Technique

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New retraction technique to allow better visualization of Calot's triangle during laparoscopic cholecystectomy

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Abstract:
Background: Bile duct injuries during laparoscopic cholecystectomy (LC) are thought to occur because surgeons tend to confuse the common bile duct (CBD) with the cystic duct. Among reasons for this misidentification, the difference in the way the operating field is exposed in LC compared to open cholecystectomy should be noticed. Using Dr. Reddick's technique, which is commonly practiced, the upward and the lateral traction of the gallbladder results in a narrower Calot's triangle and angulation of the CBD. These anatomical distortions are thought to contribute to ductal injuries during LC.
Methods: We propose a new method to expose Calot's triangle during LC. The principle of this technique is to expose the hepatic hilus by retracting the caudal surfaces of the quadrate and lateral lobes of the liver using an atraumatic curved instrument.
Results: The advantages of this technique are that one gains wide exposure of the hepatic hilus, leaves Calot's triangle undistorted, and avoids tenting the CBD.
Conclusions: This new technique may make LC safer and decrease the number of bile duct injuries associated with the misidentification of the anatomy.

Key words: Retraction technique — Bile duct injuries — Calot's triangle

In our hospital, we have treated gallbladder diseases by laparoscopic cholecystectomy since 1992. Currently, laparoscopic cholecystectomy is indicated for almost all cases of gallbladder diseases, with the exception of malignancies.

Until recently, we were employing methods for the visualization of the operative field which were recommended by Reddick and Olsen [6], and which are still commonly used in the United States. Dr. Reddick's technique uses a forceps inserted into a lateral port to retract the fundus of the gallbladder and the liver upward, while another forceps is inserted into a port in the midclavicular line to retract the infundibulum outward. We believe that this technique does not allow adequate exposure to effectively dissect Calot's triangle because the anatomy is distorted and narrowed by retracting the fundus upward and the infundibulum laterally from the gallbladder (Fig. 1). In a different ''European'' technique described by Perissat [5], a forceps or retractor is inserted into the port in the midclavicular line to retract the inferior surface of the liver upward. We believe that this exposure is sometimes not sufficient and the anterior edge of the liver may extend downward over Calot's triangle and interfere with the procedure. The liver may also be injured by the traumatic retractor instrument (Fig. 2).

We have designed a new technique to expose the hepatic hilus for laparoscopic cholecystectomy which is straightforward, easy to perform, and gains a wide exposure atraumatically.

Surgical technique

Under general anesthesia, the patient lies supine with the left leg straight and the right leg abducted about 30° to 45° in reverse Trendelenburg position. The surgeon stands on the patient's left side with the camera assistant between the patient's legs and the operative assistant on the patient's right side. The trocars are placed in the umbilical, subxiphoid, right midclavicular, and anterior axillary lines. The Hasson approach for establishing the pneumoperitoneum is employed.

To expose Calot's triangle, we first retract the quadrate lobe and lateral segment of the liver cephalad with Roticulator (USSC) forceps inserted into the lateral trocar. The tip of the Roticulator instrument flexes around the lifted liver in order to avoid the forcep tip injuring the surface of the liver (Figs. 3 and 4); this prevents forceps inserted from the midclavicular port and the anterior axillary port from crossing each other.

The surgeon employs a two-handed technique using forceps through the midclavicular port and the subxiphoid port. Calot's triangle is dissected by retracting the infundibulum of the gallbladder laterally and caudally. This technique does not narrow Calot's triangle because no upward traction of the gallbladder is employed to open the hepatic hilus. Less traction force is also required using this technique, since traction is not being exerted from both upward and lateral directions. By lifting the liver, the common duct is stretched axially and the distortion of the common duct is prevented.

