Liver Abscess and Prolonged Postoperative Intra-Abdominal Free Air without Anastomotic Leakage after Laparoscopic Gastrectomy

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Keywords
Gastric cancer · Laparoscopic surgery · Liver abscess · Nathanson liver retractor · Prolonged intra-abdominal free air

Abstract
An 84-year-old thin, i.e., body mass index of 17.8, woman with gastric cancer underwent laparoscopic distal gastrectomy and lymph node dissection followed by Roux-en-Y reconstruction. During the operation, Nathanson liver retractor (NLR) was used to press the left lobe of the liver. The patient recovered uneventfully and was discharged on the 9th postoperative day. The patient, however, developed abdominal pain just on the day of discharge. Sudden onset of the abdominal pain and massive free air on computed tomography made us do diagnostic laparoscopy. Detailed laparoscopic observation showed slight liver swelling at the pressure site of the NLR, superficial band-shaped color change on the left lobe of the liver, and no anastomotic leakage, suggesting the massive free air caused by prolonged retention of postoperative intra-abdominal air. Two days later, persistent fever, inflammatory findings, and presumed liver abscess showing no healing tendency made us do ultrasound-guided aspiration to the liver focus. Bacterial culture test showed the bacterium Escherichia coli, being sensitive to meropenem. Despite the failure of abscess drainage, antibiotic therapy using meropenem gradually alleviated her symptoms and the patient was discharged from the hospital in 15 days after the abscess aspiration. Surgeons should note possible prolonged postoperative intra-abdominal free air and liver abscess without anastomotic leakage after laparoscopic gastrectomy especially in thin patients to avoid inappropriate postoperative management.

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**Introduction**

Laparoscopic surgery generally needs more operation time but has various advantages to the patients over open surgery such as less postoperative pain, earlier return to normal activities, and less postoperative complications. Laparoscopic surgery, therefore, has been generally performed not only for benign diseases such as gallstones, appendicitis, and inguinal hernia but also for malignant diseases such as colorectal cancer, esophageal cancer, and gastric cancer.

In laparoscopic surgery, careless procedures outside the video display of the operative field often cause major complications. In addition, laparoscopic surgery does not allow surgeons to directly palpate the organs and sometimes places unaware high pressure to the organs, leading to unexpected postoperative complications.

Intra-abdominal extra-luminal free air, when observed in about 5th day or later after operation, on computed tomography (CT) highly suggests some damage, i.e., perforation or leakage, of the gastrointestinal tract. In addition to the massive intra-abdominal free air, concomitant inflammatory findings further make surgeons much strongly assume the possibility of anastomotic leakage as one of the postoperative serious, sometimes fatal, complications. We herein report an extremely rare case of a liver abscess, probably due to the use of Nathanson liver retractor (NLR) [1–3], and prolonged postoperative intra-abdominal free air without anastomotic leakage after laparoscopic gastrectomy.

**Case Report**

An 84-year-old thin, i.e., body mass index of 17.8, woman with epigastralgia was referred to our hospital. Upper gastrointestinal endoscopy showed 0–ǁ type lesion in the lower part of the stomach. After confirming well-differentiated atypical cells in the biopsied specimen, endoscopic submucosal dissection was performed to the target gastric cancer with curative intent. Pathological study showed 0–ǁ type cancer 23 × 17 mm in size, growing mainly in tubular fashion. Cancer cells infiltrated 420 μm in depth beyond submucosa and were also observed in the lymphatics. The patient, therefore, underwent laparoscopic distal gastrectomy with regional node dissection followed by Roux-en-Y reconstruction. Pathological study showed neither residual nor metastatic cancer cells in the resected stomach and the dissected lymph nodes, respectively. During the laparoscopic operation, NLR was introduced through beneath the xiphoid process and was positioned to lift the lateral area of the liver toward diaphragm (Fig. 1a). Operation time was 235 min with no intra-operative complications, and a total amount of intra-operative bleeding was nominal as 3 mL. The patient resumed drinking.

**Fig. 1.** Laparoscopic findings of the liver. **a** In the laparoscopic gastrectomy, NLR (arrow) was used to get a good view of the surgical field. **b** Diagnostic laparoscopy showed slight swelling in the left lobe of the liver (arrowheads). **c** Superficial band-shaped color change (arrowheads) was also observed on the left lobe of the liver.
water and eating on the postoperative days 1 and 3, respectively, and was discharged on the 9th postoperative day neither with elevated hepatic enzyme levels nor with abdominal image evaluation using plain film after operation. Just on the discharge day, the patient began to feel loss of appetite and thereafter developed slight abdominal pain. Only 2 days after discharge, the patient was taken to our hospital by ambulance due to the marked aggravation of the symptoms. Laboratory tests showed inflammatory findings and liver dysfunction, white blood cell count of 27,400/μL, C-reactive protein of 28.8 mg/dL, aspartate aminotransferase of 143 U/L, and alanine aminotransferase of 51 U/L. Ultrasound showed an oval mass 4 cm in size in the liver segment 3 (Fig. 2). CT showed a low intensity lesion in the liver, no abdominal distention, and massive free air in the abdomen (Fig. 3). We, therefore, highly suspected anastomotic leakage with abdominal abscess and did emergent diagnostic laparoscopy. On laparoscopy, slight liver swelling at the pressure site of the NLR (Fig. 1b) and superficial band-shaped color change on the left lobe of the liver (Fig. 1c) were observed. However, neither anastomotic leakage nor polluted ascites was observed. We, therefore, judged that massive free air in the abdomen should be caused by prolonged free air retention after laparoscopic distal gastrectomy. Based on the idea that presumed liver abscess could be manageable with transcutaneous approach, we only inserted drains around the anastomotic sites and infra-diaphragmatic

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**Fig. 2.** Ultrasound findings of the liver. Ultrasound showed an oval lesion with heterogeneous internal echoes and no attenuated posterior echoes (arrowheads). These findings highly suggested a liver abscess.

