

A Novel Surgical Technique for Complex Common Bile Duct Stone Extraction: Finger Assisted Laparoscopic Surgery (FALS)

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Abstract: ***Objectives:** To describe a new surgical technique for the management of complex common bile duct stone and its feasibility along with reproducibility. **Methods:** We developed a new surgical technique to remove the impacted stone in common bile duct which was previously attempted but failed by one or more ERCP. We did this technique by inserting one finger through the laparoscopic port to negotiate the impacted stone in CBD after failed LCBDE with presently available stone extraction methods and ultimately extracted the large stone from CBD. **Results:** We did this new technique on three patients who had impacted stone with one or more failed attempts by ERCP and failed by even LCBDE. We succeeded in extracting the stone with this method in all cases without any complication. The time duration to extract the stone by this method are about 5 to 7 minutes only. By adopting this method to extract the impacted large stone in CBD after failed LCBDE, we avoided conversion to open and evaded using sophisticated laser lithotripsy which might cost more with morbidity. **Conclusion:** The result of the study indicates that all the cases with complex CBD stone where clearance is not possible by ERCP/ LCBDE can be removed very easily by this technique without opting for electrohydraulic or laser lithotripsy which consumes more time and cost.*

Keywords: Complex CBD stone, Finger assisted laparoscopic procedure, Novel technique for CBD stone removal

1. Introduction

Laparoscopic surgery has lot of advantages over the conventional surgery. But, it has its own disadvantages like absence of tactile sensation and not always possible to perform complicated procedures. We had a situations where we struggled in doing CBD stone extraction through laparoscopically. We innovatively thought of using fingers (Finger assisted laparoscopic surgery²-FALS) through one of the ports to dislodge the impacted stone in CBD and extracted it laparoscopically without conversion. From April 2015 to December 2019 we had 15 cases of complex CBD stone¹⁴ which was a failed cases of stone retrieval. Initially, we posted all these cases for LCBDE and proceeded. From April 2015 to June 2017 we had 8 cases and later part we did 7 cases with similar situation. Out of initial 8 cases we succeeded with LCBDE only on 3 cases with lot of struggle and consumption of time. Rest of the 5 cases were opened and stone in the CBD was removed. Later on, from the ninth case we thought of inserting finger(s) through one of the nearest port to CBD into the abdominal cavity and through tactile sensation we retrieved the impacted stone. We continued the same technique for next LCBDE failed 3 cases out of 7 and succeeded in removing stone from CBD.

2. Operative Technique

The procedure starts under general anaesthesia with patient in supine position placed on C- arm compatible table with head elevated position (reverse trendelenberg position). Through 1 cm umbilical incision, veress needle inserted into the abdominal cavity and pneumoperitoneum was created targeting the intraabdominal from 12mmHg to 14mmHg. Once the abdomen is distended with CO₂ gas, 10mm optical trocar was inserted through the umbilical wound and 30° scope introduced into the abdominal cavity for primary surveillance. Then, 10 mm working port was inserted in the

midline of abdomen in the epigastric region at the level of liver margin. One 5mm port are inserted at the level of fundus of gallbladder along the midclavicular line and another 5mm port along the anterior axillary line just below the right subcostal margin (position of working ports may vary according to patients abdominal contour and position of gallbladder). Surgeon will stand on left side of the patient, cameraman will stand on left side of the surgeon and assistant will stand on right side of the patient to retract the gallbladder. Using the Maryland forceps and bipolar forceps Calot's triangle was identified, dissected and cystic artery and duct were identified. Cystic artery was clipped and transected and cystic duct was dissected until to see the dilated Common bile duct. Gallbladder was dissected from the liver bed and cystic duct opened



Figure 1: Intraoperative cholangiogram



Figure 2: Needle aspiration from CBD¹¹

partially to do intraoperative cholangiogram by inserting the cannula into it (figure -1). Common bile duct was identified by inserting a needle and aspirate for bile (figure -2). Once CBD was identified it was opened vertically with the help of endoknife and looked for bile to flow into the peritoneal cavity. All the debris and bile was sucked out (figure -3) and measures to extract the stone impacted in the CBD are attempted using balloon retraction (figure -4) method or basket retrieval under Cholelithoscope



