

CASE REPORT

Esophageal perforation associated with fracture of the upper thoracic spine from blunt trauma: a case report

Tetsuji Inoue¹ and Michio Abe²

We report the successful conservative management of an unusual case of esophageal perforation associated with an upper thoracic spinal fracture from blunt trauma in Minamata, Kumamoto, Japan. A 69-year-old man became paraplegic secondary to an L1 burst fracture caused by a boating accident and underwent posterior fixation on the day of admission. The patient also had a minimally displaced T4 vertebral fracture. Fever, dyspnea and elevated inflammatory markers all persisted postoperatively. Computed tomography showed free mediastinal air at the T4 level, and an esophagram showed contrast medium leakage, which helped diagnose esophageal perforation. The esophageal perforation healed with conservative treatment without life-threatening complications. The possibility of esophageal injury should always be considered when treating upper thoracic spinal injuries due to blunt trauma.

Spinal Cord Series and Cases (2016) 2, 15034; doi:10.1038/scsandc.2015.34; published online 7 April 2016

Esophageal perforation or rupture from blunt trauma is extremely rare.^{1,2} It is a life-threatening condition that requires prompt diagnosis and treatment, which can be difficult because symptoms are subjective and the clinical manifestations are nonspecific, subtle or sometimes absent early on. A diagnostic delay of >24 h increases mortality rates.^{1,2} We report the successful conservative management of an unusual case of esophageal perforation associated with an upper thoracic spinal fracture from blunt trauma.

A 69-year-old man was brought to our hospital immediately after a boating accident. On admission, he complained of severe back pain and inability to move his legs. He was mentally alert with normal vital signs. Neurological deficits were noted during the physical examination. Motor function to the lower extremities was completely lost. A loss of sensation was detected below the L2 dermatome except for the saddle region. The bulbocavernosus, patellar tendon and Achilles tendon reflexes were absent. Initial computed tomography (CT) revealed a T4 vertebral body fracture with minimal displacement, fractures of thoracic spinous processes 5–7, an L1 burst fracture with anterior subluxation of T12 and ankylosing spinal hyperostosis (Figures 1a and b). Other injuries included fractures of the right fourth to tenth ribs, right hemothorax and a left clavicular fracture.

Reduction and internal fixation via a posterior approach were performed on the day of admission. Oral intake was initiated on day 1. A chest tube was inserted on day 2 because the right-sided hemothorax had increased. At that time, blood tests showed a white blood cell count of $15\,100\ \mu\text{l}^{-1}$ and a C-reactive protein level of $24.86\ \text{mg dl}^{-1}$. We removed the chest tube on day 5. The hemothorax had decreased, and there was no evidence of infection. However, his increased white blood cell count had increased to $17\,100\ \mu\text{l}^{-1}$, and his C-reactive protein level was $34.12\ \text{mg dl}^{-1}$. We administered antibiotic treatment, but

intermittent fever persisted without improvement, and the patient complained of dyspnea.

An increased procalcitonin level on day 12 indicated sepsis. Follow-up CT demonstrated free mediastinal air at the T4 level (Figure 2a). Re-evaluation of the first CT scan revealed that small air inclusions had been present in the extra-esophageal soft tissues slightly cephalad to the fractured vertebra (Figure 2b). The diagnosis of esophageal perforation was confirmed by contrast esophagography (Figure 2c). We immediately prohibited oral ingestion and started treatment with total parenteral nutrition and antibiotic medication. Closure of the esophageal perforation was confirmed by esophagography on day 34 (Figure 2d). Chest CT revealed disappearance of the free mediastinal air at the T4 level. Blood tests showed decreases in the white blood cell count (to $9200\ \mu\text{l}^{-1}$) and C-reactive protein level (to $2.67\ \text{mg dl}^{-1}$), but the intermittent fever persisted. The patient began to complain of lateral chest pain. Magnetic resonance imaging showed T4 vertebral body destruction and an extensive epidural abscess, indicating pyogenic spondylitis secondary to the esophageal perforation (Figure 2e). The pyogenic spondylitis was treated conservatively with three consecutive antibiotics (imipenem/cilastatin, doripenem and cefazolin in turn) for 4 weeks. On day 106, magnetic resonance imaging showed healing of the pyogenic spondylitis (Figure 2f). Four months after the accident, the patient was declared well and the therapy was considered successful.

