

## Delayed diagnosis of traumatic diaphragmatic rupture

Teruaki Mizobuchi, MD · Naomichi Iwai, MD  
Hiromasa Kohno, MD · Nao Okada, MD  
Tomoki Yoshioka, MD · Hiroki Ebana, MD

Received: 20 November 2008 / Accepted: 21 January 2009  
© The Japanese Association for Thoracic Surgery 2009

**Abstract** We report a case of late presentation of traumatic rupture of the diaphragm discovered incidentally on chest radiography (CXR) during an annual medical checkup. A 60-year-old man suffered severe blunt trauma from heavy steel frames collapsing against his back, resulting in pelvic and femoral fractures as well as pulmonary contusions. The patient recovered, but 10 months later CXR performed for lung cancer surveillance during an annual medical checkup revealed a traumatic rupture of the diaphragm. Video-assisted thoracic surgery was performed with reduction of the intestine and primary closure of the diaphragmatic defect. The patient recovered uneventfully. This report serves as a useful reminder that a medical history of severe blunt trauma should provoke a high index of suspicion for diaphragmatic rupture during annual medical surveillance.

**Key words** Traumatic diaphragmatic rupture · Delayed diaphragmatic rupture · Video-assisted thoracic surgery

---

T. Mizobuchi (✉) · N. Iwai · H. Kohno · N. Okada  
Department of Chest Surgery, Matsudo City Hospital, 4005  
Kamihongo, Matsudo-shi, Chiba 271-8511, Japan  
Tel. +81-47-363-2171 (ext. 1764); Fax +81-47-363-2189  
e-mail: tmizobuchi@hotmail.com

T. Yoshioka  
Department of Traumatology and Critical Care Medicine,  
Matsudo City Hospital, Chiba, Japan

H. Ebana  
Department of Surgery, Tokyo Metropolitan Health and  
Medical Treatment Corporation Okubo Hospital, Tokyo, Japan

### Introduction

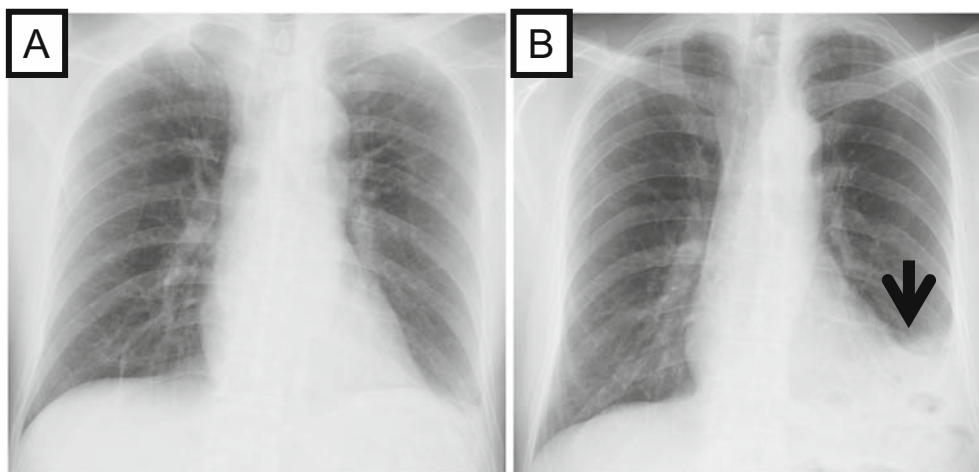
Traumatic diaphragmatic rupture may result from severe blunt injury to the chest and abdomen; it occurs in 0.8%–5.8% of patients who suffer such trauma.<sup>1</sup> However, the diagnosis is sometimes difficult and may be easily missed during the acute phase,<sup>2</sup> resulting in late presentation.<sup>3</sup> Because delayed traumatic rupture of the diaphragm may be identified during an annual medical checkup, we believe that this report serves as a useful reminder of the importance of appropriate follow-up in patients with a history of blunt trauma.

