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CASE REPORT

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Tension pyopneumothorax caused by *Parvimonas micra*: a case report

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Abstract

Tension pyopneumothorax is a rare and life-threatening complication of pneumonia, lung abscess, and empyema, and immediate thoracic drainage or surgery is required. A 70-year-old man presented to another hospital 2 weeks after exacerbation of dyspnea and anorexia. Chest X-ray imaging revealed leftward deviation of the mediastinum, pleural effusion, and collapse of the right lung. The patient was referred to our hospital for surgical treatment. He underwent chest drainage immediately after the transfer. The patient's blood pressure was elevated after drainage. Chest X-ray imaging showed improvement in the mediastinal deviation, but expansion failure of the lung occurred. Debridement and parietal and visceral decortications were performed under thoracotomy. The thoracic cavity was irrigated using a pulse lavage irrigation system with 12,000 mL of saline. The patient underwent fibrinolytic therapy with intrathoracic urokinase postoperatively because of persistent high inflammatory marker levels and multilocular pleural effusion. *Parvimonas micra* was detected in the preoperative pleural fluid culture. He was discharged on postoperative day 22 and followed up as an outpatient afterwards. Two years have passed since the surgery, and there has been no recurrence of empyema. Decortication of the parietal and visceral pleura and irrigation using a pulse lavage irrigation system were effective.

Keywords Tension pyopneumothorax, *Parvimonas micra*, Decortication, Surgery, Pulse lavage irrigation system

Background

Tension pyopneumothorax (TPPTx) is a rare and life-threatening complication of pneumonia, lung abscess and empyema [1]. Empyema occurs when there are purulent exudates within the pleural space, which may or may not be associated with air or gas. TPPTx occurs when an empyema causes pneumothorax. Large amounts of purulent exudates and gas can cause lung collapse and shift the mediastinal organs, such as the heart, lungs, and trachea. Increased intrathoracic pressure can reduce the venous return with secondarily decreased cardiac output, and mediastinal deviation can compress the contralateral lung, leading to an emergent situation [2, 3]. Therefore, immediate thoracic drainage or surgery is often required. Herein, we report a successful surgical treatment of TPPTx caused by *Parvimonas micra*.

Case presentation

A 70-year-old man presented to the hospital 2 weeks after experiencing exacerbation of dyspnea and anorexia. His medical history included comorbidities, such as hypertension, atrial fibrillation, untreated dental caries, and periodontitis. He had a body temperature of 37.6 °C, blood pressure of 92/58 mmHg, and heart rate of 105 bpm. A chest X-ray (anterior–posterior view) revealed right lung collapse and decreased radiolucency

