Case report

Spondylodiscitis initially presenting as exudative pleural effusion: A case report and review of the literature

Jongmin Park\textsuperscript{a,b}, Byunggeon Park\textsuperscript{a,c},*, Jae-Kwang Lim\textsuperscript{a,b}, Kyung Min Shin\textsuperscript{a,c}, Jung Guen Cha\textsuperscript{b}, Jihoon Hong\textsuperscript{b}, Yun Su Kim\textsuperscript{d}, Jongsoo Park\textsuperscript{e}

\textsuperscript{a} Department of Radiology, School of Medicine, Kyungpook National University, 680 Gukchaeosang-ro, Jung-gu, Daegu 41944, South Korea
\textsuperscript{b} Department of Radiology, Kyungpook National University Hospital, 130 Dongaoke-ro, Jung-gu, Daegu 41944, South Korea
\textsuperscript{c} Department of Radiology, Kyungpook National University Chilgok Hospital, 807 Hogukno, Buk-gu, Daegu 41404, South Korea
\textsuperscript{d} Department of Radiology, Daegu Catholic University Medical Center, Catholic University of Daegu College of Medicine, 33 Duryunggwan-ro 17 Gil, Nam-gu, Daegu 42472, South Korea
\textsuperscript{e} Department of Radiology, Seoul National University Hospital, 101 Daehak-Ro, Jongno-Gu, Seoul 03080, South Korea

\textbf{ARTICLE INFO}

\textbf{Keywords:}
Pleural effusion
Spondylodiscitis
CT
MRI

\textbf{ABSTRACT}

Pleural effusions are associated with a variety of disease states, rendering the differential diagnosis challenging. Spondylodiscitis is an uncommon disease, and its prompt diagnosis can reduce morbidity and mortality. However, an atypical manifestation of the disease, such as pleural effusion, can result in delayed diagnosis. A 76-year-old woman presented with back pain and right pleural effusion. Magnetic resonance imaging revealed paravertebral soft tissue infiltration, with enhancement of bone marrow and intervertebral disk at the T8 and T9 levels, suggesting spondylodiscitis. In patients with exudative pleural effusion, spondylodiscitis may be the cause, so careful analysis of imaging is necessary.

1. Introduction

Pleural effusions are associated with a wide variety of disorders of the lungs as well as some systemic disorders. Despite a proper diagnostic workup, the cause can remain unknown in up to 20% of cases [1]. The reported incidence of spondylodiscitis in developed world is estimated at 2.2-5.8 cases per 100,000 person years and spondylodiscitis can be a rare cause of exudative pleural effusion [2,3]. Since the initial focus of the investigation for pleural effusion is usually on the pleural diseases, its diagnosis may be delayed in such a case. A careful analysis of early imaging studies can reduce this delay.

Herein, we report a case of exudative pleural effusion caused by pyogenic spondylodiscitis of a thoracic vertebra.

2. Case presentation

A 76-year-old woman was admitted to our hospital with mid-thoracic back and left flank pain of three weeks duration. She had no cough, sputum, or other upper respiratory infection symptoms. She had a history of hypertension, controlled with medication, and no other underlying diseases.

On admission, her body temperature was 36.4 °C. Laboratory study showed a white blood cell (WBC) count of 11070/µL, C-reactive protein (CRP) of 9.02 mg/dL, erythrocyte sedimentation rate of 75 mm/h, total protein of 7.6 g/dL, and serum lactate dehydrogenase (LDH) of 144 U/L. A chest x-ray revealed opacification of the right lower lung field and blunting of the right costophrenic angle, suggesting pleural effusion (Fig. 1). Chest computed tomography (CT) showed a loculated right pleural effusion with pleural thickening, as well as passive atelectasis in right lower lobe (Fig. 2a and b). There was neither pneumonic consolidation nor mediastinal lymphadenopathy. Thoracentesis to determine the cause of the pleural effusion yielded exudates with an LDH level of 201 U/L, and a protein level of 5.0 g/dL. WBC count was 200/mm\textsuperscript{3}, with 58.3% lymphocytes. Adenosine Deaminase was 23.7 IU/L. Gram staining and Ziehl-Neelsen staining were negative. Culture of the pleural fluid demonstrated no growth of a micro-organism, and there were no malignant cells upon cytopathic examination. Urinalysis revealed pyuria, and \textit{Escherichia coli} (E.coli) was yielded in both the urine and blood.

* Corresponding author at: Department of Radiology, School of Medicine, Kyungpook National University, Kyungpook National University Chilgok Hospital, 807 Hogukno, Buk-gu, Daegu 41404, South Korea.

