Q Fever Pneumonia in Southwest Germany: Radiographic and Clinical Findings

Q-Fieber-Pneumonie im Südwesten Deutschlands: Radiologische und klinische Befunde

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Key words
Q fever, pneumonia, coxiella burnetii, lung infection

Results
Females and males were equally affected. The mean age was 44.9 ± 15.7 years. About half of the patients (45%) acquired their infection in the second quarter of the year. The main complaints were fever, cough and dyspnea. While the white cell blood count was in the normal range in most of the patients, the CRP value was markedly elevated. Q fever-related hepatitis was found in 63% of the patients.

Conclusion
Unilobar, unilateral, segmental opacities are the key feature of Q fever pneumonia chest radiographs. Definitive radiographic differentiation from other community-acquired pneumonias is not possible, but Q fever pneumonia should be considered in middle-aged patients with segmental opacities living in an endemic area.

ABSTRACT

Purpose Q fever is a worldwide zoonosis that causes clinical symptoms ranging from mild flu-like symptoms to severe pneumonia and/or hepatitis. This retrospective study was conducted to describe the radiographic and clinical signs in patients with acute Q fever pneumonia in Southwest Germany.

Patients and Methods
40 patients with IgM-positive Q fever-related pneumonia who were treated in the years 2006 to 2016 in our hospital were retrospectively identified. Clinical and laboratory data were analyzed. Chest radiographs were reviewed by two radiologists and interpreted using a standardized protocol.

Results
Females and males were equally affected. The mean age was 44.9 ± 15.7 years. About half of the patients (45%) acquired their infection in the second quarter of the year. The main complaints were fever, cough and dyspnea. While the white cell blood count was in the normal range in most of the patients, the CRP value was markedly elevated. Q fever-related hepatitis was found in 63% of the patients.

Air space opacification was the predominant radiographic sign and was found in 27 of the patients (82%). The typical chest radiographic pattern was a single segmental opacity. However, multiple segmental opacities and patchy opacities were also found. Lobar opacities were found in 27 of the patients (82%).

Schlussfolgerung

Einseitige, auf einen Lappen beschränkte segmentale Verschattungen sind die wichtigsten Befunde bei der Q-Fieber-Pneumonie. Da diese Veränderungen aber auch bei anderen Pneumonien auftreten können, ist eine Differenzierung anhand der Thoraxaufnahme nicht sicher möglich. Auf jeden Fall sollte aber bei jüngeren Patienten mit segmentalen Infiltraten die in einem Endemiegebiet leben an eine Q-Fieber-Pneumonie gedacht werden.

Kernaussagen

- Einseitige, auf einen Lappen beschränkte segmentale Verschattungen sind die wichtigsten Befunde bei der Q-Fieber-Pneumonie.
- Lobäre, fleckige sowie multisegmentale Verschattungen können ebenfalls auftreten.
- Die Röntgenhorax Aufnahme erlaubt nicht die Differenzierung von Q-Fieber von anderen Pneumonien.
Introduction

Q fever is a zoonosis with a worldwide distribution that is caused by the bacterium Coxiella burnetii [1]. 25 to 100 cases of Q fever are annually reported in Germany [2] with the highest incidence of the disease in the state of Baden-Württemberg in Southwest Germany. The bacteria are found in feces, urine and milk of infected animals. However, the most important route is the shedding of C. burnetii into the environment during parturition [3]. Humans are infected by the ingestion of unpasteurized milk or milk products or by the inhalation of contaminated dust. The clinical signs of acute infection range from asymptomatic infections and mild flu-like symptoms to severe pneumonia and hepatitis [4]. In 1 – 5 % of patients with acute, untreated Q fever, a chronic disease with valvular heart disease, arterial aneurysms and osteomyelitis develops [1]. About 50 % of infected patients become symptomatic [5]. The signs and symptoms of acute illness include a flu-like syndrome with fever, cough, myalgia and headaches [6]. The onset is usually abrupt. Q fever-related hepatitis is found in around 85 % of patients with an elevation of liver enzymes from 2 to 10 times normal values. There is a high regional heterogeneity in the incidence of Q fever-related hepatitis. While hepatitis is common in Southern Europe, it is infrequent in North America. Hepatitis is more common in younger patients, while pneumonia is more common in older patients [7].

