Novel H1N1 influenza and Panton-Valentine leukocidin *Staphylococcus aureus* necrotizing pneumonia

The association between seasonal influenza and staphylococcal pneumonia has long been recognized (Chickering and Park, 1919; Roberts et al, 2008), and both meticillin-resistant *Staphylococcus aureus* and Panton-Valentine leukocidin *S. aureus* have been associated with seasonal influenza pandemics (Roberts et al, 2008; Kearns et al, 2009; Murray et al, 2010). To the authors' knowledge this is only the second reported case of the worrying combination of Panton-Valentine leukocidin *S. aureus* and novel H1N1 influenza co-infection. This is a particular concern because both infections can be life threatening in young adults.

Panton-Valentine leukocidin *S. aureus* causes skin and soft tissue infections and rarely severe necrotizing pneumonia with a high mortality, usually affecting young people (Kearns et al, 2009). It is characterized by haemoptysis, tachycardia, tachypnoea and leukopenia. Although data are limited, co-infection with influenza is reported in 21–75% of cases (Kearns et al, 2009). UK guidelines (Health Protection Authority, 2008) advise specific therapy with immunoglobulin and toxin-inhibiting antibiotics with good lung penetration (two of clindamycin, linezolid or rifampicin).

Discussion

This case highlights two important points relevant to the current pandemic. First, the patient presented acutely with bacterial pneumonia and no prodromal illness, reinforcing the importance of excluding H1N1 co-infection even when a bacterial aetiology seems obvious. Second, on admission the patient had minimal features suggestive of Panton-Valentine leukocidin *S. aureus* pneumonia and although *S. aureus* was cultured on admission, a sputum sample taken

Dr NA Barrett *is Consultant in the Department of Critical Care,*
Dr D Armstrong-James *is Specialist Registrar in the Directorate of Infection,*
Dr J Edgeworth *is Consultant in the Directorate of Infection and* **Dr D Wyncoll** *is Consultant in the Department of Critical Care, Guy's and St Thomas' NHS Foundation Trust and King's Health Partners, London SE1 7EH*

Correspondence to: Dr NA Barrett

Figure 1. Chest radiograph on presentation to the hospital demonstrating a left lower lobe consolidation.

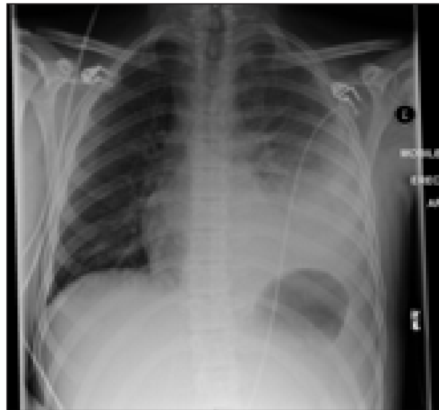
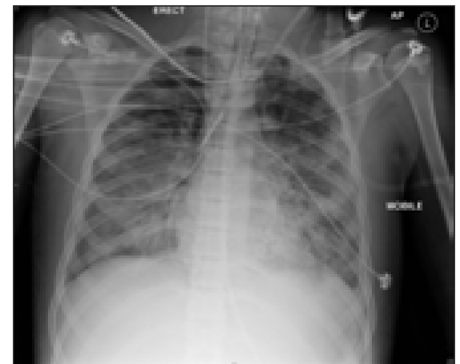


Figure 2. Chest radiograph after tracheal intubation demonstrating a widespread infiltrate consistent with adult respiratory distress syndrome.



Case Report

A 17-year-old man with no significant medical history and no prodromal symptoms presented to the emergency department with a 2-day history of left-sided pleuritic chest pain and a dry cough. His respiratory rate was 16 breaths/minute, pulse 125 beats/minute, blood pressure 113/73 mmHg, temperature 36.6°C and oxygen saturation 93% (fraction of inspired oxygen 0.21). His peripheral blood white blood cell count was $23.1x10^9$/litre and C-reactive protein was 520 mg/litre. Legionella and pneumococcal urinary antigen tests were negative. A chest radiograph (*Figure 1*) demonstrated rounded consolidation behind the heart. He was admitted for oxygen, clarithromycin and co-amoxiclav therapy.