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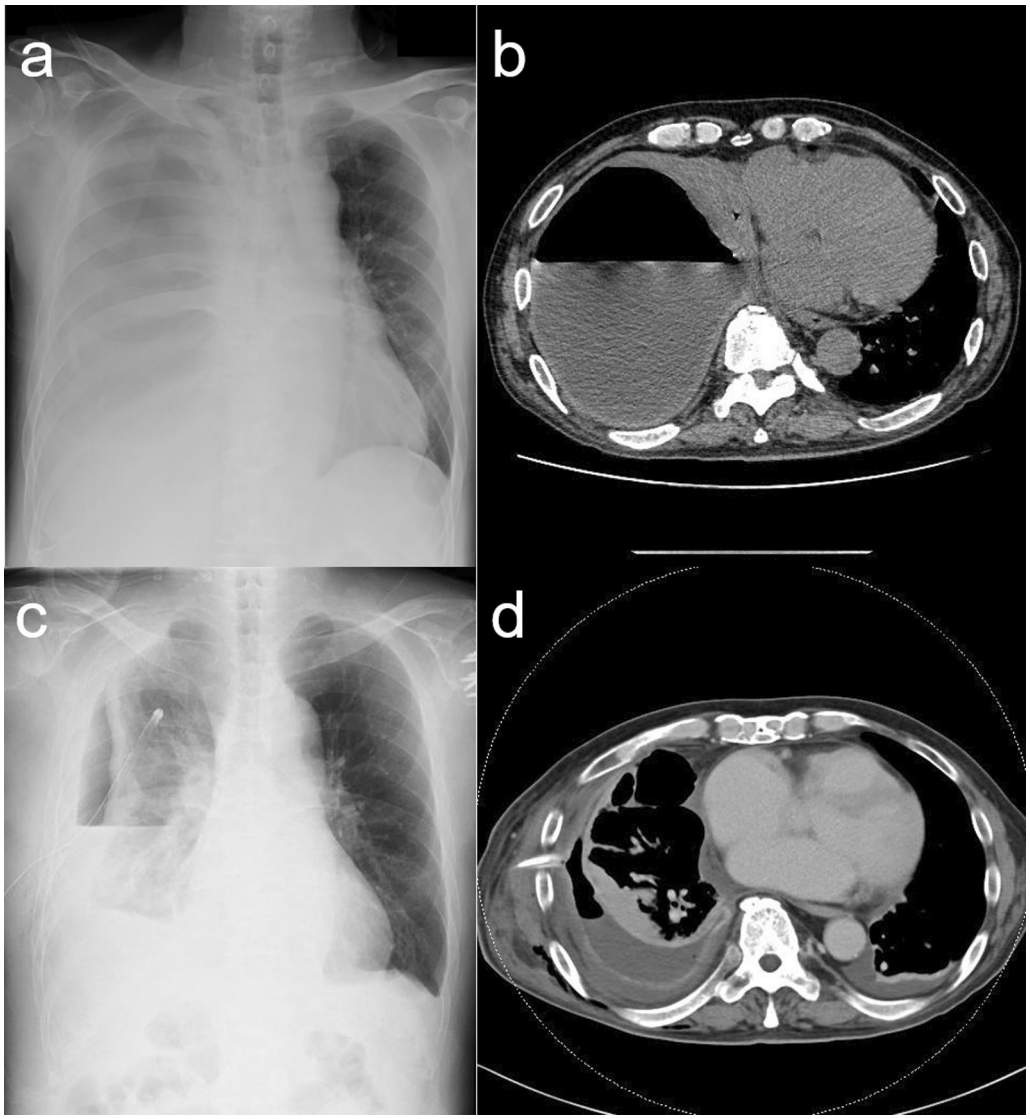

Fig. 1 **a** Chest X-ray imaging and **b** computed tomography (CT) at the first visit. Chest X-ray imaging revealed right lung collapse and pleural effusion, and leftward deviation of the mediastinum. (Supine, anterior–posterior view) Chest CT revealed pleural effusion with air-fluid level and collapse of the right lung. **c** Chest X-ray and **d** CT imaging after drainage showed improvement in the mediastinal deviation and an expansion failure of the lung

of the right thoracic cavity with leftward deviation of the mediastinum (Fig. 1a). Chest computed tomography revealed pleural effusion with air-fluid level and collapse of the right lung (Fig. 1b). No mediastinal air was observed. White blood cell count and C-reactive protein levels increased markedly to 21,900 /MCL and 24.03 mg/dL, respectively. Procalcitonin level was elevated to 1.90 ng/mL. Thoracentesis was performed and 860 mL of the pleural fluid was aspirated. The pH of the pleural effusion decreased markedly down to 7.1. After initiating meropenem (MPEM) administration (3.0 g/day), the patient was referred to our hospital for surgical treatment. He underwent chest drainage immediately after the transfer. From the tube, 2000 mL of foul-smelling pus drained without air leakage. The patient's blood pressure increased to 124/74 mmHg. Chest X-ray imaging

