

Segment IV Approach is Useful for Whole-Layer Laparoscopic Cholecystectomy for Gallbladder Polyps

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Abstract

Background

Whole-layer laparoscopic cholecystectomy (W-LC) has recently been advocated as a total biopsy for potentially malignant neoplasms of the gallbladder; however, it is not an injury-proof procedure. This study reports W-LC using the segment IV approach (technique for securing the whole-layer gallbladder at the medial origin of the cystic plate).

Methods

Twenty among twenty-five patients diagnosed with potentially malignant gallbladder polyps underwent this technique.

Results

Mostly, W-LC was performed successfully (median operative time 135 min) without intraoperative and postoperative complications. Pathological findings indicated that cholesteric polyps was the most common type ($n=13$), followed by adenomatous polyps (25%) and carcinoma in situ (5%).

Conclusions

We conclude that the segment IV approach is appropriate for performing total biopsy in patients diagnosed with potentially malignant gallbladder polyps.

Background

The standard approach for benign lesions is laparoscopic cholecystectomy (LC); However, doubts exist regarding its performance for potentially malignant gallbladder lesions [1]. Sometimes, it is difficult for imaging modalities to diagnose gallbladder lesions preoperatively; hence, whole-layer laparoscopic cholecystectomy (W-LC) is advocated as total biopsy of the gallbladder. However, a safe procedure has not been reported to avoid vasculobiliary injury (VBI) [1].

This study introduces a new procedure using the segment IV approach, used for performing LC safely in patients diagnosed with potentially malignant gallbladder polyps (GBP).

Methods

At the Jikei University Kashiwa Hospital, out of 25 patients who underwent LC, the segment IV approach was used in 20 W-LCs (performed by TY, SF, YT, and HS) because these patients were diagnosed with GBPs of more than 10 mm in diameter located at the side of the liver bed and LCs were electively scheduled.

The segment IV approach is a diagonal line (D-line), first imaged as a scheduled line, at the inferior surface of the liver, along which the whole-layer of the gallbladder (cystic plate) is first extracted [2, 3] (Fig. 1). The conventional 4-port or reduced-port method was used for performing all LCs. Flexible videoscopes of 5 mm or 10 mm were placed at the umbilicus, and superficial landmarks such as Rouvière's sulcus (essential landmark), inferior surface of segment IV of the liver, gallbladder infundibulum, and common bile duct were recognized. Gallbladder dissection was performed by tying and retracting the falciform ligament through the 5-mm epigastric port (operator's right hand) and was effective in reconciling the working forceps vector with the D-line (lies ventral to Rouvière's sulcus) [2].

On the D-line, the transition zone between the liver surface and gallbladder serosa, dissection was started using electrocautery, which enabled to enter the plane between the cystic plate and Laennec's capsule. To avoid an injury to Laennec's capsule, the cystic plate was bluntly dissected along the D-line using a flexible videoscope. Imaginary D-line lies on the right border of the hilar plate [4, 5]. During the procedure, Glissonian sheath's anterior surface was occasionally exposed without injuring it. As dissection progressed, the round tip of the dissecting forceps was visible while incising the posterior gallbladder serosa and the whole-layer gallbladder was separated. LC and W-LC were differentiated by the dissecting layer of the gallbladder, i.e., along the subserosal inner layer in LC, whereas along the subserosal outer layer in W-LC (Fig. 2). After the extraction of the gallbladder (W-LC), surgical gauze was packed in the dissected space (Fig. 3), which was used as hemostasis for small veins in the Laennec's capsule and acted as a visible landmark for achieving critical view of safety (CVS), which can be achieved by dissecting the entire gallbladder subserosa and soft tissues on the side of the gauze (Fig. 4). After dividing the cystic artery and cystic duct, the whole-layer gallbladder was bluntly dissected from the Laennec's capsule. Laennec's capsule of the liver is usually dissected in parts at the fundus of the gallbladder [5] (Fig. 5, black arrow).

