

Surgeon at work

Dissection of the gallbladder from the liver bed during laparoscopic cholecystectomy for acute or subacute cholecystitis

GORO HONDA, TOMOHIRO IWANAGA and MASANAO KURATA

Department of Surgery, Tokyo Metropolitan Cancer and Infectious Diseases Center, Komagome Hospital, 3-18-22 Honkomagome, Bunkyo-ku, Tokyo 113-8677, Japan

Abstract

Current literature suggests that early laparoscopic cholecystectomy (LC) for acute cholecystitis (AC) can be safely performed within 72 h of symptom onset. However, for various reasons, in clinical practice, fibrosed gallbladders are frequently encountered during early LC for AC. The subserosal layer of the gallbladder wall can be divided into an inner and an outer layer. The inner layer has an abundant vasculature and some fibrous tissue; it abuts the muscularis propria. The outer layer consists of abundant fat tissue; it abuts the serosa or the liver parenchyma. In both patients with AC and those without cholecystitis, dissection of the gallbladder in the outer layer facilitates removal of the gallbladder without tearing the gallbladder or injuring the liver parenchyma behind the liver bed. However, in patients with AC lasting 72 h or more, the subserosal layer becomes solid and thick due to inflammatory cell infiltration and fibrotic change. Thus, adequate dissection of the outer layer becomes difficult. However, there is a layer between the inner and outer layers that can be dissected bluntly and easily. Thus, we could dissect the gallbladder from its liver bed safely, surely, and quickly by using our original technique which was validated by histological examination.

Key words Acute cholecystitis · Laparoscopic cholecystectomy · Liver bed

Introduction

Current literature suggests that early laparoscopic cholecystectomy (LC) for acute cholecystitis (AC) can be done safely within 72 h of symptom onset.^{1–6} In the Tokyo guidelines, in general, early LC is recommended for AC.⁷ However, in clinical practice, fibrosed gallbladders are frequently encountered by surgeons who attempt early LC for AC, because they have to perform

LC for patients who: (1) have had acute inflammatory symptoms for 72 h or more before admission; (2) have previously had one or two AC episodes that were treated conservatively; or (3) could not undergo LC within 72 h of the onset of symptoms due to healthcare facility factors, such as difficulty in scheduling imaging examinations or surgery.⁸ Several modified techniques are used to safely perform LC for such subacute cholecystitis without the need to convert to open surgery.⁹ One such technique is presented in this article. Our technique involves dissection of the gallbladder from the liver bed and has been validated histologically.

In this article, the following definitions are used. The subserosal layer (ss) of the gallbladder wall is divided into an inner layer (ss-i) and an outer layer (ss-o). The ss-i layer consists of abundant vasculature and some fibrous tissue; it abuts the muscularis propria (mp). The ss-o layer consists of abundant fat tissue; it abuts the serosa or the parenchyma of the liver (Fig. 1).

Procedure

We usually perform LC with four ports in the presence of pneumoperitoneum. After the operative field is sufficiently secured by carefully taking down adhesions around the gallbladder, the structures in Calot's triangle are completely exposed. We usually incise only the serosa, using a diathermy instrument (hook or blunt dissector), and expose each structure bluntly, using a cylindrical suction instrument. With the blunt exposure, the fat tissue of the ss-o layer surrounding the neck of the gallbladder and the cystic duct is ablated, and the homogeneous surface of the ss-i layer, which is dark green or light gray in color and comparatively soft, is exposed (Fig. 2). The cystic duct and arteries are exposed in close proximity to this homogeneous ss-i layer of the neck of the gallbladder, without exposing the surface of the bile duct and the hepatic arteries if possible. Then