showed improvement in the mediastinal deviation; however, an expansion failure of the lung was noted, and surgery was planned (Fig. 1c, d). There was no fistula or air leaking from the parenchyma at the beginning of the surgery (Fig. 2a). We first attempted thoracoscopic debridement. However, the parietal and visceral pleura were markedly thickened. Therefore, we converted to thoracotomy and performed parietal and visceral decortication. The parenchyma itself was normal without inflammation or abscess (Fig. 2b). Thoracic cavity was irrigated using a pulse lavage irrigation system with 12,000 mL of saline. An apical and a basal drain were placed over the lung apex and diaphragm. The operation time was 161 min, and the volume of blood loss was 600 mL. The apical drain was removed on postoperative day (POD) 3. On PODs 5 and 13, the patient underwent fibrinolytic therapy using intrathoracic urokinase administration to promote lung expansion because of persistent high inflammatory marker levels and multilocular pleural effusion. *P. micra* was detected in the preoperative pleural fluid culture. Based on the pleural effusion culture, it was determined to be the causative bacterium, and antibiotics were de-escalated from MPEM to metronidazole (1500 mg/day) on POD 8. The basal drain was removed on POD 20, because no bacteria were detected in either of the two pleural fluid cultures. The patient was discharged on POD 22 (Fig. 3a). The patient is under careful follow-up as an outpatient; at present, 2 years have passed since the operation, and there has been no recurrence of empyema (Fig. 3b, c).

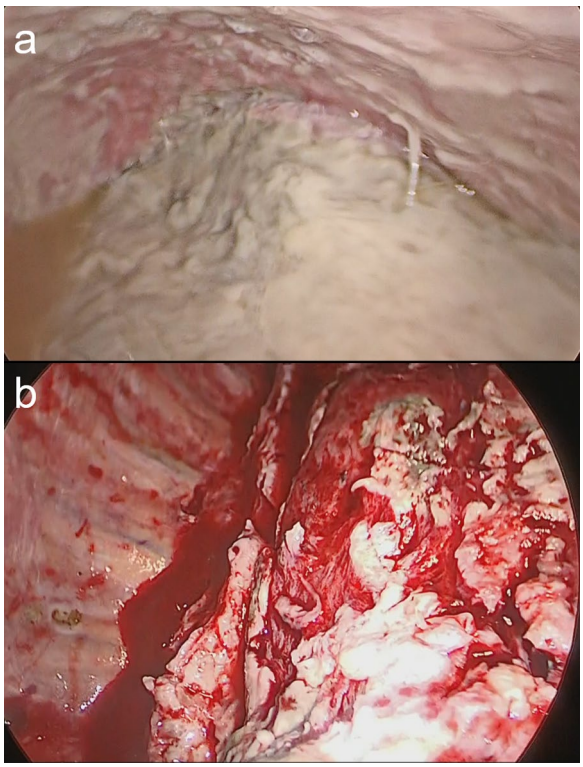

Fig. 2 Intraoperative images. **a** The parietal and visceral pleura were markedly thickened. There was no fistula or air leaking from the parenchyma at the beginning of the surgery. **b** After parietal and visceral decortication. The parenchyma itself was normal without inflammation or abscess

Discussion

TPPTx is a rare and life-threatening condition that was previously reported only in 20 cases, including our case [1, 3–20] (Table 1). Pyothorax has a high mortality rate (15%), and 30% of cases require early and appropriate treatment, such as surgical drainage of the pleural space [21]. Of the 20 previously-reported TPPTx cases of (five women and 15men), nine (45%) had a serious course, including cardiopulmonary arrest, shock, respiratory failure, and sepsis, and two of them had a fatal outcome. Of the 17 patients with a confirmed prognosis, three (17.6%) died. The average age was 52.1 (standard deviation: 17.6) years. Four cases involved the gastrointestinal tract (gastropleural fistula, esophageal rupture), four cases had lung infection (lung gangrene, echinococcal cyst, pulmonary nocardiosis, and aspiration pneumonia), four cases underwent treatment for malignancies, and three cases had a history of immunocompromising conditions (human immunodeficiency viral infection, steroid addict). Facultative or obligatory anaerobes were identified from pleural effusion cultures in 10 of 15 previously-described cases.