Results

The median operative time and intraoperative blood loss were 135 (range, 54–290) min and 10 (range, 0–100) mL, respectively. During hospitalization, intraoperative and postoperative complications were not reported.

The most common type was cholesteric polyps ($n=13$, 65%); adenomatous polyps was reported in five cases (25%) and carcinoma in situ in one patient (5%). The mean postoperative hospital stay was 3.4 days (range, 3–4).

Discussion

Laparoscopic surgery has been widely accepted as a feasible and safe treatment modality for many cancers of the gastrointestinal tract. Recently, the investigation of incidentally discovered gallbladder cancer (GBC) after LC (incidence rate of 0.2–2.8%) was reported [6–10].

Laparoscopic surgery on GBC is considered as a contradiction [11–12]. This could be due to the high malignancy of GBC as well as the risk of peritoneal dissemination by bile juice spillage during manipulation, which could worsen long-term outcomes [13–14]. Thus, perforation at initial surgery has a higher risk of disease dissemination in GBC [15–16]. Moreover, the gallbladder's structural characteristics, such as lack of a submucosal layer and the existence of the Rokitansky–Aschoff sinus (RAS), makes accurate estimation of the depth of tumor invasion difficult [17]. Hence, W-LC as a total biopsy of the gallbladder has been advocated for potentially malignant GBP. According to a report on incidentally discovered GBC after LC, patients with cancers confined to the mucosa (T1a or less) had 5-year survival rates of up to 100% after cholecystectomy alone [18]. This has reached a consensus in most guidelines [19–20].

Resection is recommended for cancers invading the muscle layer of the gallbladder wall (T1b or above), even though its extent and timing remains controversial [9, 21]. These reports indicate that W-LC is feasible for elective LC as a diagnostic and treatment strategy for neoplasms of the gallbladder up to T1a GBC. In the present report, only one out of 20 patients was diagnosed with malignant disease with GBP. As per our operative policy, it is important to carefully perform elective laparoscopic surgery for potentially T1a GBC to avoid gallbladder perforation.

W-LC has an advantage of pathological investigation of the whole layer of the gallbladder, especially in cases with RAS, which is characterized by gallbladder hypertrophy of the mucosal epithelium that invaginates into the interstices of a thickened muscular layer of the gallbladder, which influences patient outcome in early gallbladder carcinoma [20–22]. W-LC has also been reported to cause extreme VBI in severely inflamed gallbladders [23]. Therefore, further research to perform safe W-LCs needs to be conducted. The limitations of this study are single institute and retrospective investigation and limited number of patients.

Conclusions

In the present study, we developed a procedure to secure W-LCs by using the segment IV approach, based on the anatomical feature that there is no important structure along the D-line; hence, the cystic plate can be securely encircled [2–3].

In elective LC for potentially malignant GBP, the segment IV approach is a promising method for securing W-LC.

Abbreviations

LC
laparoscopic cholecystectomy
W-LC
whole-layer laparoscopic cholecystectomy

VBI
vasculobiliary injury
GBP
gallbladder polyps
D-line
diagonal line
CVS
critical view of safety
CIS
carcinoma in situ
GBC
gallbladder cancer
RAS
Rokitansky–Aschoff sinus

Declarations

Ethics approval and consent to participate:

This study was conducted retrospectively in accordance with the Declaration of Helsinki and with the approval of the Ethics Committee of the Jikei University School of Medicine (approval no. 30-150 (9171)). All patients provided written informed consent prior to undergoing surgery.

Consent for publication:

Not applicable.

Availability of data and materials:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

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Authors' contributions:

YT, SF, HS, and YT participated in project development, data collection, and manuscript writing. NT, TI, MY, KK, UH, SY, MK, and SK participated in treating these patients and searching for literature. MO, YT, RS, RM,

YI, EI, HN, YB, SI, NT, and TI participated in manuscript editing. All authors read and approved the final manuscript.