Esophageal perforation from blunt trauma is extremely rare,¹ and perforation from blunt trauma associated with a thoracic spinal injury is even rarer. To the best of our knowledge, only seven cases have been previously reported, all caused by high-impact traffic accidents (Table 1).^{3–9}

Such esophageal perforations have been previously reported to occur at the upper thoracic level (Table 1).^{3–9} Nakai *et al.*⁷ suggested that, because the esophagus runs close to the spinal

¹Department of Orthopaedic Surgery, Minamata City General Hospital and Medical Center, Minamata, Japan and ²Department of Surgery, Minamata City General Hospital and Medical Center, Minamata, Japan.

Correspondence: T Inoue (tetsu6943@yahoo.co.jp)

Received 2 July 2015; revised 8 October 2015; accepted 30 October 2015



Figure 1. Initial computed tomography (CT) revealed a T4 vertebral body fracture with minimal displacement, fractured thoracic spinous processes 5–7 (a), an L1 burst fracture with T12 anterior subluxation (b) and ankylosing spinal hyperostosis.

column between C5 and T4, esophageal perforation is possible with hyperextension injuries of the thoracic spine. Regarding the mechanism of the spinal injury in the present case, it is likely that shear stress was concentrated on the cervicothoracic and thoracolumbar junctions because of decreased flexibility of the thoracic spine due to ankylosing spinal hyperostosis. The esophagus may have been injured directly (by the anterior edge of the T4 vertebral body) or indirectly (by rapid stretching). Ischemic esophageal perforation with a delayed appearance on CT is unlikely because CT demonstrated free air in the mediastinum on the day of the injury.^{1,9}

Thoracic esophageal perforation causes mediastinitis and sepsis more easily than cervical esophageal perforation.^{1,2} In addition, a treatment delay of >24 h has been associated with higher complication and mortality rates in patients with esophageal perforation.^{1,2} Therefore, early diagnosis and appropriate management are extremely important for saving the lives of such patients. However, the early diagnosis of esophageal injury due to blunt trauma is difficult because symptoms are subjective and clinical manifestations are nonspecific and slight, meaning that they are easily masked by symptoms and manifestations of other damaged vital organs.^{1,2} Accordingly, delayed diagnosis is a common occurrence, particularly when there are other injuries that attract attention.^{3,4,6,8} This situation often makes treatment difficult and can result in fatal outcomes.¹ In our patient, subtle dyspnea on the day of injury was considered to be caused by the multiple right rib fractures and hemothorax. The T12–L1 spinal injury with