### Case

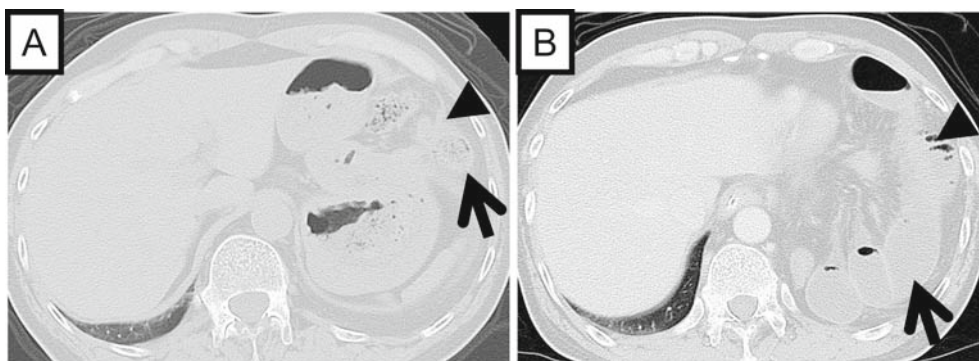
Steel frames weighing 350 kg collapsed against the back of a 60-year-old man, who was transferred to an emergency department and diagnosed with multiple pelvic fractures, right femoral fracture, and pulmonary contusions. The femoral fracture required surgery, and the pelvic fractures and lung injuries were managed nonoperatively. The patient recovered and was transferred to a rehabilitation facility after 57 days of hospitalization. A chest radiograph (CXR) obtained prior to discharge showed no herniation or displacement of bowel (Fig. 1A). Ten months later, routine CXR obtained for lung cancer surveillance during an annual medical checkup demonstrated a left lung base opacification with bowel loops (Fig. 1B). The patient was then referred to our department of thoracic surgery.

He had no major complaints, but bowel sounds were detected in the left lower thoracic region. A confirmatory computed tomography (CT) scan of the chest revealed delayed traumatic rupture of the left diaphragm

**Fig. 1** **A** Chest radiography before discharge from the emergency department shows no diaphragmatic rupture. **B** Chest radiography at an annual medical checkup, conducted 10 months after the initial injury, reveals left basal opacification with bowel loops



**Fig. 2** **A** Computed tomography scan shows a defect in the left diaphragm (arrowhead), the mesentery, and large intestine in the left thoracic cavity (arrow). **B** The large intestine (arrowhead) and the fluid-filled small intestine (arrow) have herniated into the left thoracic cavity



(Fig. 2A), and a recommendation was made for immediate thoracoscopy and diaphragmatic repair to prevent life-threatening intestinal obstruction and strangulation. Because he was asymptomatic, the patient could not be persuaded to undergo surgery, and he was discharged home against medical advice.

Three weeks later, the patient was emergently admitted to the hospital with acute abdominal pain. He denied shortness of breath or other symptoms. Admission physical examination revealed a temperature of 37.4°C, respiratory rate of 30 breaths/min, heart rate of 66 beats/min, and oxygen saturation of 98% on room air. An abdominal examination revealed diffuse tenderness without peritoneal signs. Laboratory data included a white blood cell count of 15 400/μl (normal 4000–8000/μl), C-reactive protein level of 0.43 mg/dl (normal <0.3 mg/dl), and creatine phosphokinase (CPK) level of 817 IU/l (normal 32–187 IU/l). Thoracoabdominal CT scanning demonstrated herniation of small and large bowel loops through the left diaphragm, with evidence of obstruction, along with reduced intestinal enhancement (Fig. 2B).

The patient consented to emergency surgery. Video-assisted thoracic surgery (VATS), utilizing a mini-thoracotomy with a 10-cm skin incision at the ninth intercostal space showed herniation of bowel loops into

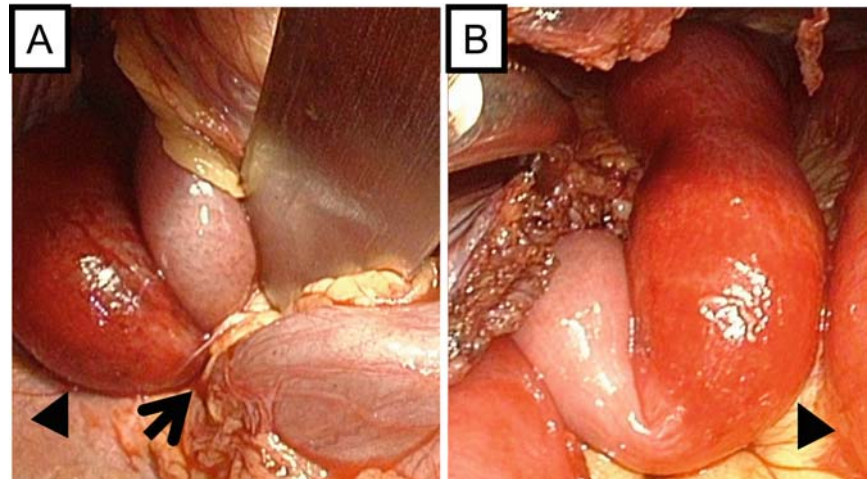
the chest. The intestines were in a mildly ischemic state (Fig. 3A), and normal color returned soon after repositioning allowed reperfusion (Fig. 3B). There was no need for laparotomy or bowel resection. Because the edges of the ruptured diaphragm were deemed strong enough to perform direct suture closure, the diaphragmatic defect was closed primarily with eleven 2/0 TI-CRON sutures (Covidien, Norwalk, CT, USA). The postoperative course was uneventful. He was able to begin eating on the fifth postoperative day and was discharged after a total of 9 days.

