies. We found that the key point for success in this procedure is to negotiate the scope through choledochotomy wound without causing any injury like common bile duct laceration and perforation. Once it is negotiated, visualization is perfect and manipulation is easy as mentioned above. In most of the instances, use of ureterorenoscope is for completion choledochoscopy as the un-impacted stones are easily extracted by milking, flushing, irrigation, biliary fogarty and dormiabasketing. In our series, 24 patients required manipulation through scope for stone removal. Among them, for 3 cases of impacted stones, pneumatic lithotripsy was used for stone fragmentation.

The procedure we found is quite safe even in difficult situations. One of our patients was a known case of Brugada syndrome who underwent laparoscopic primary closure of the duct and two cases had macronodular liver cirrhosis with Childs-Pugh criteria A. Both the cases of cirrhosis were in their extreme of ages. One was 10 years old child of Wilson's disease with common bile duct stone and another was a case of 68yr old gentleman of alcoholic liver disease. In the former, open primary closure was done and in later laparoscopic primary closure was performed. All of these patients were discharged on 5<sup>th</sup> post operative day.

In our experience, the Semirigidureterorenoscope is very effective and had been an important armamentarium for biliary surgery whether open or laparoscopic. It can be safely and efficiently used for completion choledochoscopy when flexible choledochoscope is not available and it gives extra-advantages for the management of difficult and impacted stones.

## CONCLUSION

Use of ureterorenoscope for choledochoscopy is safe, feasible and effective but requires certain level of skill and experience. It has added advantages over conventional flexible choledochoscope. A critical thinking among the practising surgeon has to develop to work according to the feasibility of the working environment, resources and set up.

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