Offprint requests to: G. Honda

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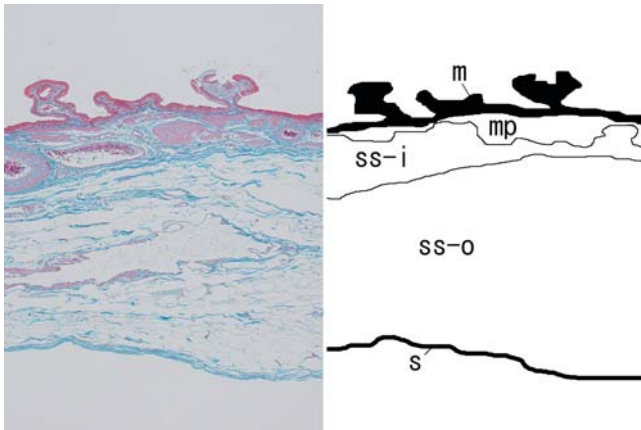


Fig. 1. Microscopic view of a normal gallbladder wall. The subserosal layer (ss) can be divided into inner (ss-i) and outer (ss-o) layers. The ss-i layer consists of abundant vasculature and some fibrous tissue (collagen fiber is stained blue). The ss-o layer consists of abundant fat tissue and a few arteries (deep branches of the cystic artery) and a few veins. *m*, mucosa; *mp*, muscularis propria; *s*, serosa. Masson trichrome, $\times 40$



Fig. 2. The structures in Calot's triangle have been exposed, and the fat tissue of the ss-o layer surrounding the neck of gallbladder and the cystic duct has been ablated. The homogeneous surface of the ss-i layer has been exposed (arrows). The cystic duct has been secured by placing two clips across it (arrowhead)

the cystic duct is clipped and the arteries are dissected. Subsequently, the gallbladder is dissected from the liver bed. Prior to dissection of the gallbladder, the serosa (visceral peritoneum) of the gallbladder adjacent to the liver is incised as entirely as possible. During this procedure, we firmly incise not only the serosa but also the fibrosed fat tissue of the ss-o layer. Thus, blunt dissection in the liver bed becomes possible in the layer that is the same as the ss-i layer exposed at the neck of the gallbladder. Dissecting in this layer allows for considerably easier blunt dissection of the gallbladder from the liver bed (Fig. 3). With the sealing and cutting of several

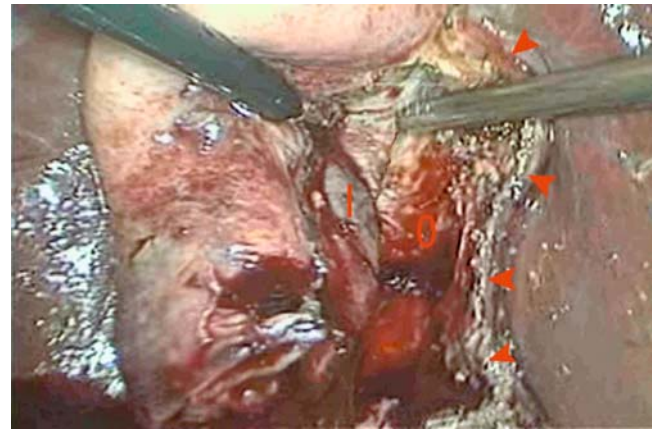


Fig. 3. The serosa (visceral peritoneum) and the ss-o layer adjacent to the liver have already been incised (arrowheads). The gallbladder is bluntly dissected from the liver bed with a cylindrical suction instrument placed at the body of the gallbladder from the internal segment (left) side. The soft layer of the ss-i layer (*l*), which is exposed on the side of the gallbladder, and the hard layer of the ss-o layer (*o*) are being separated by blunt dissection



Fig. 4. The gallbladder has already been removed. The yellow ss-o layer, in which the fat tissue has fibrosed and become thick, remains on the liver bed. Clips secure the cystic duct (arrow)

vessels, especially the deep branches of cystic artery,¹⁰ which cross from the more outer part of the ss-o layer to the ss-i layer, blunt dissection of the gallbladder from the liver bed is completed safely, surely, and quickly. The dissection in the liver bed is facilitated by starting the dissection at the body of the gallbladder from the internal segment (left) side and then proceeding to the anterior segment (right) side (in other words, not proceeding from the neck side to the fundus side of the gallbladder; Fig. 3). Once the gallbladder is removed completely from the liver bed, the thick, fibrosed, ss-o layer, which has been left on the liver bed, is observed (Fig. 4). Using this technique, the almost completely

cystiform gallbladder is detached from the liver bed, without tearing the gallbladder or injuring the parenchyma of the liver bed.

