Innovative Approach to a Frozen Calot's Triangle During Laparoscopic Cholecystectomy

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Received: 30 July 2015 / Accepted: 14 September 2015 / Published online: 30 September 2015
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Abstract The laparoscopic cholecystectomy is now the “gold standard.” In around 2 % of cases, there is a need to convert because of the difficult dissection encountered in the Calot's Triangle, a “frozen Calot's triangle.” There is no consensus among surgeons about how to tackle this situation. To lower the conversion rate, there is a continuous attempt made to innovate. The authors present their rationale and experience in 100 difficult cases by creating a retro-gallbladder tunnel and encircling the gallbladder by a gauze for maneuvering.

Keywords Laparoscopic cholecystectomy · Frozen Calot's · Retro-gallbladder tunnel · Gauze sling

Introduction

The incidence of difficult Calot's triangle dissection is about 15 %. In difficult circumstances, there is a tendency to convert. The incidence of conversion from centers adopting a “no hesitation policy” to convert of 7–10 % is now settling down to an acceptable 1–2 %. Bile duct injuries in the laparoscopic series is 0.4–1.3 %, as compared to 0.2–0.3 % in the open series [1]. Thirty-four to forty-nine percent of all surgeons doing laparoscopic cholecystectomy have committed a bile duct injury. Conversion rate decreases with experience. We describe our experience of 667 laparoscopic cholecystectomies

of which 100 cases were difficult. We used our innovation in 82 cases reducing our conversions and bile duct injuries.

Our Innovation

Our innovation is based on constant biliary and extra-biliary anatomical landmarks in an area of numerous variations. These landmarks are unaltered by any pathology of the gallbladder.

Rouviere's Sulcus

This is a 2–5-cm sulcus running to the right of the liver hilum anterior to the caudate lobe. It contains the right portal triad or its branches. The sulcus identifies the plane of CBD accurately (a fact substantiated by cholangiographic studies) [2]. It can be identified in 80 % of cases. This sulcus is taken as the starting reference point for the commencement for a safe dissection. The plane of this sulcus should always be kept in mind during surgery. This extra-biliary reference point is a constant landmark on the liver surface not distorted by any pathology.

Cholecystic Plate

Gallbladder is attached to the liver by loose areolar connective tissue that contains lymphatics and rarely small ductules (ducts of Luschka). This plane is called the cholecystic plate. Being avascular is a safe plane for retro-gallbladder dissection. This feature of avascularity is unaltered in all forms of cholecystitis. Advantage is taken of this fact to create the retro-gallbladder tunnel [3].

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Cystohepatic Triangle

Calot described this triangle in 1891 formed by the cystic duct, hepatic duct, and the cystic artery. This triangle has now been modified to the cystohepatic triangle. In reality, it is a space bounded by the cystic duct, hepatic duct, and the inferior surface of the liver. It contains the RHA, cystic artery, Lunds lymph node, connective tissue, and lymphatics. The constant landmarks of this triangle being the inferior surface of liver and the right side of the common hepatic duct, dissection should be inferior to the liver and to the right of the duct [4] (Fig. 1).

Operative Technique

The initial steps of the operation are the same as for routine laparoscopic cholecystectomy. When difficulty is encountered in dissection as in a frozen Calot's Triangle, the following steps are followed (Fig. 2).

The Rouviere's sulcus is identified. Dissection begins ventral to this sulcus. A peritoneal incision is made high on the body of the gallbladder. This incision extends on the medial and lateral peritoneal reflections [5]. The gallbladder remains attached by the fundus, as the dissection proceeds dorsally and ventrally till a plane is created in the cholecystic plate [3]. A small tunnel is made behind the body of the gallbladder. Gauze is then passed through this tunnel engulfing the gallbladder to form a sling. This is held by a grasper and used as a multipurpose tool. This step is necessary as the gallbladder is difficult to grasp. The sling lifts the gallbladder away from the liver bed in the cholecystic plate, without the fear of shearing.

Dissection deeper to this plane may injure the liver while superficial dissection may cause perforation of the gallbladder. The Rouviere's sulcus should be intermittently visualized (Fig. 2).

The dissection then proceeds to the junction of the cystic duct and gall bladder neck to establish the critical view of safety. In 15 cases, further dissection was difficult due to obliteration of the Calot's triangle by dense adhesions; to prevent any biliary injury, we did a subtotal (partial) cholecystectomy. We prefer this sling method in all cases where the Calot's triangle is frozen.

