

# Feasibility of Telementoring as an Intraoperative Time-out Tool during Laparoscopic Cholecystectomy for Prevention of Biliovascular Injuries

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## ABSTRACT

Laparoscopic cholecystectomy is commonly performed procedure for gallbladder diseases. Biliovascular injuries are well known complications and various standard and safe strategies have been developed for safe cholecystectomy. Intraoperative time out is one of the strategies where two or more surgeons stop during surgery before dividing any structure in Calot's triangle. COVID-19 pandemic has expanded the horizon of telesurgery, teleconsultation, use of artificial intelligence and robotics in surgical training and execution. Easily available mobile applications like Facebook messenger, WhatsApp and Viber can be used for intraoperative time-out during difficult cholecystectomy with expert surgeon outside the vicinity of theatre. Such tools are cost effective and definitely boost the confidence of surgeons during surgery in case of any complexity, or help in stopping the procedure and in timely referral.

**Keywords:** Cholecystectomy; laparoscopy; telementoring.

## INTRODUCTION

Biliovascular injuries (BVI) are common complications of laparoscopic cholecystectomy (LC).<sup>1</sup> There are various local and technical factors responsible for BVI.<sup>2-4</sup> Three conceptual steps for avoidance of bile duct injury are achieving Critical view of safety (CVS), reaching the inflection point and knowing conditions that require bail out procedures.<sup>1</sup> In all these steps, opinion of more than two surgeons or availability of experienced surgeon is of help. Use of mobile application for teleconsultation and telementoring during surgery has been reported. Hence, we are presenting our three consecutive cases of LC that were rescued with the help of Facebook video conference.

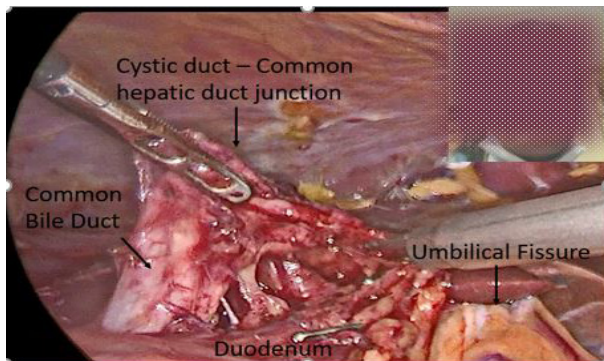
## CASE REPORTS

### CASE 1

Sixty-seven-year-old male had history of recurrent biliary colic, sonography and Contrast-enhanced computerized

tomography (CECT) revealed contracted gall bladder with enhancement of gall bladder wall. Patient was planned for LC. Intraoperatively gall bladder was shrivelled and barely visible due to dense inflammation. Dissection of Calot's triangle was difficult. Since the anatomy was unclear, intraoperative time out was done with expert surgeons via Facebook video conferencing application using mobile phone. After teleconsultation, it was found that common bile duct (CBD) was assumed to be the cystic duct (CD) and hence was dissected for application of clip (Figure 1). The junction of CD and common hepatic duct (CHD) was thought to be infundibulo-cystic junction. Further dissection was not attempted due unclear anatomy (Figure 1). Hence, LC was converted to open procedure as advised by expert surgeon and safe cholecystectomy was contemplated. Patient was discharged on sixth postoperative day. During follow-up, he was readmitted for deep incisional wound infection, which required debridement and injectable antibiotics. He is doing fine on three months follow up.