Results

Thirty-nine patients with subacute cholecystitis with fibrous gallbladder had an LC in which our technique for liver bed dissection was used; 34 LCs were performed at the Kokura Memorial Hospital and 5 at the Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital. In all cases, the surgery was started by resident surgeons with 3 to 10 years of postgraduate training, and the first author (a board-certified surgeon of the Japanese Society for Endoscopic Surgery) stepped in if necessary. In all cases, the LC was completed without any intraoperative complications. The mean operating time was 138 min (range, 59 to 178 min), and the median blood loss was 90 ml (range, 10 to 390 ml). Postoperatively, 1 patient had jaundice due to stones or sludge that had probably fallen from the gallbladder into the bile duct intraoperatively; the jaundice had cleared by the third postoperative day, with conservative treatment. The other patients had no complications. The mean postoperative hospital stay was 6.1 days (range, 3 to 18 days).

Discussion

When a ordinary LC is done, without gallbladder perforation and/or liver bed injury, for a gallbladder that has a normal wall or a wall with only edema due to AC, the gallbladder is usually dissected in the ss-o layer, which consists of soft areolar tissues (Fig. 5). When an LC is done using our technique for a gallbladder that has a fibrosed wall, the cut surface of the dissected gallbladder (Fig. 6) is usually along the ss-i layer (Fig. 7). We considered that we could expose the ss-i layer without perforation more easily for a gallbladder that had a fibrosed wall than for one that had a normal wall (especially in the body of the gallbladder), because the ss-i layer had also become toughened by fibrotic change.

Several patients did not have an adequate layer between the ss-i and ss-o layers; therefore, a successful blunt dissection between the two layers could not be carried out. These patients had probably had severe cholecystitis that had been cured conservatively before the LC; the whole subserosal (ss) layer had become scar tissue locally. We considered that such scar tissue had displaced a deep ulcer or an abscess located between the gallbladder and the liver that had occurred as the result of previous severe cholecystitis. Therefore, we

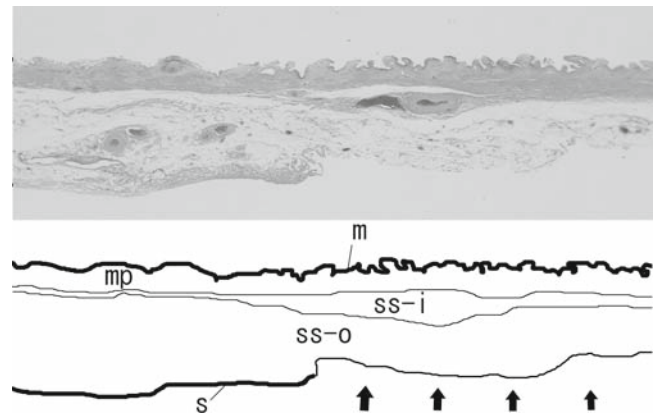


Fig. 5. Microscopic view of the gallbladder wall that has been dissected using the ordinary laparoscopic cholecystectomy (LC) technique. At the center of the serosal side, there are layers in steps that are made by incising the serosa from the visceral peritoneal side into the liver bed. The dissected surface (*fine line shown by pointed arrows*) lacks serosa. This surface is very close to the liver. H&E, $\times 10$