Parvimonas micra is a bacterial flora in the oral cavity and gastrointestinal tract, and can be a pathogenic bacterium for chronic periodontal disease, alveolar pyorrhea, peritonsillar abscess, chronic sinusitis, chronic otitis media, and pulmonary suppuration [24]. Cobo et al. [24] reported pleurisy in three (9.6%) out of 31 cases of *P. micra* infection, and intrathoracic infection was relatively rare. *Parvimonas micra* is part of the oral flora, and 16 out of the 31 aforementioned cases had comorbidities, such as periodontitis and dental caries, dental procedures, or tooth extraction [24]. This patient had

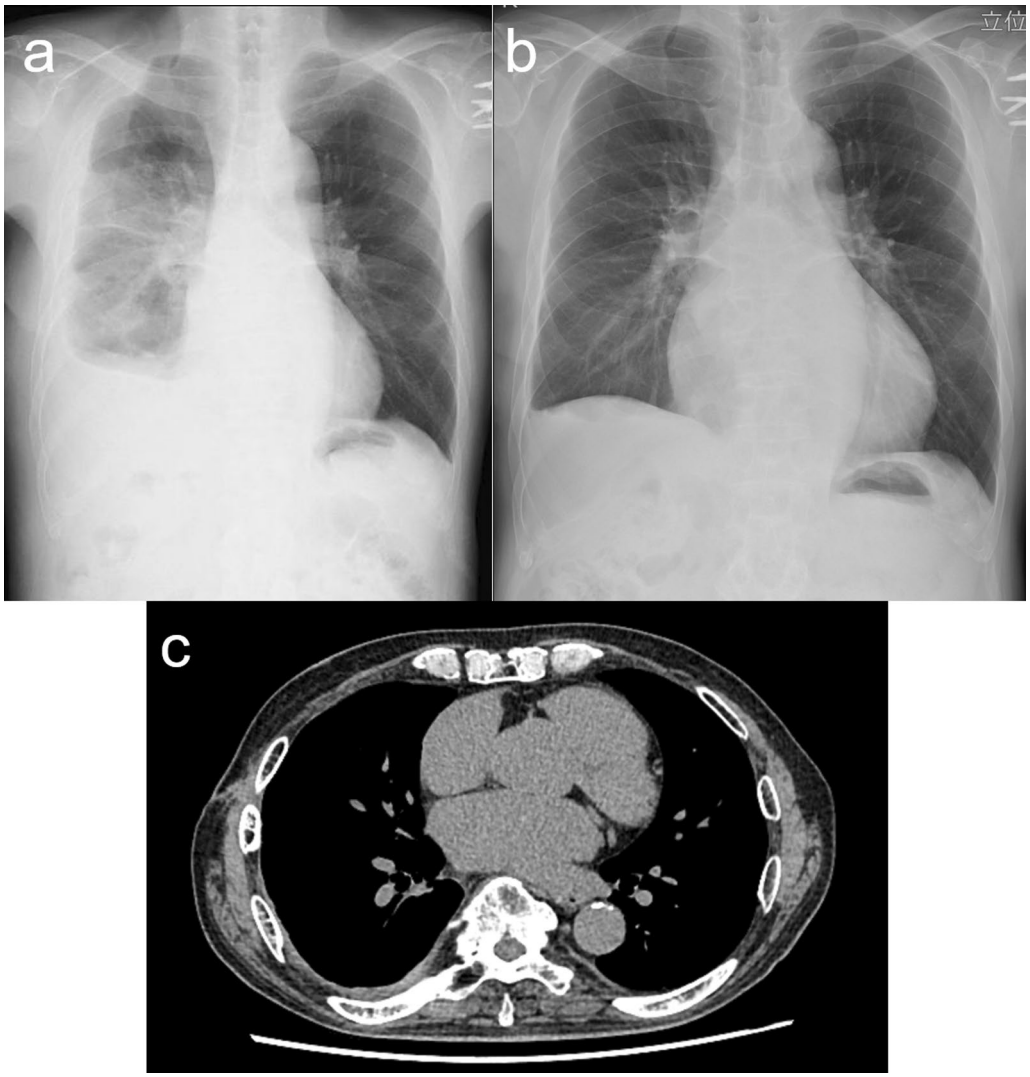

Fig. 3 Postoperative images. **a** Chest X-ray at the discharge. **b** Chest X-ray and **c** computed tomography images at the 2-years follow-up examination

untreated dental caries and periodontitis, which were suspected to be related to TPPTx occurrence.