The diagnosis is made using an immunofluorescence assay (IFA) or an enzyme-linked immunosorbent assay (EIA). Blood cultures are typically sterile, since C. burnetii does not grow in routine blood cultures [8]. In very early infections the antibody level might not be detectable or may be very low. In these cases PCR can be used to detect C. burnetii [8].

The reported radiologic findings in patients with Q fever pneumonia on chest radiographs or CT scans vary and the available literature is sparse [9, 10]. To our knowledge, there is no study that systematically describes the radiographic findings of Q fever pneumonia on chest radiographs in Germany.

The purpose of this study is the characterization of patients with Q fever pneumonia and analysis of the findings on chest radiographs in Southwest Germany.

Results

Patient characteristics are given in Table 1. The mean age of the patients at presentation was 44.9 years. Females (48 %) and males (52 %) were almost equally affected. Direct and close contact to animals was reported by none of the patients. Half of the patients (50 %) presented with dry cough. Headache or myalgia was present in 23 % and 15 % of patients, respectively. 23 patients (58 %) had a body temperature > 38.5 °C. 30 % of the patients complained of dyspnea. Oxygen saturation of 94 % or below was obtained in 30 % of the patients. About half of the patients (45 %) acquired their infection in the second quarter of the year. The remaining patients acquired their infection almost equally distrib-
uted in the other three quarters of the year. 25 (63 %) of the patients had Q fever-related hepatitis. The white cell count was elevated in only 7 patients (18 %). Procalcitonin was measured in 15 patients and was elevated in only 4 patients (27 %). In contrast, the levels of C-reactive protein were elevated in all 40 patients. The infection had no impact on platelet count, renal function and liver function (as determined by normal bilirubin and INR levels).

The findings in the three patients in whom initial CT scans of the thorax were performed revealed single consolidations in the left lung in all patients. In one patient there were patchy consolidations in the apex of the left lung, in one patient there were patchy consolidations paracardial, and in the third patient a segmental consolidation in the left lower lobe was seen.

Chest radiographs on admission were available in 33 of the 40 patients. Of the 33 chest radiographs, 2 were without pathological findings.

▶ Table 2 shows the distribution of the affected lobes in the 33 patients with Q fever pneumonia for whom the chest radiographs were available.

Discussion

In our paper, we describe the clinical, radiologic and laboratory findings of patients with Q fever pneumonia in Southwest Germany. Whereas three studies described a male preponderance [11 – 13], Caron et al. [14] described a male-to-female ratio of 1:3.4. In contrast to these authors, we did not find any gender-specific preponderance but rather a balanced female-to-male ratio. Our laboratory findings are consistent with the data of other groups who reported a normal white cell count in most of the patients with Q fever pneumonia [3, 8, 15] whereas the CRP values were markedly elevated in the patients. In contrast, the mean procalcitonin (PCT) levels were only slightly elevated. Unfortunately, the PCT levels were available in 16 patients only. Of these patients, two had markedly elevated PCT levels and the remaining patients had normal or almost normal PCT levels. It remains unclear why
Table 3 The table shows the radiographic pattern of 33 patients with Q fever pneumonia.

<table>
<thead>
<tr>
<th>radiographic pattern</th>
<th>patients (n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>air space opacities</td>
<td>27</td>
<td>82%</td>
</tr>
<tr>
<td>lobar</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>segmental</td>
<td>23</td>
<td>70%</td>
</tr>
<tr>
<td>patchy</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>nodular findings</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>micronodular (0.5 – 0.9 cm)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>macronodular (1.0 – 2.9 cm)</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>mass-like (≥ 3 cm)</td>
<td>3</td>
<td>9%</td>
</tr>
<tr>
<td>reticular findings</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>pleural effusion</td>
<td>4</td>
<td>12%</td>
</tr>
</tbody>
</table>

Fig. 1 Posteroanterior chest radiograph of a 22-year old man presenting with a 10-day history of fever and cough. IgM titer against C. burnetii was 306 and IgG was 207 U/ml. These findings make an infection of more than two weeks likely. The radiograph shows a pleural effusion that was later diagnosed as pleural emphysema and a mass-like lesion in the right middle lobe.