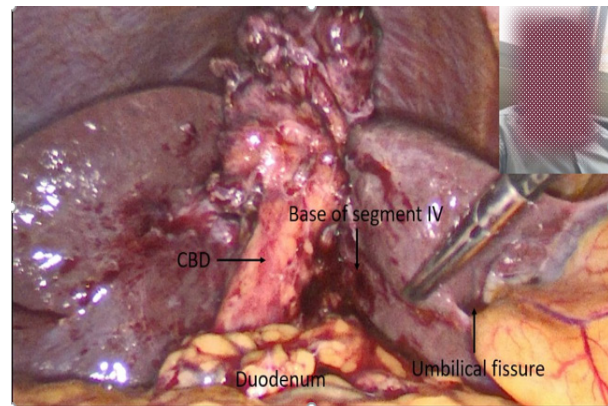
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**Figure 1.** Intraoperative telementoring using Facebook messenger, where common bile duct has been dissected assuming the CD and cystic duct-common hepatic duct junction has been lifted assuming the infundibulo-cystic junction.

### Case 2

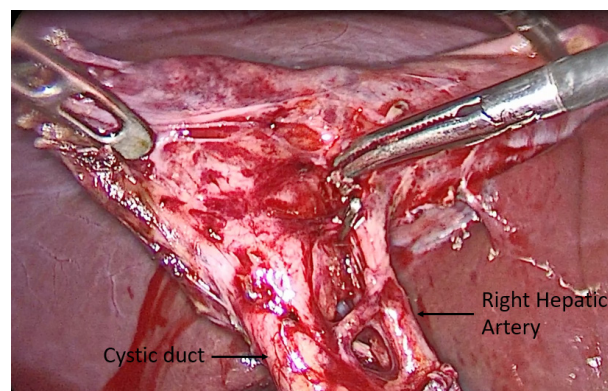
Seventy-six-year-old male presented in Surgical OPD after five months following ERCP and stenting for biliary pancreatitis due to the ongoing COVID pandemic. He was planned for LC. Intraoperative view revealed a shrunken gallbladder and unrecognizably contracted cystic duct. There was dense adhesion at Calot's triangle due to retraction of the fundus of gall bladder. Among the three fixed anatomical landmarks, umbilical fissure and base of segment four was visible. However, Rouviere's sulcus was not visible. Before proceeding for dissection, intraoperative time out was done among surgeons in the team and Facebook video conferencing was done to confirm the anatomical landmarks (Figure 2). The dissection was started above the imaginary line drawn above umbilical fissure, base of segment 4 and towards presumed R4U line (Rouviere's sulcus → base of segment IV → umbilical fissure). Fenestrating subtotal cholecystectomy was done. Abdominal drain and biliary stent were removed on fifth postoperative day. Patient is doing fine in follow up visits.



**Figure 2.** Intraoperative view of Calot's triangle showing unrecognizable contracted cystic duct and key landmarks being observed by mentor via Facebook messenger. The retraction of gallbladder has caused the traction on CBD that is crossing the presumed R4U line.

### Case 3

Twenty-four-year-old male presented with diagnosis of biliary colic. During LC, diagnostic laparoscopy showed distended and tense gall bladder. Decompression of gall bladder was done which revealed mucocele of gall bladder. There was dense adhesion in Calot's triangle but cystic duct was easily identified. However, there was a large pulsatile vessel in Calot's triangle that was giving multiple branches to cystic duct and gall bladder. Intraoperative time out was done using Facebook video conferencing application with expert surgeons in the team (Figure 3). In accordance with the expert's recommendation, all the small branches from RHA to Calot's triangle were clipped individually in order to preserve RHA. The patient was discharged 16 hours after the surgery with normal postoperative course. The patient is doing fine during follow up.



**Figure 3.** Right hepatic artery and its branches to structure in Calot's triangle.

## DISCUSSION

We presented our three consecutive cases of LC where we used Facebook video conferencing mobile application as adjunct for intraoperative time out. We were able to prevent injury to CBD in first two cases and injury to RHA in the third case.