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Figures

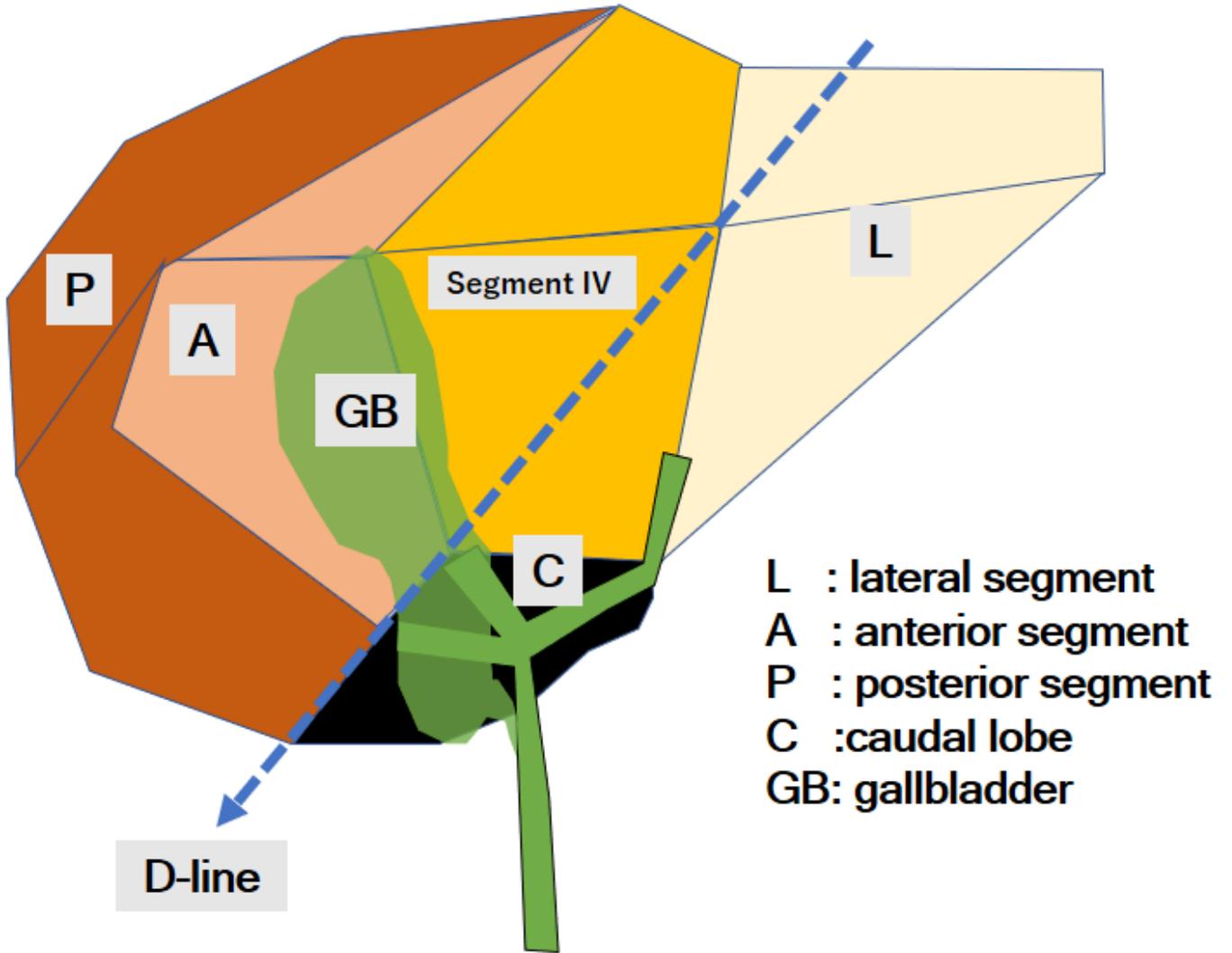


Figure 1

Schematic representations of the segment IV approach.

