



Unexpected Elevation of the Right Diaphragm After Laparoscopic Surgery

Haruka Katafuchi¹; Yukari Adachi²; Masahiro Nishida²; Tsukasa Koyama³; Yukio Hayashi^{1*}

¹Anesthesiology, Yoka Municipal Hospital, Yabu, Hyougo, 667-8555, Japan.

²Gastroenterological Surgery, Yoka Municipal Hospital, Yabu, Hyougo, 667-8555, Japan.

³Radiology, Yoka Municipal Hospital, Yabu, Hyougo, 667-8555, Japan.

***Corresponding Author(s): Yukio Hayashi**

Anesthesiology Service, Yoka Municipal Hospital, 1878-1, Yoka, Yoka-cho, Yabu, Hyougo, 667-5555, Japan.

Tel: 81-79-662-5555;

Email: yhayashi@anes.med.osaka-u.ac.jp

Abstract

Introduction: Several complications are reported after laparoscopic surgery. In this case, we underestimated small elevation of the right diaphragm in preoperative chest X-ray photograph, resulting in hypoxia due to atelectasis after laparoscopic surgery.

Case presentation: A 78-year-old man underwent an emergent laparoscopic surgery for incarceration of right inguinal hernia. The preoperative chest XP showed small elevation of the right diaphragm, but no respiratory problem was noted before anesthesia. We converted from laparoscopic to the open approach because of severe adhesions. The total duration of the laparoscopic procedure was 216 minutes. A chest radiograph immediately after surgery show that the right diaphragm was significantly elevated compared with the left diaphragm. We confirmed atelectasis of the inferior lobe of the right lung by the chest CT on the first postoperative day. On the second postoperative day 2, the patient developed postoperative delirium and rehabilitation was postponed. The delirium resolved with no consequence and we restarted rehabilitation on the fifth postoperative day. A chest radiograph showed that the elevation of the right diaphragm was not noted on the seventh postoperative day. Diaphragmatic laxity was suspected in this patient after the surgery.

Conclusion: We reported a case of unexpected significant elevation of right diaphragm after laparoscopic surgery. Preoperative chest XP gave us a hint to image this unexpected event. However, we failed to evaluate this hint before anesthesia properly, resulting in postoperative atelectasis.

Received: Apr 06, 2023

Accepted: Apr 20, 2023

Published Online: Apr 27, 2023

Journal: Journal of Case Reports and Medical Images

Publisher: MedDocs Publishers LLC

Online edition: <http://meddocsonline.org/>

Copyright: © Hayashi Y (2023). *This Article is distributed under the terms of Creative Commons Attribution 4.0 International License*

Keywords: Laparoscopic surgery; Diaphragmatic laxity; Atelectasis.



Introduction

Laparoscopic surgery is a common surgical technique, but we encountered several complications [1]. We experienced a patient of unexpected significant elevation of right diaphragm after laparoscopic surgery.

Usefulness of preoperative chest X-ray photograph (XP) has been under debate and routine chest XP is not generally recommended [2,3]. However, the present case showed a small elevation of the right diaphragm in preoperative chest X-ray and we regretted to underestimate the small change in preoperative chest X-ray at our preoperative round, resulting in insufficient anesthetic management.

Case presentation

A 78-year-old man (157 cm, 55 kg) underwent an emergent laparoscopic surgery for incarceration of right inguinal hernia. His past history included appendectomy 40 years ago. The preoperative chest XP showed small, but not significant, elevation of the right diaphragm (**Figure 1**), which was pointed out by the radiologist (TK). However, no respiratory problem was noted preoperatively. Arterial blood gas analysis in room air were as follows: pH: 7.389, PaO₂: 86.6 mmHg, PaCO₂: 44.2, bicarbonate: 26.1, BE: 1.3. His preoperative ECG showed arterial fibrillation and hypertension was controlled with medications. Anesthesia was induced with propofol and maintained with sevoflurane and remifentanyl in Oxygen/Air (FiO₂ = 0.4). Monitoring in the operating room included ECG, noninvasive blood pressure, percutaneous oxygen saturation, end-tidal carbon dioxide concentration and rectal temperature. Volume control ventilation (550 ml) with PEEP (6 mmHg) was applied throughout the surgery. The patient was placed in the supine position without Trendelenburg tilt. After pneumoperitoneum (10 mmHg, occasionally increased up to 12 mmHg), inspection was started. Because of severe adhesions in the area around the terminal ileum and cecum to the groin region, we carefully performed adhesiolysis. However, it took long duration for adhesiolysis, so we decided to converse from laparoscopic to the open approach. The total duration of the laparoscopic procedure was 216 minutes. The surgery duration was 6 h and 18 min and the anesthesia duration was 6 h and 59 min. Although arterial blood pressure was stable, we sometimes observed supraventricular tachycardia (HR > 110) and controlled heart rate with diltiazem. SpO₂ was 100 % throughout the surgery. A chest radiograph immediately after surgery show that the right diaphragm was significantly elevated compared with the left diaphragm (**Figure 2**). Because SpO₂ was satisfactory, we discontinued remifentanyl and sevoflurane and administered 200 mg of sugammadex. We observed quick emergence and the patient's spontaneous breathing seemed to be good, so he was extubated in the operating room. His SpO₂ was 100 % while breathing oxygen 6 L.min⁻¹ oxygen from a face mask after extubation, so he was transferred to the surgical ward. On the postoperative day (POD) 1, although we started early mobilization, his Spo₂ reduced under 90 % in room air, so breathing oxygen from a face mask was needed. Chest X-P on POD 1 still showed the elevation of the right diaphragm and we confirmed atelectasis of the inferior lobe of the right lung by the chest CT (**Figure 3**). On POD 2, he developed postoperative delirium, including confusion, logorrhea and disorientation, so rehabilitation which was scheduled on POD 2 was postponed. His delirium continued despite pharmacological treatment with haloperidol. On POD 5, the delirium

