



Safe Laparoscopic Cholecystectomy Techniques in Difficult Cases

Zor Olgularda Güvenli Laparoskopik Kolesistektomi Teknikleri

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Cholecystectomy is one of the most frequently performed operations in general surgery practice. Its main indications are symptomatic gallstones, complications of gallstones and gallbladder polyps. In symptomatic patients, the gold standard today is laparoscopic cholecystectomy.

Although the number of bile duct injuries seen in laparoscopic cholecystectomy has decreased in recent publications, it is still twice as high as in open cholecystectomy (1). The most common cause of bile duct injuries in gallbladder surgeries is insufficient identification of tissues. Although the anatomical variations of the bile ducts up to 30% and the surgeon's experience are important factors, the most important reason for serious injury is the cut of the common bile duct, which is mistaken for the cystic duct. Previous attacks and dense adhesions are identified as another important factor. When the operation is started, if the situation is different from the standard expectations, it is important to prevent complications. Although many suggestions have been made about what we should do in this situation, the techniques we apply make things much easier. These are "critical view of safety", "triangle of safety technique", "fundus first" and "subtotal or partial laparoscopic cholecystectomy" techniques (2,3). If the anatomy cannot be understood, intraoperative cholangiography, intraoperative ultrasonography, fluorescence imaging methods may be guiding. In this article, I will talk about safe laparoscopic cholecystectomy techniques in difficult cases.

The generally applied method in laparoscopic cholecystectomy is the infundibular technique. Here, dissection is started from the neck of the bladder, the upward structures are clarified, the

cystic artery and cystic duct are exposed, then clipped and cut (2). When laparoscopic cholecystectomy began to be widely used, some of the publications stated that biliary tract injuries increased. Injury is mostly caused by misidentification of anatomical tissues and technical difficulties. Inadequate surgical technique, inability to understand how the injury occurred, delay in conversion to open surgery, insufficient field of view, inflammation, aberrant anatomical structures, and male gender were defined as risk factors in some publications (1,4-6). Various opinions have been put forward in order to better determine the anatomical structures in laparoscopic cholecystectomy, and different perspectives have been tried to be put forward, especially when applying the dissection stage (3,4,6).

Critical View of Safety (CVS)

This method was defined by Strasberg in 1995 (7). There are 3 criteria in the CVS. The first is the cleansing of the elements in the Calot triangle from fat and fibrous tissues. The second criterion is the separation of the lowest part of the gallbladder from the cystic layer, where fibrous adhesions can be seen as the gallbladder is not peritonized. Sometimes this layer can be the liver bed. The third criterion is to make it clear that only two structures enter the gallbladder. The basic rationale of CVS is to apply the two-stage method used in open cholecystectomy to define the bile ducts. In the first, the cystic duct and artery are determined by dissection of Calot's triangle, then the gallbladder is completely separated from the bed and it is shown that there are only two structures connected to the gallbladder.

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Triangle of Safety Technique (TST)

This technique was described by Almutairi and Hussain (8). The aim of the TST technique is to define a new anatomical area different from Calot's triangle, which will create a safe dissection area away from the common bile duct in clarifying the tissues. While the gallbladder is pushed from the fundus to the right lobe of the liver by the assistant, the surgeon pushes the sac from the Hartman pouch laterally with his/her left hand. It is clarified in 4 basic steps using TST electro cautery hook. In the first step, the peritoneum on the gallbladder wall is dissected down from the midline parallel to the cystic artery and up to the junction of the cystic artery and cystic duct. In the second step, the branches of the cystic artery are determined one by one in accordance with the layers under the peritoneum and proceed to Calot's artery, where the cystic artery and cystic duct meet. In dissection, the place where the cystic duct enters the infundibulum and the posterior wall of the gallbladder are clarified. The third step is to separate the lateral peritoneal adhesions. The fourth step is to reach the lateral wall of the gallbladder by separating the tissues between the borders of the TST, while not injuring the branches of the posterior cystic artery.

"Fundus First" Laparoscopic Cholecystectomy

Here, unlike normal, the dissection is started from the fundus and progressed downwards to the liver hilum.⁴ This technique is also called the "top-down" method. This method, which is frequently used in open cholecystectomy, is preferred in laparoscopic cholecystectomy when Calot's triangle is not prominent. In the anterograde approach, dissection is performed from the fundus to the infundibulum. The gallbladder is dissected from the liver bed. Some peritoneum is left in the liver bed to retract the liver. After making sure the cystic artery and cystic duct structures, these structures are clipped and cut.