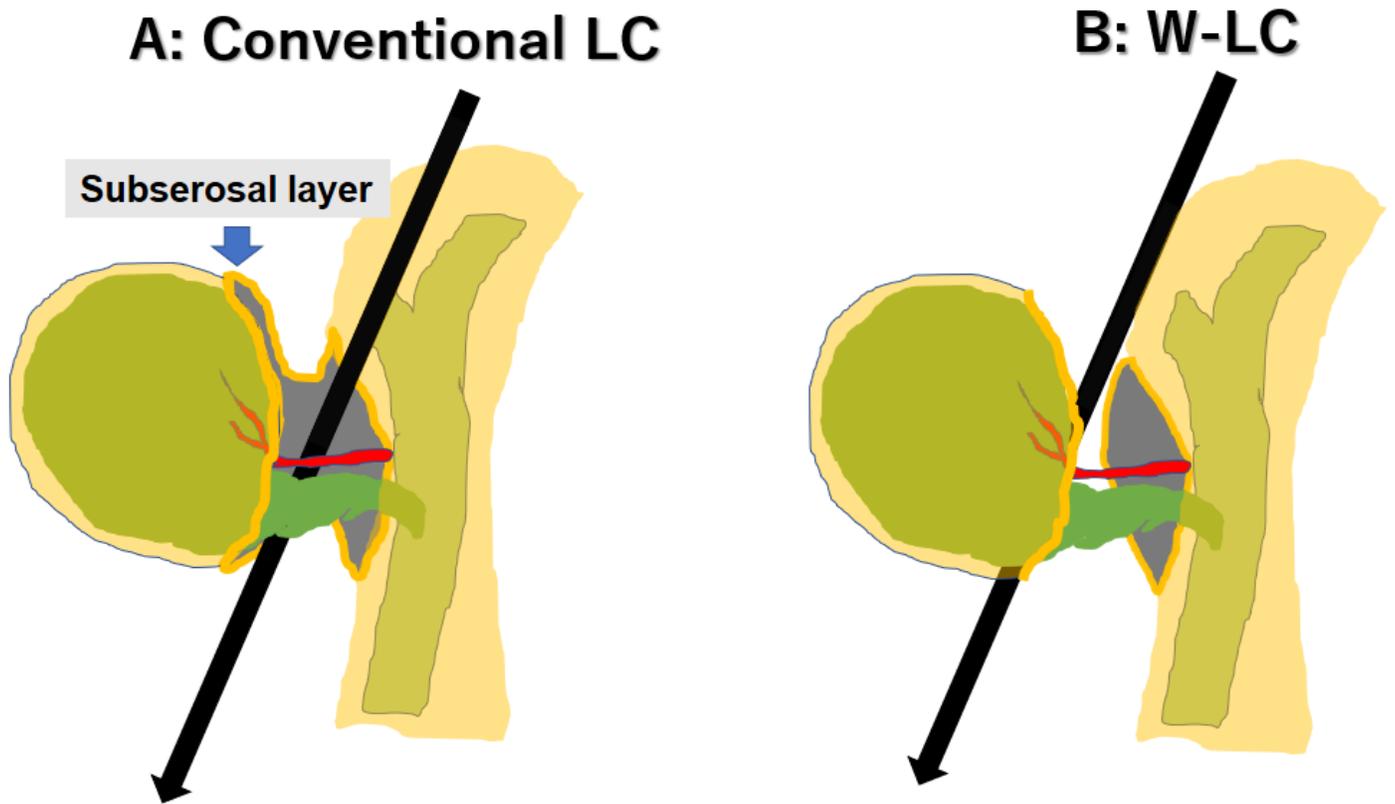


Figure 2

Schematic representations of the difference between conventional LC and W-LC. A. The subserosal layer of the gallbladder is partially dissected in conventional LC. B. The subserosal layer of the gallbladder is completely dissected in W-LC.

