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Radiographic features of staphylococcal pneumonia in adults and children

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Abstract

Background – Clinical and laboratory features do not accurately correlate with the cause of community acquired pneumonia. A study was performed to examine whether the radiographic features of staphylococcal pneumonia are sufficiently distinct to aid early diagnosis.

Methods – The chest radiographs of 34 patients (including eight children) with proven staphylococcal pneumonia were reviewed by two experienced observers using methods described previously. Features on presentation and follow up were noted.

Results – The most striking features were the presence of multilobar consolidation on presentation, cavitation, pneumato-coeles and spontaneous pneumothorax, together with a tendency to radiographic deterioration after admission in both adults and children. Some of these features are much less common with other causes of community acquired pneumonia. However, most of the cases did not have these classic features.

Conclusions – The presence of certain radiographic features, including multilobar shadowing, cavitation, pneumato-coeles, and spontaneous pneumothorax, are seen with staphylococcal pneumonia in adults and children, but their absence does not exclude the diagnosis.

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Keywords: staphylococcal pneumonia, radiographic changes, adults, children, diagnosis.

Staphylococcal pneumonia is an uncommon but serious infection which accounts for about 1% of community acquired pneumonias.¹ The clinical and laboratory features of different forms of community acquired infection have

been shown not to be an accurate predictor of aetiology.² Staphylococcal pneumonia is said to have characteristic radiographic features^{3,4} and, as such, these may assist early clinical identification of staphylococcal infection to allow appropriate antibiotic therapy. However, no studies have been made of the radiographic appearances of staphylococcal pneumonia since effective antibiotics became widely available which may act to modify the radiographic picture of the infection. We have previously reported on the clinical and laboratory features of 61 cases of community acquired staphylococcal pneumonia in adults⁵ and report here the radiographic findings of 34 patients, including eight children, with proven staphylococcal pneumonia.

Methods

Cases of community acquired staphylococcal pneumonia were identified from admission diagnosis records of the Trent Region and chest radiographs of 34 patients were available for study. As in our previous clinical study,⁵ the diagnosis was accepted if *Staphylococcus aureus* was isolated as a heavy growth from sputum, tracheal aspirate or from blood, pleural fluid, or necropsy lung tissue.

Available chest radiographs were reviewed by two experienced observers. Lateral views were available in many cases but infrequently provided extra information. Shadowing was recorded as mainly homogeneous or mainly patchy. Other features including pleural fluid, lobar or segmental collapse (loss of volume), cavitation and pneumato-coeles were noted. A pneumato-coele was differentiated from cavitation or abscess formation by the presence of a smooth and thin walled cystic structure, sometimes with a fluid level. A swollen lobe was recognised by an increase in the volume of the lobe, together with a displaced convex fissure.

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Table 1 Details of 34 cases of staphylococcal pneumonia including radiographic features

	Total (n=34)	Adults (n=26)	Children (n=8)
Median (range) (years)	–	49(24–76)	1 (1 month–8 years)
M:F	16:18	15:11	1:7
No. of deaths	9	9	0
Radiographic features on presentation			
Homogeneous shadowing	20	14	6
Patchy shadowing	11	10	1
Mixed picture	3	2	1
Swollen lobe	5	3	2
Single lobe involvement	14	12	2
Multilobe involvement	20	14	6
Bilateral involvement	12	9	3
Associated features			
Pleural effusion	11	7	4
Lobar/segmental collapse	6	5	1
Cavitation	9	7	2
Pneumatocoeles	7	4	3
Spontaneous pneumothorax	7	3	4
Deterioration after hospital admission	20/31*	15/24	5/7
Spread to opposite lung	6	4	2

* No follow up film on three patients.

Table 2 Comparison of radiographic findings in adult staphylococcal pneumonia with adapted data previously reported for causes of community acquired pneumonia⁸ expressed as percentages

	Staphylococcal (n=26)	Pneumococcal (n=91)	Legionella (n=49)	Mycoplasma (n=46)
Mainly homogeneous shadowing	60	74	82	50
Multilobe involvement on presentation	59	39	39	52
Radiographic deterioration after hospital admission	64	32	65	25
Associated features				
Pleural effusion	32	34	24	20
Cavitation	26	4	2	0
Lobar/segmental collapse	18	25	37	26

Results

The details of the cases studied and the chest radiographic findings are shown in table 1. Homogeneous shadowing occurred more frequently than patchy shadowing in both children and adults, with consolidation being present in more than one lobe at presentation in 75% of the children and just over half of the adults. Cavitation or abscess formation was noted in seven of the 26 adults, of whom five had multiple cavities. Pneumatocoeles were seen in three of the eight children and in four of the adults. Half of the children developed a spontaneous pneumothorax, in two cases associated with a pleural effusion or empyema. Two of the three adults who developed a pneumothorax had associated pleural effusions or an empyema.

Discussion

The most striking features noted were the presence of multilobar consolidation on presentation, cavitation, and spontaneous pneumothorax, together with a tendency to radiographic deterioration after admission. Such features have been well described in childhood staphylococcal pneumonia before⁶ but also seem to occur in adults. Pneumatocoeles were seen in 41% of cases, pneumothorax in 20%, pleural effusions in one third, and bilateral shadowing in 35%. Although pleural

effusions and progressive lung shadowing are said to be a feature of staphylococcal pneumonia, pneumatocoeles and pneumothorax are said to be uncommon⁴ and an observation of pneumatocoeles in an adult has warranted a case report.⁷ Our study shows that, although less common than in children, such features do occur in adults with staphylococcal pneumonia and, if present, they may be a useful clinical pointer to staphylococcal infection. It is possible that radiographic changes may be modified by effective antistaphylococcal antibiotics. Such agents were less available when previous reviews were published over three decades ago.^{3,4} We do not have the data to assess whether antibiotics given before admission might also have influenced the radiographic appearances seen in our series.

To assess the comparative radiographic features of staphylococcal pneumonia with those of other causes of community acquired pneumonia our results are compared with those from previous radiographic studies of community acquired pneumonia using similar methods and the same observers (table 2).⁸ Staphylococcal pneumonia shares some of the features of other bacterial pneumonias caused by *Legionella pneumophila* and *Streptococcus pneumoniae* apart from the presence of cavitation in a quarter of cases. Swollen lobes, said to be a characteristic feature of *Klebsiella* pneumonia, were seen in 12% of our cases and also occur occasionally with other causes of community acquired pneumonia. The swollen lobe probably represents only an intense inflammatory exudative response to a severe infection.

In conclusion, bilateral patchy shadowing, together with cavitation, pneumatocoeles, and spontaneous pneumothorax, were features of staphylococcal pneumonia in both adults and children and their presence may act as a pointer towards staphylococcal aetiology when compared with other causes of bacterial community acquired pneumonia. However, the absence of these findings does not exclude staphylococcal infection as most cases did not have these classic features.

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