resolved with no consequence, then we restarted rehabilitation including standing up beside the bed and walking in the room. On the seventh postoperative day, SpO₂ was 94~95 in room air and A chest radiograph showed that the elevation of the right diaphragm was not noted (**Figure 4**). Diaphragmatic laxity was suspected in this patient after the surgery. However, since the patient recovered without any adverse effects, further detailed examinations were omitted.

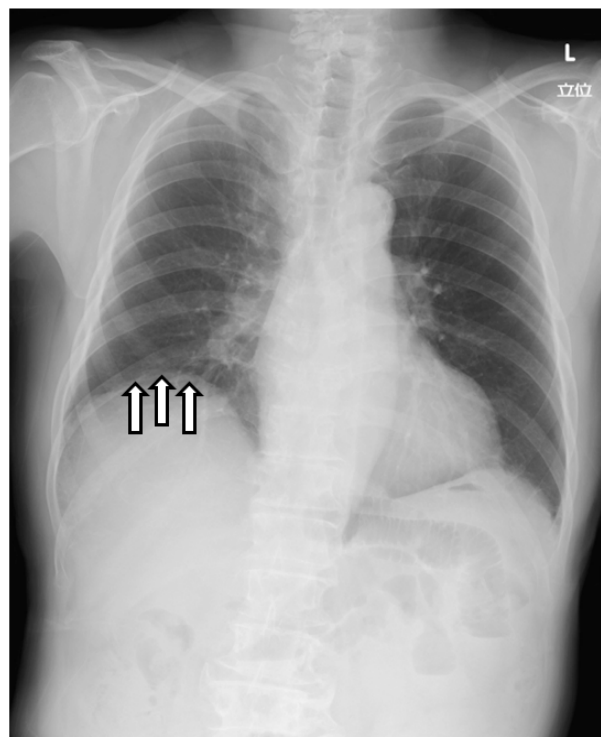


Figure 1: Chest radiograph before anesthesia. Small elevation of the right diaphragm was pointed out (arrow).

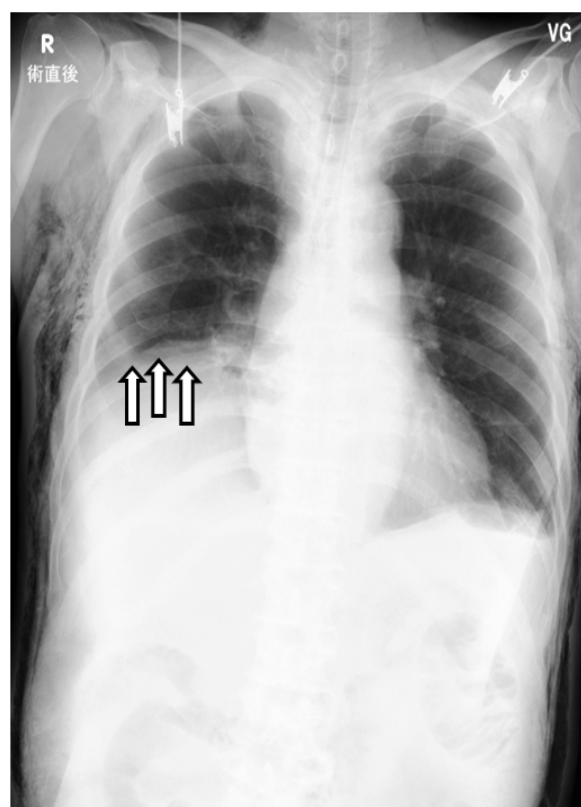


Figure 2: Chest radiograph immediately after surgery. Significant elevation of the right diaphragm was noted (arrow).