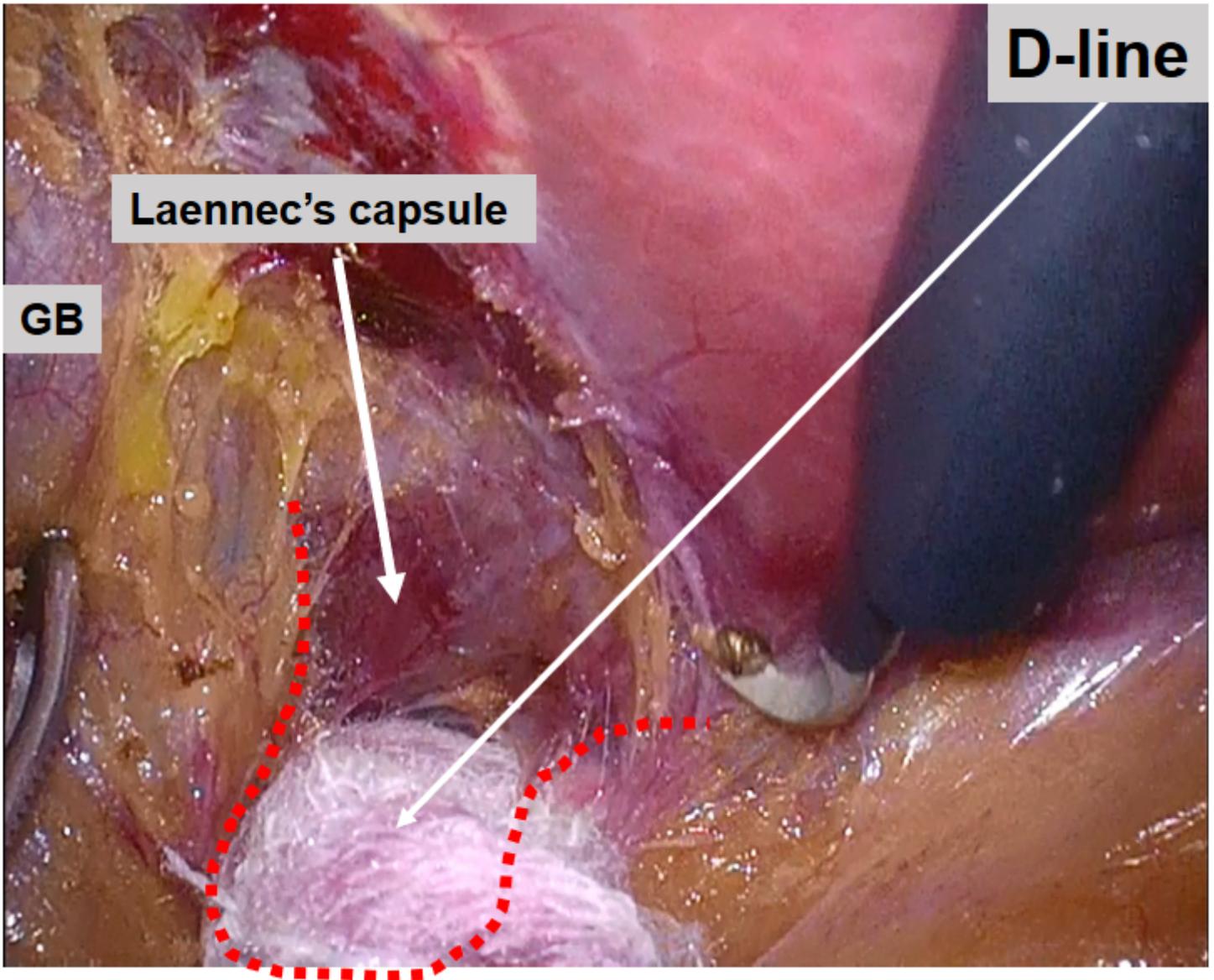


Figure 3

Intraoperative picture of encircling of the whole-layer gallbladder along the D-line. Red dotted line indicates external side face of the whole-layer gallbladder.