Figure 3: CBD opened and debris sucked¹¹



Figure 4: Balloon retrieval of stone¹¹

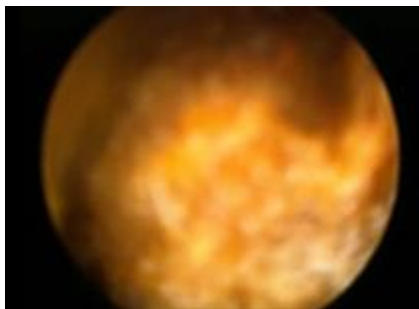


Figure 5: Cholelithoscope view of CBD stone¹¹



Figure 6: Finger inserted into the abdominal cavity¹¹

(Figure 5) etc. Once all the available methods are used unsuccessfully we decided to go for insertion of finger (index finger of left hand of surgeon) into the one of the medial subcostal 5mm port by making it into 15mm (figure-6). While doing negotiation with stone the intra-abdominal pressure was



Figure 7: Finger disimpacting the CBD stone¹¹

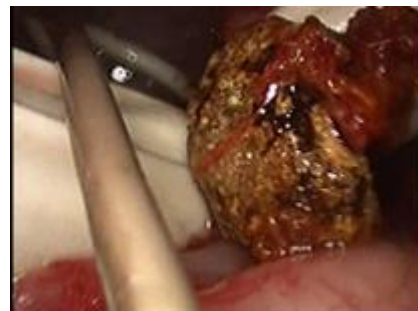


Figure 8: Impacted CBD stone cleared¹¹

Reduced to 8-10mmHg so that the surgeon's finger can reach the target comfortably but without compromising the visibility through scope (figure -7). With tactile sensation along with direct vision we could palpate the stone and disimpact it and push it toward cranially until it is visible through the opening made on the CBD (figure -8). Once the stone is visible, finger was removed and 15mm trocar was inserted into the wound or 5mm port inserted and the wound closed with suture to avoid leakage of gas from inside the abdominal cavity. All the extracted stones and removed gallbladder are kept in the retrieval bag and parked somewhere in the abdominal cavity to remove it safely at the end of procedure. Cholelithoscope was inserted into the CBD for the presence of any residual stones. Once CBD stone clearance was confirmed 12 Fr T-tube was inserted into the CBD and the long end was brought out through the closet anterior abdominal wall and secured well. Common bile duct defect are closed with 3-0 polyglactin and tube drain was kept in the Morrison's pouch and brought through

right flank. Specimens were removed finally from one of the port under vision and send for histopathological examination. All the trocars are removed under vision and wounds are closed with skin staplers after fascial closure with 2-0 polyglactin.

3. Results

From April 2015 to December 2019 we posted 15 cases of complex Common bile duct stone¹⁴(CBD) for Laparoscopic Common bile duct exploration(LCBDE). Out of initial 8 cases CBD stone clearance was completed successfully on 3 cases only with lot of difficulties and consumption of time and the remaining 5 cases were converted to open surgery and stones are cleared(Table -1). During performing the ninth case we had a similar problem of not able to retrieve stone through any of the available methods and we thought

of doing finger assistant for the retrieval of impacted stone in CBD. It took around 7 minutes to disimpact the stone with this method. We adopted this method for the next two cases presented with the same scenario and succeeded in clearance of stone from CBD and avoided conversion to open thus improved the quality of procedure, reduced considerable operative time and surgery related morbidity. In our small study group majority of them are females and with deranged liver function but fit for general anesthesia.From our observation it was found that for the above surgical scenario instead of converting to open or doing electrohydraulic or laser lithotripsy to clear the stone in CBD this novel technique(FALS – Finger Assisted Laparoscopic surgery) may help a lot and reduces the operative time, avoids the morbidity of open surgery and cut down the cost that will be spend of further sophisticated procedures.