Empyema surgery is based on debridement and lavage of the pleural cavity. Recently, the effectiveness of using pulse lavage irrigation system in the treatment of empyema has been reported [22, 23]. Pulse irrigation uses high water pressure and can wash the area of its application without damaging the surrounding soft tissues, such as nerves and blood vessels. Moreover, the fibrin and necrotic tissues can be easily removed and washed. It has been reported that 90% of patients with acute empyema in the fibrinopurulent phase were cured completely without recurrence after pulse irrigation [22]. This case was considered to be in the late fibrinopurulent phase to the chronic organizing phase. It was observed that decortication and pulse irrigation were effective in cleaning the thoracic cavity.

In conclusion, we successfully treated a rare case of TPPTx caused by *P. micra* infection. The patient developed TPPTx owing to gas production from an anaerobic bacterial infection. Decortication of the parietal and visceral pleura and irrigation using a pulse lavage irrigation

Table 1 The previous case reports of tension pyothrax and pyopneumothorax in adult

Case	Age	Sex	Background	Etiology	Culture of PE	Outcome			References
						Fatal complication	Treatment	Prognosis	
1	20	F	Pharingitis	Unknown: air way tear or pharyngeal-mediastinal-pleural comunication?	*Streptococcus pyogenes*	–	Antibiotics, drainage	Alive	[4]
2	28	F	HIV positive	ND	ND	CPA	Resuscitation, drainage	ND	[3]
3	47	F	RTx for breast cancer	Gastropleural fistula	ND	CPA	Resuscitation	Alive	[5]
4	65	F	MALT lymphoma	Gastropleural fistula	*Gram positive bacilli*	–	Drainage, surgery; total gastrectomy	Dead	[6]
5	65	F	DM	–	*Actinomyces sp, mixed anaerobes*	–	Antibiotics, drainage, intrathoracic urokinase	Alive	[7]
6	30	M	Hodgkin's disease	Left lung gangrene	ND	Septic shock	Surgery; fenestration	Alive	[8]
7	31	M	Drug abuse	Unknown: pneumonia?	*mixed anaerobes*	–	Antibiotics, drainage	Alive	[9]
8	35	M	–	–	*Staphylococcus sp.*	–	Antibiotics	Alive	[10]
9	38	M	Pulmonary echinococcosis	Ruptured echinococcal cyst	*Acinetobacter baumanii* (sptum)	–	Antibiotics, drainage	Alive	[11]
10	42	M	21 trisomy, DM	ND	failed to identify	CPA	Resuscitation, drainage	Dead	[1]
11	45	M	Unknown	ND	*prevotella denticola*	Shock, RF	Antibiotics, drainageintubation and mechanical ventiration	ND	[12]
12	49	M	ND	–	*Streptococcus viridans, Peptococcus*	–	Antibiotics, drainage	ND	[13]
13	59	M	Aspiration pneumonia, Parkinson's disease	Bronchopleural fistula	*Prevotella and Wolinella sp.*	Shock, RF	Surgery; drainage and decortication	Alive	[14]

Table 1 (continued)