Problem of misidentification are common and cause serious complications. Common bile duct, mistaken for cystic duct, are usually injured, and may be associated with hepatic artery injury. Superior traction of pouch of Hartmann causes cystic duct and common bile duct to align and be visible as one structure that may be injured.<sup>4</sup> During infundibular technique of dissection, cystic duct is followed up to gall bladder to see the flaring of infundibulum, which is a clue to identify cystic duct. However, when common bile duct is isolated mistakenly and followed up such flare may be seen at junction of cystic duct and hepatic duct resembling the infundibulo-cystic junction.<sup>4</sup> These are common in patients with short cystic duct, large stone in Hartmann pouch and severe acute inflammation.<sup>4</sup> Recently, Strasberg has defined inflection point in cholecystectomy as the moment or point in time at which the decision is made to halt the attempt to perform a total cholecystectomy laparoscopically and to finish the operation by a different method.<sup>1</sup> In all of our consecutive three cases we were able to prevent major BVI using telementoring as intraoperative time out tool.

Achieving CVS is one of the standard practices to reduce BDI. This is not always practical so other strategies to reduce BVI also have been explained by SAGES.<sup>5</sup> Among six strategies recommended by SAGES, the third strategy is to make liberal use of cholangiography or other methods to image biliary tree intraoperatively in difficult cases or unclear anatomy.<sup>5</sup> IOC at times may be impractical and even cause injury to CBD (short or absent cystic duct, fibrotic cystic duct). At times interpretation of IOC may be challenging and mistaken. These scenarios stress the importance of appropriate training in both performing and interpreting an IOC.<sup>6</sup> In LMIC, the availability of fluoroscopy, trained personnel and contrast agent are the main constraint factors. Other intraoperative imaging modalities like laparoscopic ultrasound, fluorescent cholangiography have also been recommended but are not easily available in LMIC.<sup>7</sup> Fifth strategy advises intraoperative momentary pause prior to clipping and cutting until CVS is achieved. Sixth strategy advises that it is helpful to obtain the advice of a second surgeon when it is practical, under conditions in which the dissection is stalled, the anatomy is unclear or under other conditions deemed "difficult" by the

surgeon.<sup>8</sup> In all of these strategies, decision of more than two surgeons or an experienced surgeon would definitely help. In LMICs trained surgeons are not adequate; at times a single surgeon has to perform such procedures in remote areas. So intraoperative decision making may be challenging requiring abandonment of the procedure and referral to a higher centre. With use of such video conferencing applications, intraoperative decision making can be improvised for safe contemplation of procedure or timely referral. During these strategies, use of tele mentoring with easily available smart phone applications like Facebook, WhatsApp and Viber based video conferencing can prevent major biliovascular injury. Kapoor et al. recommended use of smartphone-based video sharing platforms like Facebook live, WhatsApp.<sup>8</sup> In LMIC the role of such application can definitely add confidence to operating surgeon in remote areas and help to abandon procedure for timely referral or to perform bail out procedure.<sup>8</sup> Various predictive model and score for difficult cholecystectomy have been advised in literature.<sup>3</sup> Preoperative sonographic signs, CECT based preoperative findings (pucker sign), MRI based preoperative finding that can be used for patient selection, optimization and surgical planning can be used to pre inform the surgical team at distance to be available during the surgery for tele mentoring.<sup>9</sup>

In the era of application of Robotics and Artificial intelligence (AI) in surgery in developed countries, use of such simple application in LMICs can aid to overcome geographical limitation for mentoring.<sup>10</sup> Though telementoring and teleconsultation cannot replace traditional teaching in operating theatre, use of this application can create a foundation for robotics and AI application in surgical education in LMICs.<sup>11</sup>

## CONCLUSIONS

LC is commonly performed procedure worldwide. Several strategies have been discussed and are being practiced to minimize Biliovascular injuries. Intraoperative momentary pause at inflection points to seek expert opinion is also routinely practiced. We here presented three consecutive cases of LC where we used Facebook video conference as intraoperative time out tool before clipping and cutting any structures. We were able to prevent major BVI in these cases. We therefore recommend using such applications when performing difficult cholecystectomy in remote areas to facilitate bringing highly experienced mentor to areas in need of expertise. This allows inexperienced surgeons to perform complex procedure safely, decide for bail out procedure or timely referral hence reducing BVI.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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