## Discussion

We report the case of delayed traumatic rupture of the diaphragm discovered incidentally by routine CXR during an annual medical checkup. In our case, the left-sided traumatic rupture was caused by chest and lower back trauma and had been asymptomatic and undiagnosed for 10 months after the initial injury. It is not clear when the diaphragm actually ruptured, but it must have occurred after discharge because the pre-discharge CXR showed no herniation.

Shah and colleagues performed a meta-analysis of 980 patients with traumatic rupture of the diaphragm.<sup>2</sup> Trau-

**Fig. 3** **A** There is a defect in the left diaphragm (*arrow*). The small intestine (*arrowhead*) appears mildly ischemic. **B** The color of the small intestine (*arrowhead*) improves soon after repositioning and reperfusion



matic rupture of the diaphragm affects predominantly males (male/female ratio 4 : 1), is most often caused by blunt trauma (75%), and occurs more frequently on the left side (left 68.5%, right 24.2%, bilateral 1.5%). Chest and splenic trauma are the most commonly associated injuries (44% and 38%, respectively).

The diagnosis of diaphragmatic rupture may be delayed in up to 14.6% of traumatic ruptures of the diaphragm.<sup>2</sup> On the other hand, 67% of diaphragmatic ruptures are recognized within 12 h of the initial injury.<sup>1</sup> Regarding the length of delay, McHugh et al. reported nine cases of delayed presentation of ruptured diaphragm, and the period of delay varied from 6 months to 16 years.<sup>3</sup>

Divisi et al. recommended VATS for the diagnosis of traumatic rupture of the diaphragm, especially in cases involving liver herniation into the thorax.<sup>4</sup> VATS may play a crucial role in the diagnosis of asymptomatic rupture of the diaphragm. Coronal and sagittal reformatted helical CT scanning is also advantageous for determining the severity of traumatic rupture of the diaphragm.<sup>5</sup>

Tanaka and colleagues reported that an increased level of CPK ( $\geq 130$  IU/l) was an independent predictive factor for surgical need in cases of adhesive small bowel obstruction.<sup>6</sup> In our case, we anticipated a need for surgical intervention because of the high CPK level. However, upon thoracotomy, the bowels were found to be in only a mild ischemic state; and our specialist in laparoscopic surgery determined that there was no need for laparotomy or bowel resection.

According to the Ministry of Health and Welfare in Japan, from 2000 to 2005 approximately 7.6 million people underwent an annual medical checkup, which includes a CXR for lung cancer screening purposes. CXR is able to detect not only nodules but also non-tumorous disease, such as diaphragmatic rupture, as

occurred in this case. Because blunt trauma is quite common and traumatic rupture of the diaphragm may go unrecognized for years, it is possible that many other cases may be identified (or missed) on annual CXR examinations performed for lung cancer surveillance. Therefore, we believe that a medical history of major trauma also should increase caregiver suspicion for such injuries during routine annual checkups. To the best of our knowledge, this is the first published case of delayed traumatic rupture of the diaphragm discovered incidentally during an annual medical checkup.

## Conclusion

Because of the potentially delayed presentation of diaphragmatic rupture, we believe that this report serves as a useful reminder that there should be a high index of suspicion for diaphragmatic injuries during routine clinical visits in patients with a history of blunt trauma.

## References

1. Matsevych OY. Blunt diaphragmatic rupture: four year's experience. *Hernia* 2008;12:73–8.
2. Shah R, Sabanathan S, Mearns AJ, Choudhury AK. Traumatic rupture of diaphragm. *Ann Thorac Surg* 1995;60:1444–9.
3. McHugh K, Ogilvie BC, Brunton FJ. Delayed presentation of traumatic diaphragmatic hernia. *Clin Radiol* 1991;43:246–50.
4. Divisi D, Battaglia C, De Berardis B, Vaccarili M, Di Francesco W, Salvemini S, et al. Video-assisted thoracoscopy in thoracic injury: early or delayed indication? *Acta Biomed* 2004;75:158–63.
5. Igai H, Yokomise H, Kumagai K, Yamashita S, Kawakita K, Kuroda Y. Delayed hepatothorax due to right-sided traumatic diaphragmatic rupture. *Gen Thorac Cardiovasc Surg* 2007; 55:434–6.
6. Tanaka S, Yamamoto T, Kubota D, Matsuyama M, Uenishi T, Kubo S, et al. Predictive factors for surgical indication in adhesive small bowel obstruction. *Am J Surg* 2008;196:23–7.