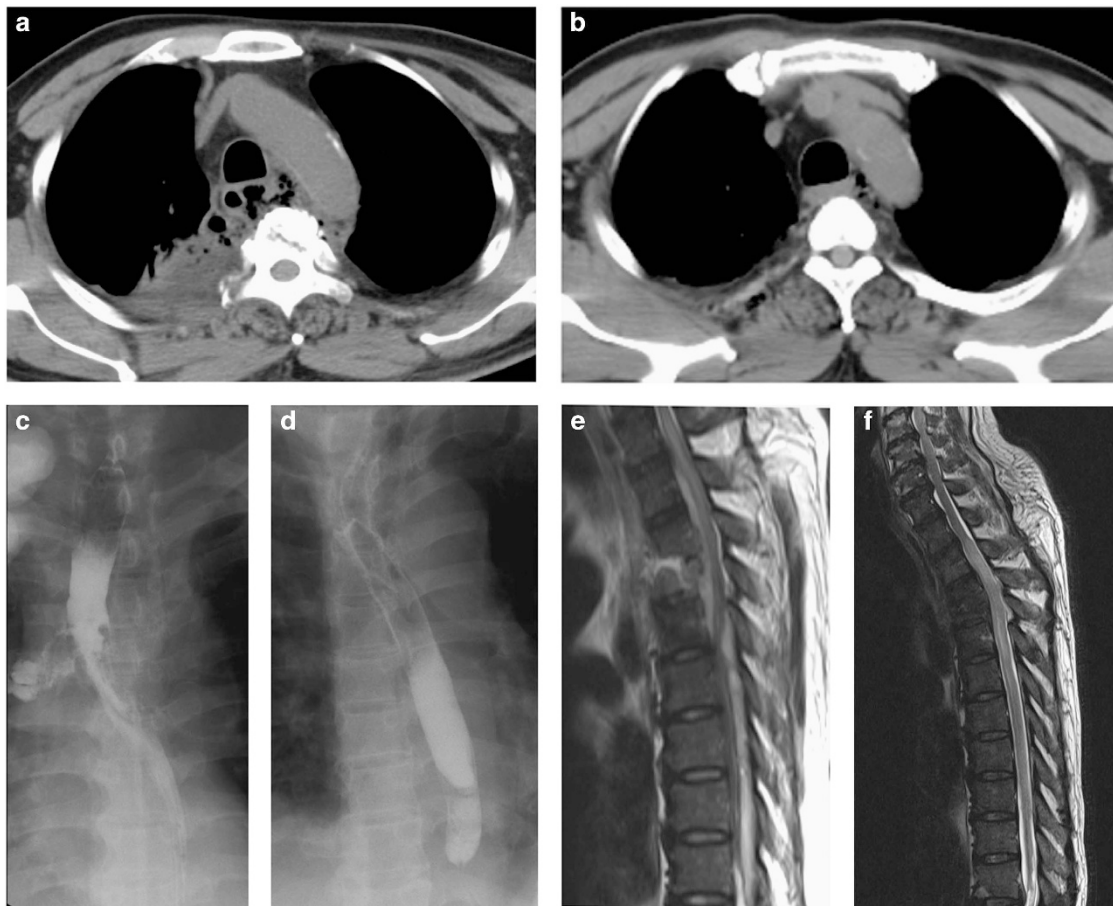


Figure 2. On day 12, follow-up CT demonstrated free air in the mediastinum at the T4 level (a). Re-evaluation of the initial CT revealed that small air inclusions had been present in the extra-esophageal soft tissues slightly cephalad to the fractured vertebra (b). Esophagography revealed contrast medium leakage at the T3–4 levels (c). On day 34, closure of the esophageal perforation was confirmed by esophagography (d). Magnetic resonance imaging (MRI) showed T4 vertebral body destruction and wide-range epidural abscess formation that was complicated with pyogenic spondylitis, which was secondary to the esophageal perforation (e). On day 106, MRI showed healing of the pyogenic spondylitis (f).

Table 1. Summarized data of seven other patients of esophageal perforation associated with spinal trauma

Case No	Author	Sex	Age (years)	Injury origin	Level of spinal injury with EP	Period from injury to diagnosis	Subjective symptom	Clinical manifestations and other injuries	Treatment for EP	Complication	Prognosis
1	Brouwers MA ³	Male	17	Moped accident	T3–T4	14 days	?	Fractured ribs, pneumothorax, lung contusions and a femoral shaft fracture	Conservative	Mediastinitis, empyema	Alive
2	Nakai S ⁷	Female	48	Motorbike crash	T3–T4	11 days	Pain in her upper, left back	Fracture of the left posterior 3rd–10th ribs	Conservative	Empyema, mediastinitis, sepsis	Dead
3	Chen SH ⁵	Male	20	Hit by an automobile	T3–T4	0 day	—	Shock and unconscious, severe neck swelling, subcutaneous emphysema, dyspnea, right pneumothorax and fractures of the right third through sixth ribs	Operation	Nothing	Alive
4	Chen HS ⁴	Male	49	Motorbike crash	T1	1 week	Severe pain in upper back and abdomen	A closed fracture of the right humerus, multiple open fractures of the bilateral lower limbs, hyperesthesia and weakness in both arms with cervical disc herniation	Conservative	Epidural abscess, right mediastinal abscess	Alive
5	Tjardes T ⁹	?	58	Motor vehicle accident	T3–T4	11 days	Severe pain in the chest and the upper thoracic spine	Nothing	Conservative	Pleural effusion	Alive
6	Taylor TR ⁸	Female	Middle age	Motor vehicle accident	T1	5 days	?	Complete antegrade amnesia, a right facial weakness, a small amount of traumatic subarachnoid blood, multiple complex skull base and facial fractures	Conservative	Nothing	Alive
7	Lee DH ⁶	Male	49	Motor vehicle accident	T2	5 months	Severe back pain in the upper thoracic area	Paraplegia with cervical ossification of posterior longitudinal ligament	Conservative	Infectious spondylitis	Alive

Abbreviation: EP, Esophageal perforation. All occurred at the upper thoracic level. Except for case 3, the diagnosis of all cases was delayed. Their subjective symptoms were nonspecific. Except for case 6, all cases had other injuries that attracted attention. Only seven cases in which esophageal perforation associated with fracture of the thoracic spine from blunt trauma have been previously reported, all caused by high-impact traffic accidents.

paraplegia appeared to be the most serious injury and thus became the main focus of management.