Table 1: Case details of complex CBD stone posted for LCBDE from April 2015 to December 2019

Cases	Sex	Age	S. bilirubin	USG report	ERCP attempt	LCBDE result	Open CBD Exploration	FALS done
1	F	32y	Normal	Cbd stone	1 failed	Pass	-	-
2	F	48y	3gm/dl	Multiple cbd stones	1 failed	failed	yes	-
3	F	42y	4.3gm/dl	Impacted 1 cbd stone	2 failed	failed	yes	-
4	F	37y	Normal	Cbd stone	1 failed	failed	yes	-
5	M	53y	2.5g/ml	Distal cbd stone	1 failed	pass	-	-
6	F	27y	normal	Cbd stone	1 failed	pass	-	-
7	F	36y	normal	Cbdstone	1 failed	failed	yes	-
8	M	32y	6gm/dl	Impacted cbd stone	2 failed	failed	yes	-
9	F	47y	3.4gm/dl	Cbd stone	1 failed	failed	-	yes
10	M	35y	4gm/dl	Large cbd stone	2 failed	failed	-	yes
11	F	61y	normal	Cbd stone	1 failed	pass	-	-
12	F	58y	normal	Cbd stone	1 failed	pass	-	-
13	M	33y	2.7gm/dl	Multiple cbd stones	2 failed	failed	-	yes
14	F	45y	1.5gm/dl	Distal cbd stone	1 failed	pass	-	-
15	F	39y	3gm/dl	Cbd stone	1 failed	pass	-	-

4. Discussion

Common bile duct stones are usually managed by two stage procedure (ERCP followed by Laparoscopic cholecystectomy-LC) or single stage procedure (Laparoscopic cholecystectomy with laparoscopic common bile duct exploration-LCBDE). Patients with failed ERCP for CBD stone is considered as high complex cases⁹. One of the reason for the failure of ERCP in extracting CBD stone is impacted large stone > 1cm¹⁴. In this situation, the options available are LC plus LCBDE or open cholecystectomy with CBD exploration. But, the success rate for laparoscopic common bile duct exploration (LCBDE) after failed ERCP are around 66% and conversion rates are high⁹. Even though the success rate of CBD stone clearance rates are over 90% with cholangioscopicelectrohydraulic lithotripsy (EHL)¹⁰ or laser lithotripsy¹², the cost and time consumption to complete the task are more. Moreover it may require multiple endoscopic attempts to clear the stone completely¹³. In case of failed LCBDE instead of opting for open or endoscopic lithotripsy, using surgeons finger(s) for dislodgement of impacted stone in CBD which was inserted through one or more of the port site will aid in retrieval of stone along with the help of blunt laparoscopic instruments. We there by achieved back the tactile sensation which is lacking in laparoscopic procedure and prevented vindicated open surgery. More over the time consumed to execute the

procedure (FALS) after decided to do so is hardly 5 to 7 minutes from our study.

Finger-assisted laparoscopic surgery (FALS) is affordable and reproducible to perform the advanced laparoscopic procedures. This new technique made laparoscopic abdominal surgery easier and safer for beginners in laparoscopic surgery and skilled surgeons in advanced laparoscopic surgery¹. This simple technique of intracorporeal finger assistance permits a fast and safe solution in selected surgical cases². In the hands of an experienced laparoscopic team, FALRP (Finger assisted laparoscopic resection of prostate) for large benign prostatic hyperplasia is a feasible, reproducible alternative approach to open surgery. It is safe, with minimal intraoperative haemorrhage and post-operative complications, and a shorter convalescence period than open surgery³. Finger assisted laparoscopic surgery can be performed in complicated surgery where distinguishing normal and inflamed tissues is must for safer surgery. This technique restores the tactile ability and allows gentle and safe blunt dissection by the operating surgeon⁴. This technique are used for various procedures like Totally Extra Peritoneal mesh repair for inguinal hernia⁵, radical prostatectomy, myomectomy^{6,7}, to control bleeding, complicated appendectomy etc. Conversions were more frequent in the early part of learning curve, fewer among the group of experts in advanced laparoscopic surgery, conversions were due to an

intraoperative complication and conversion was done because of technical difficulties⁸.

5. Conclusion

Even though, the number of cases involved in our study are only three, the FALS can be applicable in all patients with complex CBD stone¹⁴ with failed ERCP and LCBDE. Because, FALS procedure for CBD stone extraction reduces the operative time and surgical cost significantly. In order to say that this novel procedure can be adapted as a standard method we need to wait for large case series. Also, we need to do further more case study to know about its reproducibility and success rate in patients with failed ERCP and LCBDE in clearing the CBD stones.

6. Conflicts of interest

The authors declare that there no conflicts of interests regarding the publication of this paper.

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