**Fig. 3.** CT of and around the liver. Abdominal CT showed massive free air (asterisks), low intensity area in the left lobe of the liver (arrowheads), and no abdominal distention (arrows).
space to finish the operation. Two days after the emergent operation, ultrasound-guided percutaneous aspiration, without successful catheter insertion, into the presumed abscess in the liver segment 3 was done to the patient due to the prolonged unpleasant symptoms and persistent inflammatory findings. The bacterium *Escherichia coli* was detected in the blood and abscess cultures. Antibiotic therapy using meropenem brought about gradual improvement of both the inflammatory findings and symptoms, and the patient was discharged on the 15th day after abscess aspiration.

**Discussion**

Postgastrectomy complications occur mainly through the mechanism of leak, stricture, obstruction, and marginal ulcer. Of these, an anastomotic or duodenal stump leak can easily cause serious complications, sometimes leading to fatal sepsis. In this case, we initially suspected anastomotic leakage because of the massive free air on CT and sudden onset of abdominal pain. A presumed liver abscess in the liver segment 3 was also observed before diagnostic laparoscopy but did not make us emergently treat the liver focus in the operation due to the possible management of the liver abscess through percutaneous approach.

Portal vein pyemia and biliary infection play major roles in the pathogenesis of liver abscess. Demir et al. [4] reported a case of pyogenic liver abscess developing 2 weeks after laparoscopic gastrectomy. They speculated the liver abscess to be the migration of the bacteria from the minor leak at the staple line. Elsherif et al. [5] also reported a similar case of pyogenic abscess developing 2 weeks after laparoscopic gastrectomy. Portal vein pyemia seemed to be the main pathogenesis of liver abscess in these cases. In contrast, onset of the liver abscess after laparoscopic gastrectomy was somewhat earlier in our case. In addition, the liver abscess was observed just at the site compressed by the NLR. These findings highly suggested biliary infection played a major role in the pathogenesis of pyogenic liver abscess in this case. It was highly possible that the difference in the total amount of bacteria reaching the liver led to the difference in the onset time of liver abscess of the two mechanisms.

Why the use of NLR in this case caused liver abscess remains uncertain. We had no idea to excessively press the liver with NLR during the long operation time of 235 min. The contact area between NLR and the liver is naturally much smaller than those by conventional liver spatulas, possibly having placed unexpected higher pressure to the liver than conventional ones. Limited case series reported objective liver damage with the NLR use judged by images and/or histological findings [6, 7] and liver dysfunction without liver damage on images [8–10]. To avoid these complications, Hiramatsu et al. [6] proposed that a silicon disk should be concomitantly used with the NLR for reducing the liver pressure during the operation. Based on the idea that NLR can cause more harm to the liver than conventional liver spatulas, it is important for surgeons to reduce the pressure to the liver by the NLR as much as possible with the use of some kind of devices, like Hiramatsu et al. [6], to shorten the operation time and, even if the NLR provides a good surgical field, to sometimes reposition the NLR during the operation.

Carbon dioxide is usually used for pneumoperitoneum in laparoscopic surgery. Certain amount of carbon dioxide-containing gas is left in the abdominal cavity even after degassing the intra-abdominal carbon dioxide as much as possible at the end of laparoscopic operation. Image evaluations, therefore, generally show small amount of intra-abdominal gas in two or 3 days after operation but extremely rarely present long-lasting intra-abdominal free air beyond postoperative 7 days. Smith et al. [11] reported a patient with prolonged free air observed in 48th day after laparoscopic hysterectomy. Detailed mechanisms of the free air retention in the abdominal cavity for a long time remain uncertain. Nielsen et al. [12] reported
that a high body mass index and small initial amount of free air were strongly associated with a shorter course of postoperative intra-abdominal air retention. An extremely low body mass index of 17.8 in this case might have caused the long-lasting intra-abdominal air retention. We cannot further speculate the etiology of long-lasting intra-abdominal free air retention due to the lack of postoperative image evaluation of the abdomen during hospitalization. It, therefore, seems important to evaluate the abdomen with a simple abdominal X-ray in two or 3 days after operation, even if the postoperative course is uneventful, to correctly judge the possibility of persistent intra-abdominal free air. Except for massive free air in the abdominal cavity, various symptoms observed in this case were well matched with those often found in patients with a conventional liver abscess. Gastrointestinal anastomosis with Roux-en-Y reconstruction in this case made us difficult to accurately exclude the anastomotic leakage with radiography using Gastrografin. To avoid over-treatment, surgeons should note that long-lasting intra-abdominal free air after surgery could be observed especially in thin patients. In addition, it should be noted that early onset of a concomitant liver abscess if existed, the long-lasting intra-abdominal free air may not be due to anastomotic failure.

In conclusion, we experienced a rare case of a liver abscess and prolonged postoperative intra-abdominal free air without anastomotic leakage. Surgeons should note these extremely rare events after laparoscopic surgery.

**Statement of Ethics**

The study was approved by the Kishiwada Tokushukai Hospital Ethics Committee (IRB #Case 20-05). Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

**Conflict of Interest Statement**

The authors have no conflicts of interest to declare.

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**Author Contributions**

Naoki Kataoka contributed the design of the report. Shoji Oura drafted the manuscript. Shinichiro Makimoto revised the manuscript. All authors have read and approved the final version of the manuscript.

**Data Availability Statement**

All data generated during this study are included in this article. Further inquiries can be directed to the corresponding author.
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