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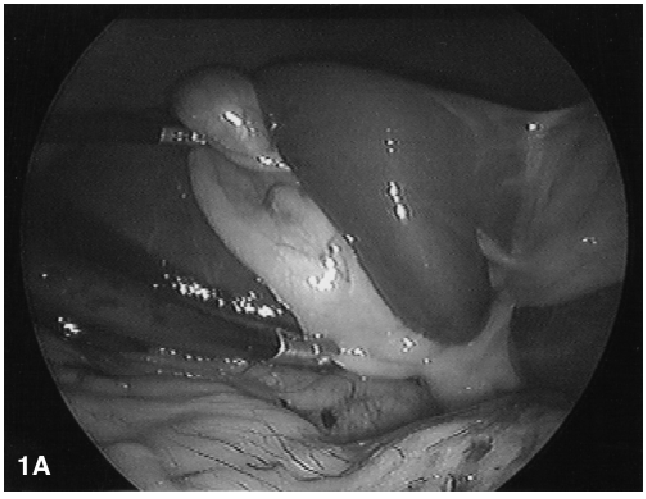

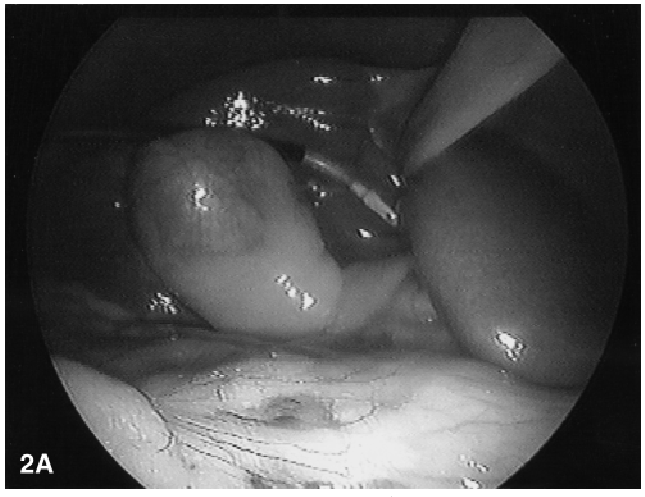

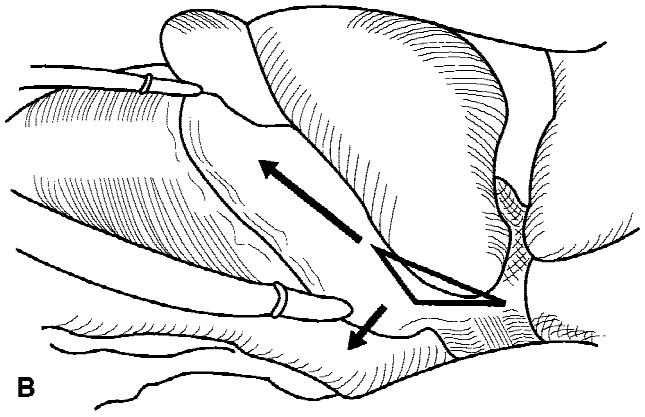

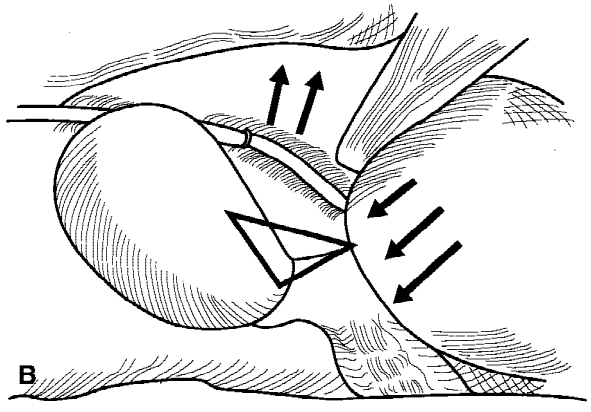

Fig. 1. A, B In this case, the fundus of the gallbladder is retracted upward to open the hepatic hilus; the axial traction distorts and narrows Calot's triangle. The lateral traction of the infundibulum of the gallbladder does not work effectively to open Calot's triangle, because the traction of the fundus and that of the infundibulum cancel each other.