E-mail address: redzon7543@gmail.com (B. Park).

https://doi.org/10.1016/j.ejro.2020.100279
Received 27 August 2020; Received in revised form 22 September 2020; Accepted 23 September 2020
2352-0477/© 2020 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
cultures. Our initial diagnostic impression was urinary tract infection, such as an acute pyelonephritis (APN). Abdomen CT showed no radiologic evidence of APN, and the patients had no complaint of costovertebral angle tenderness. Also the pleural effusion was not sufficiently explained by a consideration of urinary tract infection.

Interestingly, after careful review of the chest CT images, a mild paravertebral soft tissue infiltration was demonstrated at the T8-9 levels (Fig. 2c and d). Subsequent magnetic resonance imaging (MRI) displayed a high signal intensity on T2-weighted images in the bone marrow and paraspinal soft tissue of T8-9 vertebrae. After intravenous injection of contrast agent, bone marrow and paraspinal soft tissue was enhanced. The enhanced T1-weighted image also demonstrated that enhancement of the paraspinal soft tissue contiguously spread to the adjacent right pleura (Fig. 3). These MRI findings suggested that inflammation due to spondylodiscitis of the thoracic vertebrae had spread to the adjacent right pleura, which may have caused the exudative pleural effusion.

Paravertebral soft tissue or involved spinal segment by image-guided biopsy was not obtained. The patient was treated with meropenem and amikacin intravenously, and a chest tube was inserted into the right hemothorax for drainage of the pleural effusion. The patient had an uneventful recovery, her back pain still remained, and her CRP dropped to 1.61 mg/dL on the day of discharge, nearly two months after admission.

3. Discussion

Pleural effusions accompany a wide variety of diseases of the lungs and pleura as well as systemic disorders. To appropriately manage the pleural effusion, it is important to first determine its cause [1]. The most common causes of exudative pleural effusion include malignancy, tuberculosis, and pneumonia [4]. Less frequently, contiguous spread from adjacent infection, such as a liver abscess or pancreatitis, can give rise to pleural effusions [1].

Incidence of spondylodiscitis or vertebral osteomyelitis is increasing in the developed world and estimated at 2.2-5.8 cases per 100,000 person years [2]. Early diagnosis of spondylodiscitis and appropriate

![Chest radiograph shows opacification in the right lower lung field with a blunt costophrenic angle (arrow) suggesting pleural effusion. Consolidations (arrowheads) are also noted in right lower lung field.](image1)

![Contrast enhanced axial (a) and coronal (b) CT images show loculated pleural effusion (asterisks) and pleural thickening (arrow) with atelectasis (arrowheads). Magnified axial (c) and coronal (d) CT images show paravertebral soft tissue infiltration (arrows) in the T8-9 levels.](image2)
treatment can reduce hospital stay, morbidity, and mortality. However, non-specific clinical symptoms and signs of this disease make early diagnosis difficult [5].

Although back pain is a common presentation in spondylodiscitis, osteomyelitis is usually not at the forefront of diagnostic considerations. Therefore, diagnosis of the disease often delayed, potentially leading to severe consequences and resulting in long-term neurological impairment [6].

Several cases of spondylodiscitis, or vertebral osteomyelitis, associated with pleural effusion have been reported [3,6–10] (Table 1). Most of the patients presented with a chief complaint of back pain or thoracic pain; lesions affected by osteomyelitis were at the mid-lower thoracic vertebral levels. CT findings included pleural effusions, vertebral body height loss, and bony destructive change. MRI findings for patients with spondylodiscitis included vertebral signal change, paraspinal infiltration or mass, and decreased disc height.

We reported a case of exudative pleural effusion caused by thoracic spondylodiscitis. The chest CT revealed mild paravertebral soft tissue infiltration at the T8-9 levels; a subsequent MRI demonstrated that the visualized enhancement of the paraspinal soft tissue had contiguously spread to the adjacent right pleura. Therefore, the exudative pleural effusion of the patient may have resulted from the contiguous spread of inflammation due to the thoracic spondylodiscitis. Although the chest CT showed neither destructive change nor decreased vertebral height in our case, careful review of chest CT demonstrated a mild paravertebral infiltration, leading to a suspicion of vertebral osteomyelitis prior to the appearance of bony change or paravertebral soft tissue mass.

CT-guided biopsy for diagnosis of spondylodiscitis is often requested to identify the causative microbial pathogen when clinical and laboratory sign of infection and MRI finding are equivocal. However, CT-guided biopsy of the spine is rather invasive procedure and may result in complications such as pain, paresis or hematoma formation [11,12]. Most cases of spondylodiscitis or vertebral osteomyelitis resulted from hematogenous spread from a remote site of infection, most commonly the urinary tract [13]. In present case, although no CT-guided paravertebral soft tissue biopsy or involved spinal segment biopsy was...
obtained, spondylodiscitis was final diagnosis as considering clinical course, laboratory and culture results. This case suggests that pyogenic spondylodiscitis can be a rare cause of pleural effusion, and also gives an outline of the usefulness of a comprehensive analysis of imaging to assist in the diagnosing of unexplained exudative pleural effusion.

