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Case report

Two cases of acute pneumococcal purulent arthritis

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ABSTRACT

We present two adult cases of pneumococcal severe arthritis one case with, and other case without pericarditis those occurred in one season. Both cases eventually recovered, and the isolated *S. pneumoniae* strains were serotype 12F and penicillin susceptible. The patients were not elderly and had no medical history including pneumonia and vaccination. Although *S. pneumoniae* is a relatively rare causative pathogen of arthritis and/or pericarditis recently, a greater number of cases may be expected as a result of serotype conversion due to the increased use of pneumococcal conjugate vaccines in Japan.

Introduction

The most common cause of acute arthritis and/or pericarditis include infectious agents [1,2]. Of these, bacterial infections, including *Staphylococcus aureus*, viridans streptococci, gram-negative Enterobacteriaceae, and anaerobic bacteria, have been reported to cause purulent arthritis and/or pericarditis, which are associated with considerably rapid progression and highly fatal disease [1–3].

Streptococcus pneumoniae was previously the most common cause of arthritis and/or pericarditis with a preceding primary site of infection. However, following the introduction of antibiotics in the 1940s and more recently pneumococcal conjugate vaccines in the 2000s, its incidence has drastically decreased [2].

Here, we describe two cases of severe and purulent arthritis one case with, and other case without pericarditis those caused by *S. pneumoniae* in previously healthy and relatively young adults.

Case report

Case 1

A 47-year-old woman presented at the emergency room in February 2017 with acute pain around the left knee and high fever accompanied by extreme fatigue that had persisted for a week. She had a no medical, smoking or pneumococcal vaccination history. Physical examination indicated the following: temperature of 38.5 °C, blood pressure of 90/50 mmHg, respiratory rate of 24 breaths/min, and consciousness level of E3V3M5 on the Glasgow Coma Scale. There were crackles (rhonchi) on both lower lung fields, and chest radiography indicated heart failure with pericardial and pleural effusions. Furthermore, her left knee was swollen and showed inflammation and effusions on magnetic resonance imaging (MRI) (Fig. 1). Her initial white blood cell (WBC) count was 14,400/L and C-reactive protein (CRP) level was 34.95 mg/dL. Rapid urine antigen testing for *S. pneumoniae* was positive. We punctured her knee and turbid, yellow fluid was drained and neutrophils were found. *S. pneumoniae* was identified in left knee effusion, pericardial effusion, and blood cultures. The strain was identified as serotype 12F, and minimum inhibitory concentration (MIC) testing according to Clinical and Laboratory Standards Institute breakpoints revealed susceptibility to ampicillin (ABPC), ampicillin/sulbactam (ABPC/SBT), and piperacillin (Table 1). Thus, we diagnosed the patient with invasive pneumococcal disease (IPD), including arthritis, pericarditis, and bacteremia.

After drainage of knee and pericardial effusions in the intensive care unit, intravenous meropenem (1 g every 8 h daily) for 1 week were started because she was septic status and susceptibility of the pathogen was unknown at first. Then, ABPC/SBT (3 g every 8 h) for 3 weeks improved chest radiograph and knee MRI findings and inflammatory markers, such as WBC (4300/L) and CRP (2.25 mg/dL). She was discharged from the hospital after completing the course of treatment and continued oral amoxicillin administration for 2 additional weeks. Finally, we genetically analyzed the S. pneumoniae isolate from this patient, and sequence typing (ST) profile showed ST4846 (Table 2).

