



### Editorial

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## How Laparoscopic cholecystectomy can be made near hundred percent Safe

*Sunder Goyal*

*Professor, Department of Surgery, Kalpana Chawla Government Medical College, Karnal, Haryana-132001, India*

Laparoscopic cholecystectomy was introduced by Erich Muhe in 1985 and it has gained worldwide acceptance within a short period of time to become the gold standard treatment for cholelithiasis. The incidence of bile duct injuries have definitely increased compared with the open technique due to new procedure involving "Hand & Eye Coordination". No doubt with subsequent improvements in the equipment and training in the laparoscopy, the incidence of these injuries has decreased. However, worldwide incidence of Common Bile Duct (CBD) injury has remained fairly constant around 0.5%, as reported in literature. Even in the United States, 34 to 49% of surgeons have caused a major bile duct injury with an individual experience of one to two such cases. Bile duct injuries affect the quality of human life because these injuries often demand several invasive procedures and subsequent surgeries. These patients continue to have a higher incidence of death as compared with those who have an uncomplicated cholecystectomy. There is a major increase in healthcare expenses associated with the complications.

But with improved equipments, better "Hand & Eye Coordination" along with proper understanding of anatomy, laparoscopic cholecystectomy can be done safely up to hundred percents. In addition proper section of cases with the help of preoperative ultrasonography, complications can be reduces further. Still following factors contribute to CBD injuries-

1. Variant Anatomy-This include a short cystic duct, aberrant hepatic ducts or a right hepatic artery that crosses anterior to common bile duct.
2. Adhesions in Calot's triangle.
3. Technical errors of Equipments.

In view of the importance of anatomy of extra hepatic biliary system, it is logical to look at the possibility of assessing the anatomy while performing laparoscopic cholecystectomy. Following anatomical landmarks are very important and must be identified during laparoscopic cholecystectomy to avoid injury to biliary ducts.

1. Calot's triangle
2. Cystic Lymph node of Lund
3. Junction of cystic duct with bile duct
4. Hartmann's pouch
5. Cystic artery and right hepatic artery
6. Rouviere's sulcus
7. Safety window or critical view

The Calot's triangle is bounded on the upper border by inferior surface of liver and on the other two sides by cystic duct and common hepatic duct. Its contents usually include right hepatic artery, cystic artery, cystic lymph node of Lund, connective tissue and lymphatics. Dissection of this triangle during laparoscopic cholecystectomy is a challenging step as in reality it is a potential space rather than a large triangle. In addition, the inflammatory process due to cholecystitis further results in occlusion of the space due to adhesions.

The cystic duct joins the Hartmann's pouch of gall bladder to the bile duct and is an important structure which needs identification during laparoscopic cholecystectomy. The cystic lymph node of Lund provides a guide to it. The cystic duct may run a straight or a convoluted course and may be less than 2 cm in size in many patients. The cystic duct is usually 2-3 mm wide but can dilate in presence of stones. The cystic duct joins the gall bladder at the neck and this angle is fairly acute. The mode of joining with gall bladder may be smooth tapering or abrupt. On the bile duct side its union may show significant variations. It is always safe to dissect the cystic duct with its junction to the bile duct. It is important to remember that even in

### **\*Corresponding author:**

**Prof. Sunder Goyal**

Professor, Department of  
Surgery, Kalpana Chawla  
Government Medical College,  
Karnal, Haryana-132001, India

low insertion variety of cystic duct it rarely goes behind the duodenum. So a duct behind the duodenum is more likely to be common bile duct. Therefore two ductal structures entering the gall bladder should always be suspicious.

The Hartmann's pouch is an out pouching of the wall in the region of the neck with pressure of stones. A large Hartmann's pouch may obscure cystic duct and Calot's triangle. This may result to its adherence to the bile duct. The small cystic duct can get completely hidden and traction on the gall bladder and can lead to bile duct looking like cystic duct. An exaggerated form of the same process is 'Mirizzi' syndrome in which a large stone in the Hartmann's pouch are either adherent to or erodes into the bile duct. This can create major difficulty during laparoscopic cholecystectomy.

The cystic artery is a branch of right hepatic artery and is usually given off in the Calot's triangle. It has a variable length and enters the gall bladder in the neck or body area. It divides into anterior or superficial branch and posterior or deep branch. This branching usually takes place near the gall bladder. If the presence of the posterior branch is not appreciated it can cause troublesome bleeding during dissection. The right hepatic artery courses behind the bile duct and joins the right pedicle high-up in Calot's triangle. It may come very close to the gall bladder in form of Moynihan's hump. If such a hump is present cystic artery is very short. In this case right hepatic artery can be mistaken as cystic artery and can get torn.

The Rouviere's sulcus is a fissure on the liver between right lobe and caudate process and is clearly visible during a laparoscopic cholecystectomy during posterior dissection in a majority of patients. Being an extra biliary reference point it does not get affected by distortion due to pathology. it correspond to the level of porta hepatis where the right pedicle enters the liver. To avoid injury to bile duct, all dissection should be kept above or anterior to this sulcus

#### **Safety window or critical view-**

The limited magnified view of anatomy of Calot's triangle in laparoscopy is 2-dimensional vision as compared to 3-dimensional view in open cholecystectomy. The retraction of Hartmann's pouch during laparoscopic cholecystectomy tends to distort the Calot's triangle by actually flattening it rather than opening it out. A clear delineation of junction of the cystic duct with gall bladder is identified by cystic node of Lund with the demonstration of a space between the gall bladder and liver clear of any other structures other than cystic artery called the safety window or critical view has already been recommend as an essential step to prevent injury during laparoscopic cholecystectomy. The lower one third of the gallbladder is separated from liver to expose cystic plate. Thus two and only two structures (cystic duct and artery) are seen entering gallbladder.

Finally to conclude,

1. Always use high quality imaging equipments to optimize image of caot's trainagle.
2. Proper Orientation of caot's triange and dissection of Calot's triangle is most important along with identification of these landmarks to safeguard to biliary injuries. The dissection should be kept as close to gall bladder as possible.
3. Sensitivity of events in the operating fieldt includes visual, tactile, or auditory information. In In laparoscopic surgery, tactile input and stereoscopic depth perception are lacking, so, control for the operation is entirely dependant on visual data, so imaging equipment should be of the highest quality.

4. While there has been a lot of focus on technology and technical skills, identification of anatomy and its relevance in prevention of biliary injuries needs space in future to make laparoscopic cholecystectomy near 100% safe.

#### **Prof. Sunder Goyal**

*Professor, Department of Surgery, Kalpana Chawla Government Medical College, Karnal, Haryana-132001, India*