4. Conclusion

Spondylodiscitis is a rare etiology of exudative pleural effusion. Careful examination of the thoracic spine on initial imaging studies may be helpful in order to discover the cause of pleural effusion.

Declaration of Competing Interest

The authors report no declarations of interest.

Acknowledgement

The authors would like to thank Enago for the English language review. The authors received no specific funding for this work.

References

[1] Vinaya S. Karkhanis, Jyotma M. Joshi, Pleural effusion, diagnosis, treatment, and management, Open Access Emerg Med, OAEM. 4 (2012) 31, https://doi.org/10.2147/OAEM.S29942.
[2] M. Kehrer, C. Pedersen, T.G. Jensen, Increasing incidence of pyogenic spondylodiscitis: a 14-year population-based study, J. Infect. 68 (4) (2014) 313–320, https://doi.org/10.1016/j.jinf.2013.11.011.
[3] S.K. Gupta, A. Pandit, D.G. White, P.D. Evans, Salmonella osteomyelitis of the thoracic spine: an unusual presentation, Postgrad. Med. J. 80 (2004) 110–111, https://doi.org/10.1136/pmj.2002.002592.
[4] J.S. Ferrer, X.G. Muñoz, R.M. Orriols, R.W. Light, F.B. Morell, Evolution of idiopathic pleural effusion: a prospective, long-term follow-up study, Chest. 109 (6) (1996) 1508–1513, https://doi.org/10.1378/chest.109.6.1508.
[5] Lucy Cottle, Terry Riordan, Infectious spondylodiscitis, J. Infect. 56 (5) (2008) 401–412, https://doi.org/10.1016/j.jinf.2008.02.005.
[6] N.S. Bass, R.K. Allani, R. Shekar, A.A. Gerblich, Pyogenic vertebral osteomyelitis presenting as exudative pleural effusion: a case of five cases, Chest. 114 (2) (1998) 642–647, https://doi.org/10.1378/chest.114.2.642.
[7] Sanjiv Jari, Ahmed El-Gamel, Tim H. Meadows, Colin Campbell, Spinal osteomyelitis presenting with a life-threatening pleural empyema, Spine. 21 (23) (1996) 2806–2808, https://doi.org/10.1097/00007632-199612010-00019.
[8] Stéphane Jouneau, Anne-Claire Volatron, Benoît Desroux, Christian Michelet, Pierre Tattevin, Vertebral osteomyelitis presenting as pleural effusion, Eur. J. Intern. Med. 15 (5) (2004) 323–325, https://doi.org/10.1016/j.ejim.2004.05.005.
[9] Xiujun Zheng, Jian Wang, Chunhui Wu, A. Amir, Mehbod, Salmonella osteomyelitis of multiple ribs and thoracic vertebra with large psoas muscle abscesses, Spine J. 9 (11) (2009), https://doi.org/10.1016/j.spinee.2009.06.013 e1-e4.
[10] Ioannis Papaioannou, Andreas Balikousis, Panagiotis Koroessis, Multi-foci Salmonella enteritidis osteomyelitis of thoracic spine with pleural effusion and fatal outcome, A unique case presentation and review of the literature, J. Orthop. Case Rep. 7 (1) (2017) 69, https://doi.org/10.13107/jocnr.2250-0685.694.
[11] E. Rimondi, E.L. Staals, C. Errani, G. Bianchi, R. Casadei, M. Alberghini, M. Mercuri, Percutaneous CT-guided biopsy of the spine: results of 430 biopsies, Eur. Spine J. 17 (7) (2008) 975–981, https://doi.org/10.1007/s00586-008-0767-y.
[12] A.J. Huang, E.F. Halpern, D.I. Rosenthal, Incidence of delayed complications following percutaneous CT-guided biopsy of bone and soft tissue lesions of the spine and extremities: a 2-year prospective study and analysis of risk factors, Skeletal Radiol. 42 (1) (2013) 61–68, https://doi.org/10.1007/s00256-012-1433-2.
[13] E. Mylona, M. Samarakos, E. Kakalou, P. Fanoourgiakis, Skoutelis., A Pyogenic vertebral osteomyelitis: a systematic review of clinical characteristics, Semin. Arthritis Rheum. 39 (1) (2009) 10–17, https://doi.org/10.1016/j.semarthrit.2008.03.002.