Over 24 hours he became productive of purulent sputum and had a single pyrexial episode at 39.5°C. On the third day he rapidly deteriorated requiring transfer to the intensive therapy unit, where he progressed from conventional mechanical ventilation to high-frequency oscillatory ventilation within hours. His chest radiograph (*Figure 2*) demonstrated widespread bilateral infiltrates. He was resuscitated and received drotrecogin alfa, according to Surviving Sepsis guidelines (Dellinger et al, 2008), as he did not have haemoptysis. He developed multiple organ failure requiring haemodynamic and renal support. Empiric oseltamivir was commenced and a nasal mucosal swab tested by novel H1N1 influenza real-time reverse transcriptase polymerase chain reaction was positive. Admission blood cultures were sterile, but a sputum sample taken after one dose of co-amoxiclav grew methicillin-sensitive *Staphylococcus aureus*. All subsequent sputum cultures that day and while in the intensive therapy unit were negative.

A working diagnosis of co-infection with novel H1N1 influenza and Panton-Valentine leukocidin-producing *S. aureus* was made. Linezolid, clindamycin and intravenous immunoglobin were commenced with reference to Health Protection Authority (2008) guidance. Presence of the Panton-Valentine leukocidin (lukS-PV/lukF-PV) gene from the *S. aureus* isolate was confirmed by polymerase chain reaction at the Health Protection Authority Staphylococcal Reference Laboratory. His multiple organ failure resolved and he was converted back to conventional ventilation after 2 weeks of high-frequency oscillatory ventilation. Significant hospital and community contacts were screened for Panton-Valentine leukocidin-producing *S. aureus* and offered prophylaxis and/or advice on novel H1N1 influenza exposure. No evidence of nosocomial or inter-familial transmission of either pathogen was found.

only 6 hours later was negative by culture and Gram-stain. Given the focus on early empiric therapy of community-acquired pneumonia and frequent delay in obtaining respiratory samples, microbiological evidence to support a diagnosis of Panton-Valentine leukocidin *S. aureus* may be absent.

Conclusions

Diagnosis and institution of appropriate therapy for Panton-Valentine leukocidin *S. aureus* will require a high index of clinical suspicion during this pandemic and should be considered in the differential diagnosis of any young patient who deteriorates rapidly with pneumonia. **BJHM**

Chickering HT, Park JH (1919) *Staphylococcus aureus* pneumonia. *JAMA* **72:** 617–26

Dellinger RP, Levy MM, Carlet JM et al (2008) Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: 2008. *Crit Care Med* **36:** 296–327

Health Protection Agency (2008) *Guidance on the diagnosis and management of PVL-associated* Staphylococcus aureus *infections (PVL-SA) in England.* 2nd edn. Health Protection Agency, London (www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1218699411960 accessed 11 May 2010)

Kearns AM, Ganner M, Perry C, Cookson BD, Ellington MJ (2009) PVL-SA as a cause of CAP in England: A review of cases during 2008. Presented at the 19th European Congress of Clinical Microbiology and Infectious Diseases, Helsinki

Murray RJ, Robinson JO, White JN et al (2010) Community-acquired pneumonia due to pandemic A(H1N1) 2009 influenzavirus and methicillin resistant *Staphylococcus aureus* co-infection. *PLoS One* **5**(1): e8705

Roberts JC, Gulino SP, Peak KK, Luna VA, Sanderson R (2008) Fatal necrotizing pneumonia due to a Panton-Valentine leukocidin positive community-associated methicillin-sensitive *Staphylococcus aureus* and influenza co-infection: a case report *Ann Clin Microbiol Antimicrob* **19**(7): 5