Case	Age	Sex	Background	Etiology	Culture of PE	Outcome			References
						Fatal complication	Treatment	Prognosis	
14	62	M	Cerebral infarction sequelae	ND	*Streptococcus viridans, Morganella morganii*	Shock?, RF?	Antibiotics, drainage, intubation and mechanical ventiration	Alive	[15]
15	68	M	DM, Alcoholic hepatitis, IP treated with a steroid	–	ND	Septic shock	Drainage, ND other treatment	Alive	[16]
16	68	M	Total gastrectomy for gastric cancer, CTx for esophageal cancer	Ruptured lung abscess	*Klebsiella oxytoca, a-Streptococcus*	Shock, RF	Surgery; left lower lobectomy, decortication	Alive	[17]
17	69	M	–	Esophageal diverticulum rupture	*Candida albicans, Microaerphilic streptococci, Escherichia coli*	Sepsis	Antibiotics, drainagesurgery; feeding jejunostomy, debridement, pharyngostomy	Dead	[18]
18	74	M	Pulmonary nocardiosis, steroid therapy for autoimmune hepatitis	Ruptured lung abscess	*Nocardia pseudobrasiliensis*	–	Drainage, surgery; left lower lobectomy	Alive	[19]
19	77	M	Barrett's esophagus	Esophagopleural fistula	ND	–	Drainage, surgery; distal esophagectomy	Alive	[20]
20	70	M	HT, Af, dental caries, periodontitis	–	*Parvimonous micra*	–	Surgery; debridement, decortication	Alive	Our case

PE pleural effusion, *F* female, *M* male, *HIV* human immunodeficiency virus, *RTx* radiotherapy, *MALT* mucosa-associated lymphoid tissue, *DM* diabetes mellitus, *ND* not described, *IP* interstitial pneumonia, *CTx* chemotherapy, *HT* hypertension, *Af* atrial fibrillation, *PTx* pyothorax, *PPTx* pyopneumothorax, *CPA* cardiopulmonary arrest, *RF* respiratory failure

system seemed to be efficient in the treatment of the condition.

Abbreviations

TPPTx	Tension pyopneumothorax
MEPM	Meropenem
POD	Postoperative day
P. micra	*Parvimonas micra*

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Author contributions
YI participated in the surgery, conceived and conducted the study, and performed the literature search. HU participated in the surgery. SI, NM, and HU supervised manuscript preparation and critically revised the manuscript. All the authors have read and approved the final manuscript.

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The data underlying this article are available in the article.

Declarations

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Not applicable.

Consent for publication
Written informed consent was obtained from the patient for the publication of this report and its accompanying images.

Competing interests
The authors declare that they have no competing interests.