Fig. 2 Chest radiograph of a 64-year-old man presenting with fever and cough. IgM titer against C. burnetii was > 500. The posteroanterior view shows a segmental opacity in the lingula.

Abb. 2 Röntgenthorax eines 64-jährigen Mannes der sich mit Fieber und Husten vorstellte. Der IgM Titer gegen C. burnetii war > 500. Die posterior-anteriore Ansicht zeigt eine segmentale Verschattung in der Lingula.

Fig. 3 Chest radiograph of a 32-year-old woman presenting with fever, myalgia and headache. IgM titer against C. burnetii was > 500. The posteroanterior view shows patchy infiltrates in all five lobes.

Abb. 3 Röntgen-Thorax einer 32-jährigen Frau, die sich mit Fieber, Myalgien und Kopfschmerzen vorstellte. Der IgM Titer gegen C. burnetii war > 500. Die posterior-anteriore Ansicht zeigt fleckige Infiltrate in allen fünf Lappen.
Q fever – in contrast to other bacterial pneumonias – is not associated with an increase in the white cell count and PCT in most patients. Hence, we conclude that PCT and the white cell count are not valuable markers in the diagnosis of Q fever pneumonia. In addition, and in line with a large retrospective study from the Netherlands [15], we did not find an abnormal platelet count nor did we find an abnormal creatinine level. As expected, more than half of our patients had elevated liver enzymes as an indicator of Q fever-related hepatitis. This is described by several other authors [3, 14, 16, 17]. The presence of elevated liver enzymes in patients with acute Q fever shows a regional heterogeneity with a high percentage in southern Europe and a low percentage in North America. Our results are strengthened by the results of the retrospective analysis from the Netherlands [15] that compared patients with Q fever pneumonia to patients with pneumonia from other pathogens. Even though they found elevated liver enzymes in both groups, liver enzymes were significantly higher in the Q fever group than in the control group.

The radiographic findings in our patients were not specific for Q fever pneumonia. Unilateral, single segmental opacities were the most common findings. The lower lobes were more affected than the upper lobes. The mostly unilateral, segmental pattern was also shown by other studies [9, 18 – 20] and seems to be the typical but not unique pattern of Q fever pneumonia. Two of the three studies [18, 20] described the lower lobes to be more often affected than the upper lobes, which is congruent with our findings. In contrast to the above mentioned studies, Millar et al. [10] found multiple round opacities and linear atelectasis in 68% and 50% of the patients, respectively.

Previous studies [9, 19] described the radiographic changes in Q fever pneumonia as slowly resolving, compared to other pneumonias. As our study was retrospective, systematic follow-up chest radiographs of the patients were not available. Nevertheless, the available follow-up chest radiographs of some of the patients did support these findings.

In conclusion, the radiographic findings in our study did not allow the definite differentiation of Q fever pneumonia from other community-acquired pneumonias. Segmental and/or lobar opacities are seen in both entities. However, in young to middle-aged patients with segmental opacities living in an endemic area, the differential diagnosis should include Q fever pneumonia and initiate the appropriate diagnostic workup.

**Summary**

Patients with acute Q fever pneumonia usually present with cough, fever and myalgia. Typical laboratory findings are a normal white blood cell and a high CRP level. About two-thirds of the patients have Q fever-related pneumonia. Unilobar, unilateral, segmental opacities are the common findings of chest radiographs in Q fever pneumonia. However, patchy and lobar infiltrates are also found in some patients. In young to middle-aged patients with segmental opacities living in an endemic area, the differential diagnosis should include Q fever pneumonia and the appropriate diagnostic workup should be initiated.

**References**