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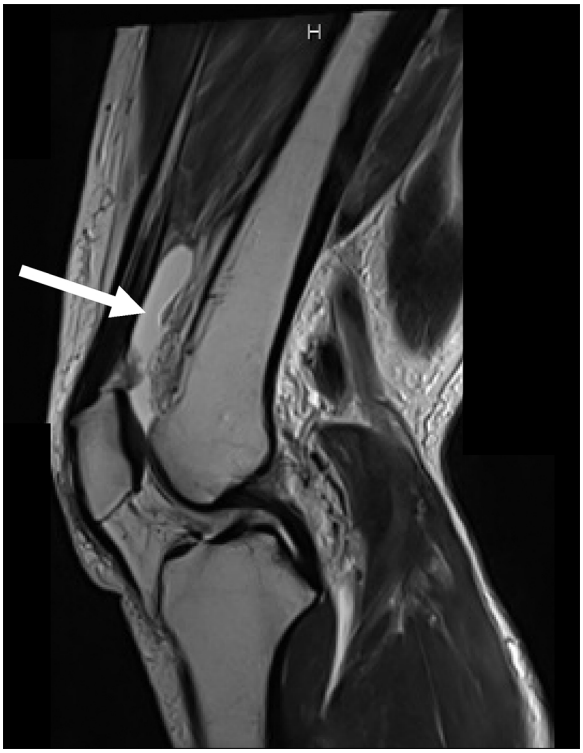

Fig. 1. Left knee magnetic resonance images of Case 1. The Left knee showed inflammation and effusion (arrow).

Case 2

A 57-year-old man who worked as a constructor visited our hospital with right hand swelling and chilling in June 2017. He had no medical history including pneumococcal vaccination, but had experienced a mild hammer injury 1 month previously.

Physical examination revealed the following: temperature of 38.2 °C, blood pressure of 120/60 mmHg, respiratory rate of 17 breaths/min, and dehydration. Chest radiography indicated no shadows on both lung fields, but MRI of his right hand showed massive inflammation (Fig. 2). His initial WBC count was 12,400/L and CRP level was 14.94 mg/dL. *S. pneumoniae* was identified in blood and right wrist cultures, and urine and right wrist specimens were positive for pneumococcal antigen. According to these findings, the patient was diagnosed with IPD, including arthritis and bacteremia. The isolate was identified as serotype 12F, and MIC testing according to Clinical and Laboratory Standards Institute breakpoints also revealed susceptibility to ABPC and ABPC/SBT (Table 1).

Treatment including intravenous piperacillin/tazobactam (4.5 g every 8 h daily) for 2 weeks followed by oral amoxicillin (500 mg every 8 h daily) for 4 weeks improved the MRI findings and wrist arthritis.

The *S pneumoniae* isolated from Case 2 was also ST4846 (Table 2).

Discussion

Bacterial arthritis with pericarditis have become very rare in modern antibiotic era [3]. Bacterial pericarditis is a rapidly progressive and highly fatal disease, and the mortality rate remains high at 40% even with treatment [1].

Table 2
Sequence typing results.

Strain (Serum type)	ST	*aroE*	*gdh*	*gki*	*recP*	*spi*	*xpt*	*ddl*
ASP1029 (12F)	4846	12	32	111	1	13	48	6
ASP1030 (12F)	4846	12	32	111	1	13	48	6

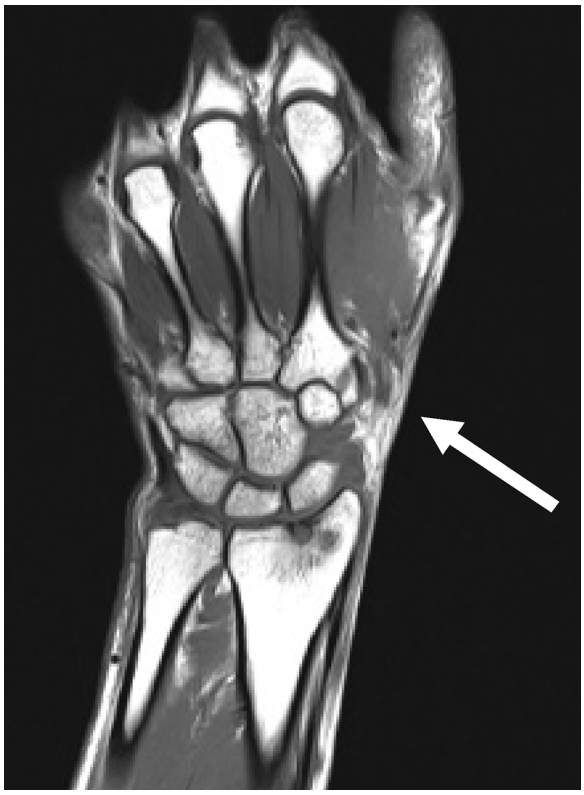

Fig. 2. Right wrist magnetic resonance image of Case 2. The right wrist showed inflammation and effusion around the thumb (arrow).