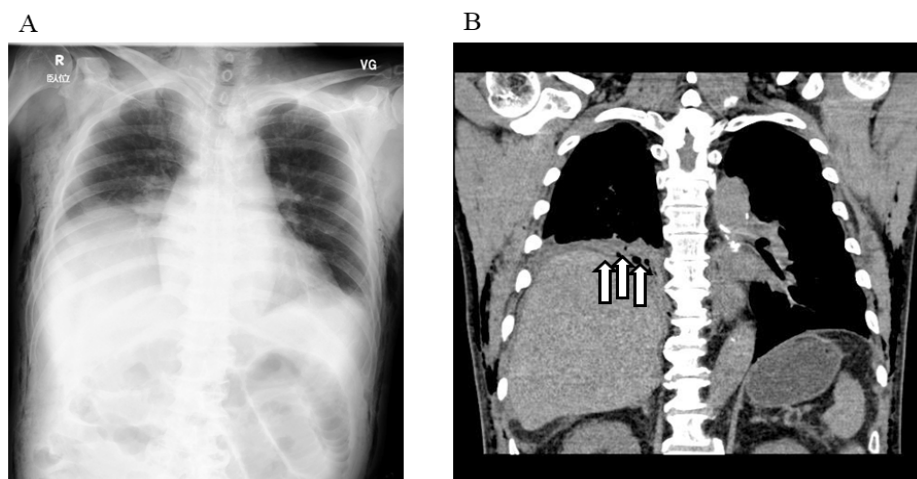


Figure 3: Chest radiograph (A) and CT (B) on the first postoperative day. Significant elevation of the right diaphragm was still observed and CT clearly showed atelectasis of the inferior lobe of the right lung (arrow).

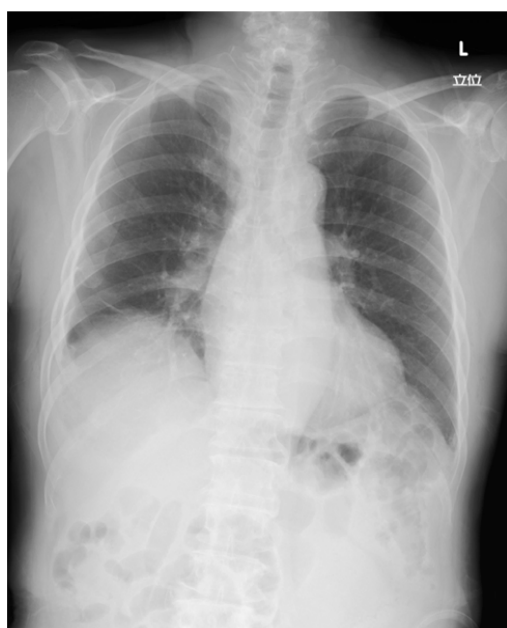


Figure 4: Chest radiograph on the seventh postoperative day.

Discussion

We experienced significant elevation of right diaphragm after laparoscopic surgery, although duration of the laparoscopic procedure was not so long, inflated pressure of pneumoperitoneum was low and Trendelenburg tilt was not done.

Atelectasis associated with the elevation facilitated hypoxia after anesthesia (**Figure 2**) and the patient required breathing oxygen from a face mask. In addition, postoperative delirium which developed on POD 2 made rehabilitation delayed, resulting in prolonged hypoxia after anesthesia. Laparoscopy causes splinting of the diaphragm and atelectasis after laparoscopic surgery is well recognized pathology [4], so one may not feel that this case report contributes to the extensive literature already published on this topic. However, this case might have potential problem in his right diaphragm before anesthesia. Although our radiologist (TK) pointed out small elevation of the right diaphragm in the preoperative chest XP (**Figure 1**), we failed to evaluate this small event properly before anesthesia. In results, we regretted not to do satisfactory anesthetic management to prevent atelectasis during anesthesia, such as higher PEEP, increasing tidal volume and frequent intermittent manda-

tory inflation.

Routine preoperative chest XP is not generally recommended, because its usefulness has not been well established [2,3]. However, the present case showed a small hint in the preoperative chest XP. If we had evaluated this hint properly, we could have performed better anesthetic management. In addition, we could clearly address the abnormal elevation after operation in comparison with the preoperative chest XP. It might be further justification of usefulness of preoperative chest XP in the present case. Thus, although it may be limited to this case, the preoperative chest XP is helpful.

The relationship between prolonged hypoxia and delirium after operation is not clear. Since the patient was irritated by attaching the face mask, the hypoxia might trigger the development of delirium. Thus, it might be possible that the postoperative delirium would not have developed, if we had prevented the atelectasis.

In conclusion, we reported a case of unexpected significant elevation of right diaphragm after laparoscopic surgery. Preoperative chest XP gave us a hint to image this unexpected event. However, we failed to evaluate this hint before anesthesia properly, resulting in postoperative atelectasis.

Acknowledgement

The authors would like to thank Ms. Ririka Tomita for language editing.

Published with the 'written consent of the patient'.

No external funding or other competing interests declared.

References

1. Cunningham AJ. Laparoscopic surgery-anesthetic implications. *Surg Endosc.* 1994; 8: 1272-1284.
2. Rucker L, Frye EB, Staten MA. Usefulness of screening chest roentgenograms in preoperative patients. *JAMA.* 1983; 250: 3209-3211.
3. Joo HS, Wong J, Naik VN, Savoldelli GS. The value of screening preoperative chest x-rays: a systematic review. *Can J Anaesth.* 2005; 52: 568-574.
4. Oti C, Mahendran M, Sabir N. Anaesthesia for laparoscopic surgery. *Br J Hos Med.* 2016; 77: 24-28.