Benefits of the gauze sling are the following:

1. Sustained traction can be applied to the body of the gallbladder by the gauze sling without fear of shearing. Thus, the gallbladder is lifted through the cholecystic plate.
2. The loose ends of the gauze facilitate mopping of the blood and act as a good pressure hemostat whenever there is spurter.

We recommend its use in difficult cases. By adopting this procedure, we have been able to carry out a comparatively cleaner and safer cholecystectomy lowering our conversion rate to <1 %. In the cases we opened, the pathological distortion was severe.

Material, Method, and Results

Six hundred sixty-seven laparoscopic cholecystectomies were performed between 2009 and 2014; we started applying this technique from 1996.

Fig. 1 Landmarks to approach the gallbladder

Fig. 2 Steps of surgery

Gauze tape was employed in 82 cases of the 100 difficult cases (82 %). We did a subtotal cholecystectomy in 15 out of the 82 cases (18.29 %).

Laparoscopic procedure had to be converted to the open procedure in three patients. Conversion rate is 0.44 % of the total cases and 3.63 % in the difficult cases (Fig. 3).

Our conversion to open initially (1996–2009) was high. In the 738 cases operated in that period, we had to open in 16 cases (2.1 %). After adapting this technique, we have been able to lower the conversion rate to 0.44 %; our conversion rate overall is 1.2 %.

Discussion

Cholecystectomy is the commonest surgery done. The laparoscopic approach is now the “gold standard.” Safety is of paramount importance when one considers the fact that this surgery is for a benign disorder and any ductal injury is associated with serious morbidity. Strasberg et al., in a large series of

25,000 open cholecystectomies, reported a 0.3 % incidence of bile duct injury. Nuzzo from Italy (2005) analyzed 56,591 cases of laparoscopic surgery and reported injury in 235 cases (0.4 %). The alternative to a difficult laparoscopic cholecystectomy is conversion to open or do a subtotal cholecystectomy. Both options should never be considered as failure.

Worldwide the accepted conversion rate is 2.0–6.0 %. Way et al. found that the primary cause of error in 97 % of cases was a “visual perceptual illusion.” Faults in technical skill were present in only 3 % of cases.

Hunter highlighted methods to minimize bile duct injury by (1) use of a 30° telescope, (2) avoidance of cautery near the common duct, and (3) proper lateral traction. Experience of the surgeon plays a major role in lowering conversion rate.

Dissection in a frozen Calot’s triangle is difficult as the fibrosis causes the gallbladder to contract or else, the gallbladder becomes friable and tense making grasping difficult. Neovascularisation causes oozing compounding the problem.

Grasping the gallbladder is the major step for this surgery. Methods normally employed are the following:

1. The gallbladder is held with a toothed grasper.
2. Placing additional trocars.
3. Placing a stitch through the fundus for retraction.
4. When these fail, the fundus first technique could be tried, which only postpones the inevitable difficult dissection to a later time.

Fig. 3 Analysis of cases

With these procedures, there is often shearing of the gallbladder compounded by continuous oozing. Here, the gauze sling is of great help. It is less traumatic and the chances of tearing or shearing the gall bladder are minimum also less chances of slipping of the gauze sling once held, unlike the grasper which repeatedly slips.

Oozing is a problem frequently encountered; one normally introduces a separate gauze piece for this. By using a gauze sling, the surgeon utilizes its loose ends to absorb blood and also as pressure agent.

Listing the benefits mentioned above of the gauze sling in holding the gallbladder and tackling oozing effectively, we recommend its use in apt situations.

Conclusion

In the present era of “zero error,” bile duct injuries are unfortunately not uncommon. It is a big tragedy for the patient. The major concern is the difficult dissection in the area of a frozen Calot’s triangle. No consensus is found among surgeons to safely dissect this area. By creating a retro-gallbladder tunnel in the cholecystic plate and use of a gauze sling to retract the

gallbladder from its bed, the surgeon minimizes complications and reduces conversions. The value of the fixed landmarks of Rouviere’s sulcus and cholecystic plate needs to be emphasized. We strongly recommend its use in all difficult cases to prevent patients from becoming biliary cripples.

Conflict of Interest None

Funding Sources None

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