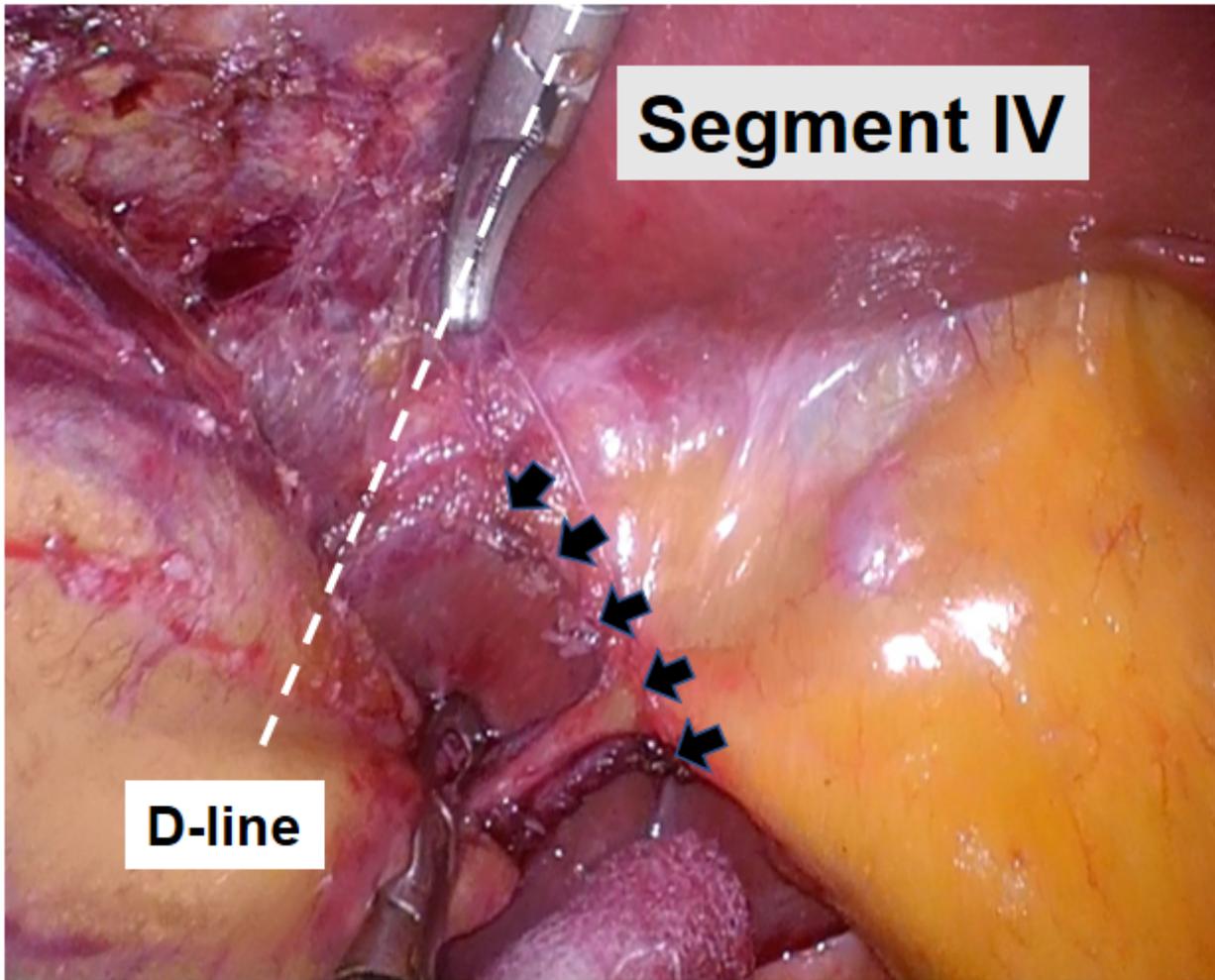
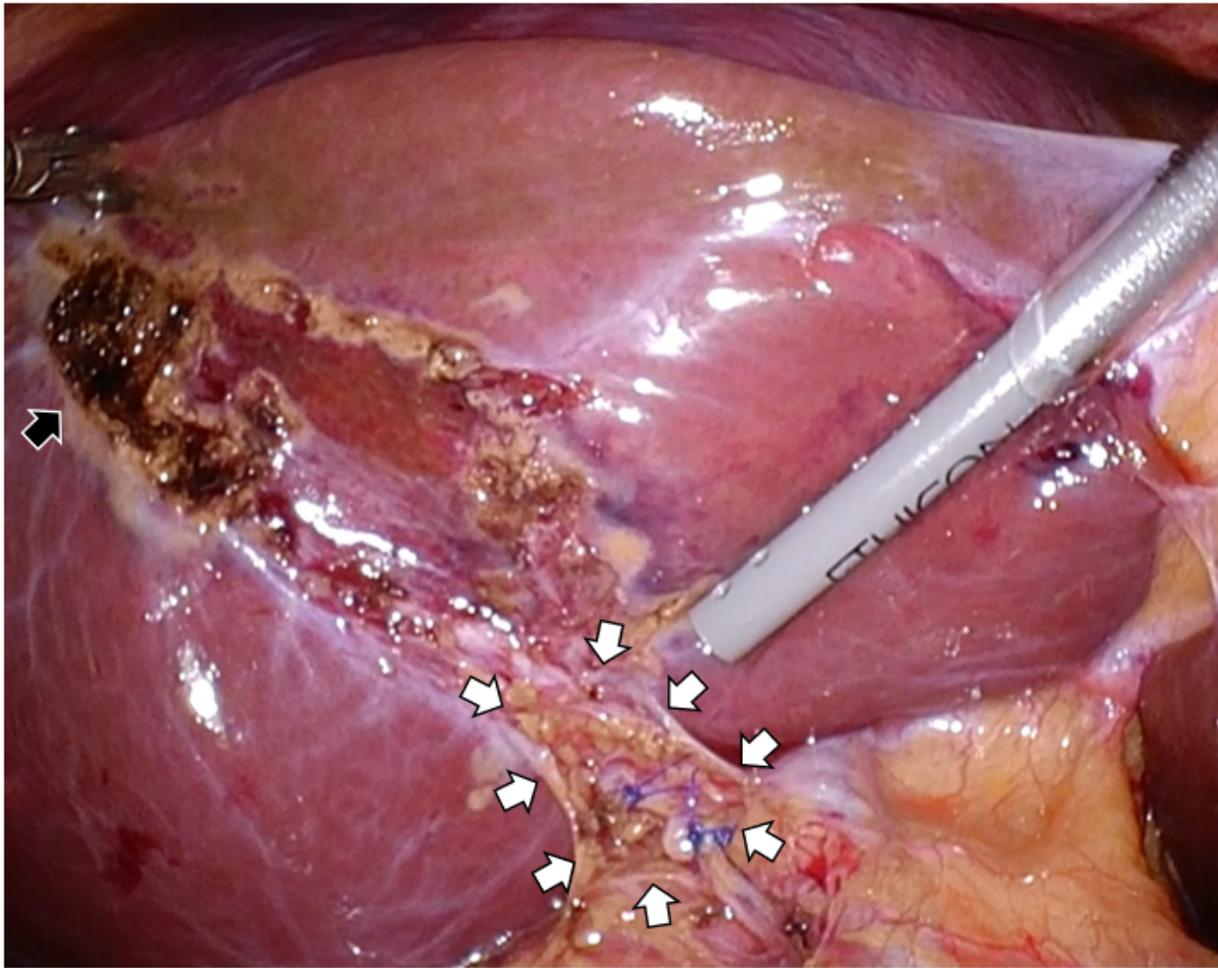


Figure 4

The critical view of safety in W-LC. The arrows indicate divided cystic plate in whole circumference at its origin.



White arrow: divided cystic plate
Black arrow: dissected Laennec's capsule

Figure 5

The view after completion of W-LC. White arrow indicates divided cystic plate in whole circumference. Black arrow indicates the region where the Laennec's capsule of the liver is dissected.