Fig. 2. A, B By lifting the inferior surface of the quadrate lobe upward, Calot's triangle is opened. The lateral segment of the liver drops over the operative field and interferes with the procedures in Calot's triangle.

Discussion

Common bile duct injuries during laparoscopic cholecystectomy appear to occur more frequently than during open cholecystectomy, at least in the beginning stages of a surgeon's learning curve [1–4]. These complications are thought to occur because many surgeons tend to confuse the common bile duct with the cystic duct in laparoscopic cholecystectomy. This misidentification of anatomy may be caused by a lack of tactile sensation, by two-dimensional sight, by lack of training, or by inadequate instrumentation, to name a few possibilities.

In addition to the above obstacles, the exposure of the operating field in laparoscopic surgery using Dr. Reddick's [6] technique differs from the situation in open surgery [7, 8]. The upward traction of the gallbladder and liver to open the subhepatic space and the lateral retraction of the gallbladder infundibulum to open Calot's triangle result in a narrower Calot's triangle and angulation of the common bile duct. These anatomical distortions contribute to ductal injuries during laparoscopic cholecystectomy.

The ''European'' technique described by Dr. Perissat [5] offers a different method of exposing Calot's triangle. In this technique, an instrument is inserted into the midclavicular port to retract the liver upward and open the hepatic hilus. With this technique, Calot's triangle is more easily exposed by lateral traction of the infundibulum. The tenting of the common bile duct is only slight because no upward traction on the gallbladder is exerted. The shortfall in this technique is that the retraction of the liver (especially a soft and nonpathologic liver) tends to extend downward over Calot's triangle. In addition, as mentioned, there is the risk of injury to the liver using straight traumatic forceps as retractors (Fig. 3).

We have developed a new method which allows an atraumatic wide operative field for laparoscopic cholecystectomy. The hepatic hilus is exposed by the atraumatic retraction of the inferior surface of the quadrate and lateral lobes using a Roticulator (USSC) instrument whose tip is flexed. Lifting a wide area of the liver facilitates the atraumatic wide exposure of the hepatic hilus, which creates a clear view of the anatomy. Calot's triangle is not distorted and the common bile duct is not tented. We have performed about 200 laparoscopic cholecystectomies with Reddick's method and 50 operations with our method. There was no differences between the operation time with this method and that with the previous method (Reddick's method). Intraoperative and postoperative complications related to the misunderstanding of the anatomy did not occur in cases with this technique.