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References

1. Bramley D, Dowd H, Muwanga C. Tension empyema as a reversible cause for cardiac arrest. Emerg Med J. 2005;22:919–20. https://doi.org/10.1136/emj.2004.019562.
2. Whiteman PJ, Wilson MT, Barcay D, Ting PP, Chen SC. Tension pyopneumothorax in a child: a case report. J Emerg Med. 2003;24:429–31. https://doi.org/10.1016/s0736-4679(03)00040-4.
3. Ahern TL, Miller GA. Tension pyothorax causing cardiac arrest. West J Emerg Med. 2009;10:61. https://doi.org/10.1111/j.1442-2026.1998.tb00494.x.
4. Khatib R, Siwik J. Pyopneumothorax: a complication of Streptococcus pyogenes pharyngitis. Scand J Infect Dis. 2000;32(5):564–5. https://doi.org/10.1080/003655400458910.
5. Roberts CM, Gelder CM, Goldstraw P, Spiro SG. Tension pneumothorax and empyema as a consequence of gastro-pleural fistulae. Respir Med. 1990;84:253–4. https://doi.org/10.1016/s0954-6111(08)80045-5.
6. Warburton CJ, Calverley PM. Gastropleural fistula due to gastric lymphoma presenting as tension pneumothorax and empyema. Eur Respir J. 1997;10:1678–9. https://doi.org/10.1183/09031936.97.10071678.
7. Kanai O, Fujita K, Okamura M, Nakatani K, Mio T. Afebrile tension pyopneumothorax due to anaerobic bacteria: fistula or gas production? Respir Med Case Rep. 2021;32:101372. https://doi.org/10.1016/j.rmcr.2021.101372.
8. Juettner FM, Arian-Schad K, Kraus I, Gallhofer G, Popper H, Friehs G. Total unilateral lung gangrene in Hodgkin's disease: treatment by thoracostomy. Ann Thorac Surg. 1991;51:302–3. https://doi.org/10.1016/0003-4975(91)90807-3.
9. Samovsky M, Loberant N, Lemer J, Altman E. Tension pyopneumothorax. Clin Imaging. 2005;29:437–8. https://doi.org/10.1016/j.clinimag.2005.07.005.
10. Hussain SA. Tension pyopneumothorax in staphylococcal pneumonia. Postgrad Med. 1977;61:238. https://doi.org/10.1080/00325481.1977.11712168.
11. Sharon H, Elhanan E, Aviram G, Hassin D. Tension pyopneumothorax due to a ruptured pulmonary echinococcal cyst. Respiration. 2012;84:327–8. https://doi.org/10.1159/000339510.
12. Javeed M, Rahmouni Idrissi F, Nazary N. A unique case of tension empyema caused by *Prevotella denticola*. Cureus. 2022;14:e25853. https://doi.org/10.7759/cureus.25853.
13. Bloom RJ, McClenathan JH. Surgical images: soft tissue—tension pyopneumothorax. Can J Surg. 2006;49:58.
14. Mitsui S, Tauchi S. Tension pyopneumothorax. BMJ Case Rep. 2021;14:e242197. https://doi.org/10.1136/bcr-2021-242197.
15. Hsieh CF, Lin HJ, Foo NP, Lae JC. Tension pyopneumothorax. Resuscitation. 2007;73:6–7. https://doi.org/10.1016/j.resuscitation.2006.08.024.
16. Ishikawa K, Hara M, Iwakami S, Yanagawa Y. A case of tension pyothorax with septic shock. J Emerg Trauma Shock. 2015;8:244. https://doi.org/10.4103/0974-2700.161663.
17. Okita R, Miyata Y, Hamai Y, Hihara J, Okada M. Lung abscess presenting as tension pyopneumothorax in a gastrointestinal cancer patient. Ann Thorac Cardiovasc Surg. 2014;20:478–81. https://doi.org/10.5761/atcs.cr.12-02195.
18. Rigg KM, Walker RW. Tension pneumothorax secondary to ruptured oesophageal diverticulum. Br J Clin Pract. 1990;44:528–9.
19. Fujimoto R, Omasa M, Ishikawa H, Aoki M. Surgery of a Nocardia lung abscess presenting as a tension pyopneumothorax. Asian Cardiovasc Thorac Ann. 2017;25:315–7. https://doi.org/10.1177/0218492317705286.
20. Matsumoto MA, Rockoff SD, Aaron BL. Tension pyopneumothorax: rare presentation of ruptured Barrett's esophagus. Chest. 1993;103:1604–6. https://doi.org/10.1378/chest.103.5.1604.
21. Shen KR, Bribriesco A, Crabtree T, Denlinger C, Eby J, Eiken P, et al. The American association for thoracic surgery consensus guidelines for the management of empyema. J Thorac Cardiovasc Surg. 2017;153:e129–46. https://doi.org/10.1016/j.jtcvs.2017.01.030.
22. Kusch E. Management of pleural empyema using VATS with jet-lavage system. J Surg. 2018;6:135–9. https://doi.org/10.11648/j.js.20180605.15.
23. Iwai S, Funasaki A, Sekimura A, Motono N, Usuda K, Uramoto H. Acute empyema treated with pulsed lavage irrigation and curettage in cases with persistent dead space: a report of two cases. Jpn J Chest Surg. 2020;34:6–12. https://doi.org/10.2995/jacsurg.34.6. (**inJapanesewithEnglishabstract**).
24. Cobo F, Rodríguez-Granger J, Sampedro A, Aliaga-Martínez L, Navarro-Marí JM. Pleural effusion due to *Parvimonas micra*: a case report and a literature review of 30 cases. Rev Esp Quimioter. 2017;30:285–92.

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