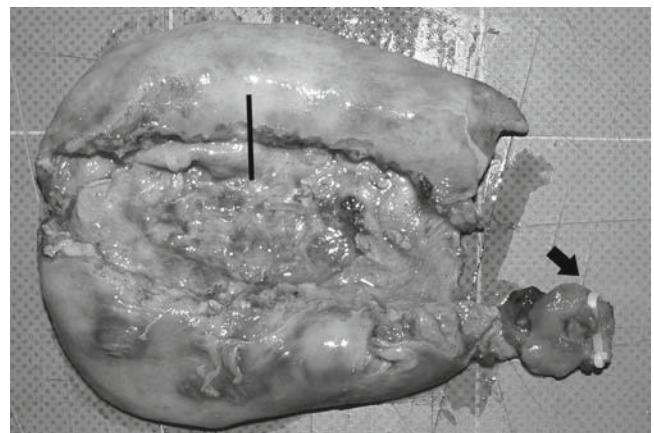


Fig. 6. Gross findings of the serosal side of the resected gallbladder, from the patient whose details are shown in Figs. 2–4. The indentation at the center of the specimen is the dissected surface of the liver bed, where the exposed ss-i layer is observed. A clip is placed across the cystic duct (*arrow*). The microscopic findings of the gallbladder wall (*vertical line*), from the visceral peritoneal side to the liver bed, are shown in Fig. 7

incised such scar tissue in the midline of the tissue layer and scraped it thinly, using a diathermy hook. However, in most patients, the scarring did not involve the whole liver bed; the layer between the ss-i and ss-o layers in the uninvolved areas was adequate to permit a successful blunt dissection to be performed.

When it is difficult to dissect the gallbladder safely from the liver bed, there is an alternative approach. The gallbladder can be intentionally opened, and the whole layer of the gallbladder wall is left on the liver bed.⁹ However, using our technique, the almost completely

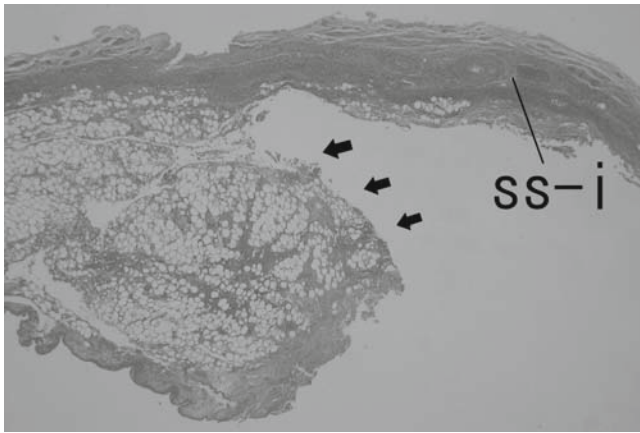


Fig. 7. Microscopic view of the gallbladder wall corresponding to the vertical line in Fig. 6. While the serosa and the ss-o layer remain on the visceral peritoneal side (*left side of Fig.*), the exposed ss-i layer with sparse fat tissues of the ss-o layer is observed on the liver bed side (*right side of Fig.*). Layer steps, which are made by incising the serosa from the visceral peritoneal side towards the liver bed, are seen (*arrows*). Both the ss-o layer and the ss-i layer are thick because of inflammatory cell infiltration and fibrotic change. H&E, $\times 40$

cystiform gallbladder can be safely, surely, and quickly detached from the liver bed, without tearing, in almost all patients with subacute cholecystitis. As well, the time required for retrieving spilled stones is also shortened. Therefore, compared to the open approach, the entire operative time is shortened. Additionally, to rule out occult gallbladder carcinoma, it is possible to conduct a comprehensive pathological examination of the gallbladder, because the whole mucosa is removed; it is also possible to avoid, or keep to a minimum, the peritoneal spreading of spilled bile, which spread may have an adverse effect on prognosis in patients with gallbladder carcinoma.¹¹

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