Laparoscopic Subtotal or Partial Cholecystectomy

In this technique, dissection of Calot's triangle, of which anatomy cannot be clearly distinguished, is avoided. If access to Calot's triangle cannot be achieved safely due to fibrosis or inflammation with CVS and "first fundus" methods, a laparoscopic subtotal or partial cholecystectomy is performed by excising a portion of the gallbladder and its contents from a safe margin. All stones and bile contents should be safely aspirated and removed from the abdomen. Here, a partial cholecystectomy is performed and cut proximal to the cystic duct. In patients in whom the posterior wall of the gallbladder is very attached to the liver, partial cholecystectomy can be performed by leaving a part of the gallbladder in place. The mucosa of the remaining posterior wall should be cauterized (9,10).

In the presence of mild to moderate inflammation, the standard procedure can be applied. The first steps in the application of laparoscopic cholecystectomy are similar in most methods. Calot's triangle is cleared of fat and fibrous tissue. This can be done by a variety of techniques: tissue is separated with holders or gauze dissectors, cautery with hooks, or blunt-ended and curved

dissectors. Dissection is usually done anterior and posterior to the Calot's triangle. There are two points to note for cautery. The first is the use of cautery at low power settings of 30W and below, and the second is to prevent unintentional damage to the surrounding tissues by pulling the cauterized tissue higher than the surrounding tissues. Cautery should be applied in shots of 2-3 seconds or less because thermal spread to surrounding tissues should be minimized. It is also important that the tissue is separated only in small pieces at one time. Because important biliary structures can be very small in diameter. With the application of these approaches, it is not difficult to clean the Calot's triangle from fat and fibrous tissue and to separate the gallbladder from under the cystic plaque in the presence of mild or moderate inflammation. When this is done, all structures are made visible before they are clipped and cut. If the tissues cannot be identified, the sac is separated from the bed until the right of the fundus. During separation of the cystic structures, the artery can be dissected first, because with the separation of the shorter artery from the cystic duct, the length of the cystic duct becomes more visible. Performing this intraoperative cholangiography also facilitates insertion of a catheter into the cystic duct if necessary. Each structure should then be clipped and cut to avoid damage. There are different methods in the literature on safe separation of the gallbladder laparoscopically. The surgeon should agree with his assistant in laying out the critical points during the dissection (5,6).

In severe inflammation, the ducts can be seen to cross the Calot's triangle and even merge with the cystic duct. However, the entrance to the gallbladder cannot be seen, sometimes the right hepatic duct directly entering the gallbladder can be seen. As in Mirizzi syndrome, the cystic duct may disappear due to a larger stone. In these conditions, the cystic duct terminates in the lower part of the right hepatic duct, and severe chronic inflammation may occur in all these patients. Surgeons are more likely to circumferentially dissect the common bile duct and consider it a cystic duct in the presence of severe acute and chronic inflammation. Because certain factors that occur in these conditions can hide the cystic duct and connect the main hepatic duct to the edge of the gallbladder. This can cause confusion between the main duct and the cystic duct and lead to bile duct damage. If the surgeon thinks that the main bile duct is the cystic duct, he/she should obtain a 360-degree view of the funnel-shaped structures similar to the fusion of the cystic duct and the gallbladder. If the cystic artery is not diagnosed, the Calot's triangle is not completely cleared, and the base of the cystic plaque is not visible, the surgeon will have difficulty continuing after isolating the common bile duct. This is actually acceptable and shows that there is a problem. It is important for the surgeon to understand this when this stage becomes more difficult during the operation. In addition, options such as intraoperative cholangiography, intraoperative ultrasonography, fluorescence imaging, conversion to open cholecystectomy, or seeking help from a colleague should be considered. The critical vision method may be superior to the infundibular technique in severe inflammatory conditions because it requires more care. The patient is definitely protected because the surgeon does not

usually refer to a wrong view. If there is severe adhesion and the anatomy cannot be differentiated, insistence on dissection should be avoided (2).

As a result, it is not possible to recommend a single method to prevent biliary tract injuries according to studies. Most of the surgeons firstly agree that CVS is the most appropriate dissection technique. If adequate vision is not achieved, “fundus first” technique is used and if this is not sufficient, “subtotal laparoscopic cholecystectomy” can be applied. In case of difficulties, it should not be avoided to resort to intraoperative cholangiography, intraoperative ultrasonography and fluorescence imaging methods. Recognition of dangerous situations and knowledge of alternative techniques will ensure that the surgery is completed with minimal risk of injury to the patient. In patients in whom exploration cannot be performed safely or in patients in whom open surgery is thought to be safer such as in patients with bleeding, open cholecystectomy should not be hesitated, and conversion to open should not be considered as a complication or failure. The request to complete the transaction should not prevent the transaction from being completed safely.

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