Evaluation that uses multiple methods and re-evaluation are important for preventing life-threatening complications such as mediastinitis and sepsis because there may be false-negative findings initially as well as changes over time.^{1,2} In our patient, initial CT demonstrated free air in the mediastinum, but we did not initially detect it because we underestimated the subtly displaced T4 fracture. Clinicians should always consider the possibility of esophageal injury in these circumstances.

Treatment of esophageal perforation should be individualized according to the cause of injury, anatomic location, time to diagnosis, underlying esophageal disease, esophagography findings and patient's condition.² We chose a conservative treatment for our patient because sepsis was not severe, despite

the delayed diagnosis of esophageal perforation. Moreover, the perforation was located in the upper thoracic region, which is difficult to access surgically. In this location, adverse effects, caused by the back-flow of gastric contents, are unlikely to occur. In addition, the size of the perforation was deemed to be relatively small based on esophagography. Despite a delayed diagnosis and the complications of sepsis and pyogenic spondylitis, we were able to successfully treat this esophageal perforation with conservative therapy because the patient's condition was relatively well maintained when finally diagnosed.² This suggests that a small perforation of the upper thoracic esophagus can be resolved with conservative treatment,^{3,4,6,8,9} even in the event of delayed diagnosis, because of the low potential for the infection to spread to the mediastinum and thoracic cavity. However, delayed diagnosis can increase the difficulty of treatment

because of complications such as mediastinitis³ and secondary spondylitis.^{4,6} We emphasize that diagnosis as early as possible is important, even if this cannot be achieved 24 h after injury.

Esophageal perforation secondary to thoracic injury from blunt trauma is extremely rare, and early diagnosis and timely treatment are very important for preventing life-threatening complications. Clinicians should always consider the possibility of an esophageal injury when encountering upper thoracic injuries due to blunt trauma.

ACKNOWLEDGEMENTS

The patient has consented to submission of the case report for publication in a journal.

ETHICAL STATEMENT

This manuscript does not contain clinical studies or patient data.

COMPETING INTERESTS

The authors declare no conflict of interest.

REFERENCES

- 1 Beal SL, Pottmeyer EW, Spisso JM. Esophageal perforation following external blunt trauma. *J Trauma* 1988; **28**: 1425–1432.
- 2 Jones WG II, Ginsberg RJ. Esophageal perforation: a continuing challenge. *Ann Thorac Surg* 1992; **53**: 534–543.
- 3 Brouwers MA, Veldhuis EF, Zimmerman KW. Fracture of the thoracic spine with paralysis and esophageal perforation. *Eur Spine J* 1997; **6**: 211–213.
- 4 Chen HC, Tzaan WC, Chen TY, Tu PH. Esophageal perforation complication with spinal epidural abscess, iatrogenic or secondary to first thoracic spine fracture? *Acta Neurochir (Wien)* 2005; **147**: 431–434.
- 5 Chen SH, Huang TJ, Chen YJ, Liu HP, Hsu RW. Flexion-dislocation injury of the upper thoracic spine associated with tracheoesophageal perforation: a case report. *J Bone Joint Surg Am* 2002; **84**: 1028–1031.
- 6 Lee DH, Kim NH, Hwang CJ, Lee CS, Kim YT, Shin MJ *et al.* Neglected esophageal perforation after upper thoracic vertebral fracture. *Spine J* 2011; **11**: 1146–1151.
- 7 Nakai S, Yoshizawa H, Kobayashi S, Miyachi M. Esophageal injury secondary to thoracic spinal trauma: the need for early diagnosis and aggressive surgical treatment. *J Trauma* 1998; **44**: 1080–1089.
- 8 Taylor TR, Lenthall R. Extension avulsion fracture of the upper thoracic spine with associated oesophageal injury. *Emerg Med J* 2010; **27**: 332–333.
- 9 Tjardes T, Wafaizadeh A, Steinhausen E, Krakamp B, Bouillon B. Extension injury of the thoracic spine with rupture of the oesophagus and successful conservative therapy of concomitant mediastinitis. *Eur Spine J* 2009; **18**: S240–S244.