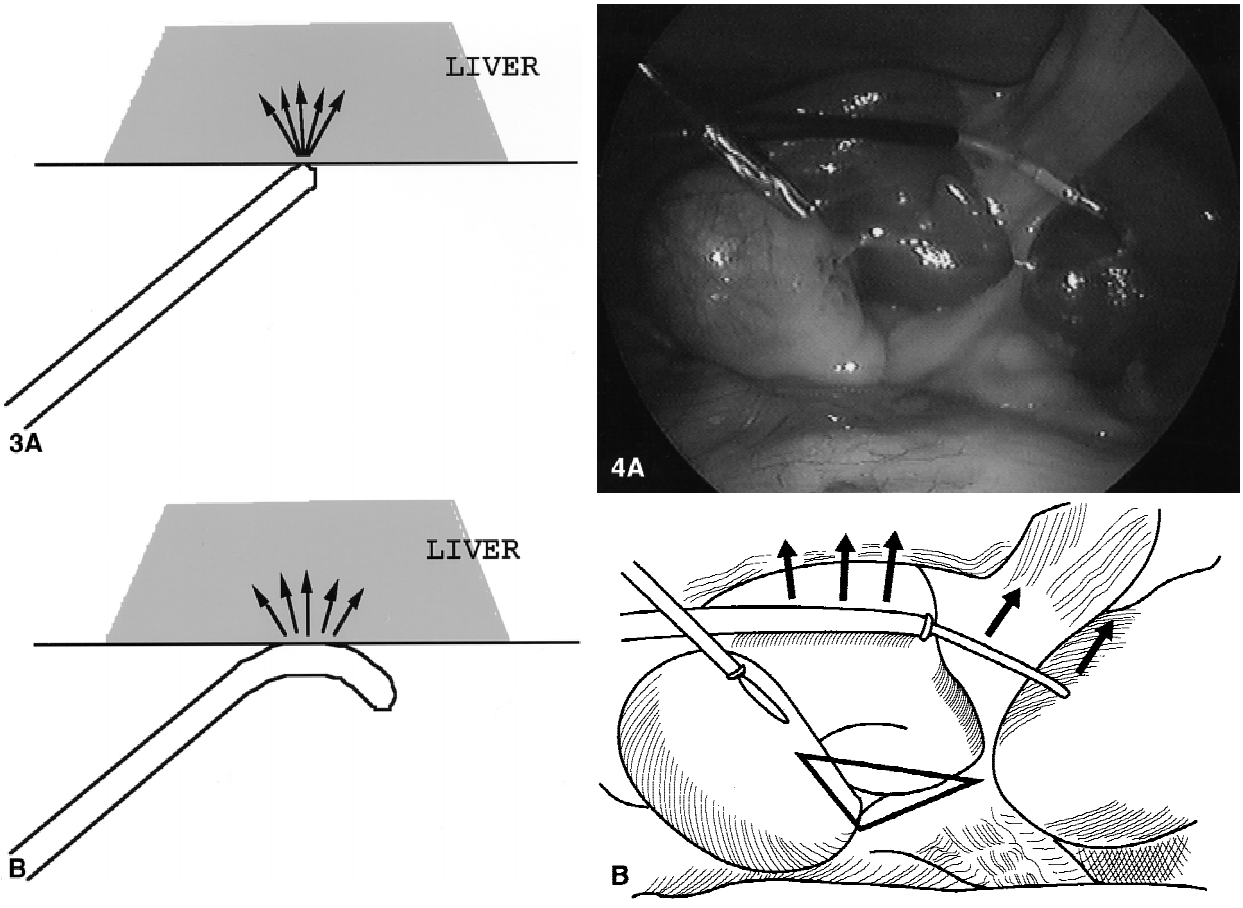

Fig. 3. The shaft of the Roticulator forceps is fully flexed in the peritoneal cavity, and its tip is directed caudally so as not to injure the surface of the liver. **A** When a straight forceps is used to lift the liver, a narrow area of the surface of the liver is pushed by the forceps tip and liable to be injured. **B** On the other side, a wide area of the surface is pushed evenly with a flexed tip in our method.

Fig. 4. A, B In our method, not only the quadrate lobe but also the lateral segment of the liver is lifted by the curved shaft. A wide operative field is secured atraumatically and Calot's triangle and the bile duct anatomy are identified clearly as in open surgery. Forceps do not touch each other, because these forceps tips are flexed and they avoid crossing the operative field.

Experienced surgeons may perform laparoscopic cholecystectomy safely and promptly even with Reddick's method, but we would like to emphasize that many of the complications that occur because of misunderstanding the anatomy occur in the surgeon's early experience. The most notable innovation of our method is that the surgeon can perceive the anatomy around the hepatic hilus easily. Surgeons—especially those not experienced in laparoscopic cholecystectomy—say that it is far easier to recognize the anatomy around the hepatic hilus with this method compared with conventional method.

It would be necessary to compare the operation time and morbidity of our method with those of the conventional method in a randomized large-scale study to evaluate the superiority of our method.

We believe that this new technique makes laparoscopic cholecystectomy safer and decreases the number of bile duct injuries associated with misidentification of anatomy around Calot's triangle.

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