In this report, we presented two cases of bacterial arthritis with or without pericarditis due to *S. pneumoniae*. Following the introduction of antibiotics in the 1940s and more recently pneumococcal conjugate vaccines (PVCs) in the 2000s, the incidence of purulent pericarditis has drastically decreased from the status as the most common cause of pneumococcal arthritis in children and elderly persons [1,2]. Since 1980, fewer than 25 cases of pneumococcal pericarditis have been reported in the English literature [4].

In Japan, the 7-valent PCV (PCV7) is recommended for children and 23-valent pneumococcal polysaccharide vaccine (PPV23) is recommended for elderly adults to increase prevention against IPD [5]. Most recently, PCV13-conjugated vaccine, suggested more powerful induction of immunological responses, was also approved by the government in 2014 for elderly 65 < years persons in addition to children. *S. pneumoniae* serotype 12F strain, those not covered by PCV7 and 13, but covered by PPV23, were detected in both our cases, suggesting that "pathogen shift" due to strong induction of PCVs in children and adults might have occurred, and IPD in young adults may increase, although

Table 1
Drug susceptibility results (mg/mL).

Strain (Serum type)	PCG	ABPC	CTX	TBPM	PAPM	MEPM	CDTR	EM	CLDM	VCM	TFLX
ASP1029 (12F)	0.06	≤0.03	0.06	≤0.008	≤0.008	0.015	≤0.03	4	≥8	0.25	≤0.12
ASP1030 (12F)	0.06	0.06	0.06	≤0.008	≤0.008	0.03	≤0.03	≥8	≥8	0.25	0.25

classical pneumococcal pneumonia in elderly persons may decrease in Japan. Before then, the serotype coverage rate against IPD by pneumococcal vaccines had decreased rapidly from 71.8% in 2006 to 51.6% in 2011 [6]. This decrease in coverage might be shown to be caused by serotype conversion of *S. pneumoniae* strains to non-PCV serotypes.

Most serotype 12F strains are genetically penicillin-intermediate susceptible *S. pneumoniae*, with alteration in penicillin-binding protein 2b gene. However, clinical isolates are susceptible to penicillins in most cases, and carbapenem shows excellent MIC90 values [5]. In fact, the isolates recovered from the two present cases showed good susceptibility to meropenem and penicillins, including amoxicillin and ampicillins (Table 1). Moreover, antibiotic treatment in addition to drainage successfully improved the patients' conditions. Serotype 12F strain was usually isolated as caused pathogens of sepsis followed by pneumonia and meningitis, but also from arthritis and pericarditis cases in Japan [7]. If we see the severe pneumococcal arthritis cases, we should consider the drainage with intravenous antibiotics treatment, especially in the case who were in septic status with dyspnea suspected with the pericarditis.

S. pneumoniae isolates from the present cases showed typical sequence typing (ST) profiles associated with serotype 12F strains in Japan, such as ST4846, and had MIC90 values < 0.015–0.12 [5,6]. However, the relation(s) between serotype, ST, and clinical pathogenicity including vaccination history remains unclear. Therefore, further clinical, epidemiological, and microbiological investigations and care are needed.

In summary, we experienced two adult cases of severe pneumococcal arthritis with or without pericarditis that occurred in one season. Both patients recovered with antibiotic treatment. The isolated *S. pneumoniae* strains were serotype 12F, showed penicillin susceptibility, and had STs common to Japanese serotype 12F strains. The patients were relatively young adults and had no complications, including pneumonia. Although *S. pneumoniae* is considered a relatively rare causative pathogen of arthritis and/or pericarditis, it may again become common as a result of serotype conversion due to the increased use of strong PCVs in Japan and we should have caution for young adults although PCVs were very effective to prevent IPD in children and elderly adults.

Conflict of interest

None.

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