ERS TASK FORCE REPORT

Guidelines for management of adult community-acquired lower respiratory tract infections

European Study on Community-acquired Pneumonia (ESOCAP) Committee

Chairmen: G. Huchon1, M. Woodhead2

Members of ESOCAP study group: G. Gialdroni-Grassi3, P. Léophonte4, F. Manresa5, T. Schaberg6, A. Torres7

Other members of ESOCAP committee: A. Didier4, J. Dorca5, M. El Ebiary7, N. Roche1

The following guidelines are based on a systematic analysis of the literature which has been discussed by members of the ESOCAP committee and by external reviewers. The literature review and detailed methods of guideline development will be published in the European Respiratory Review, along with the list of external reviewers.

Initial clinical assessment and decision on hospital referral

The management of a community-acquired lower respiratory tract infection (LRTI) should follow a systematic step-by-step process (fig. 1), beginning with a detailed history and clinical examination. Attempts to identify the type of LRTI (pneumonia, acute bronchitis, superinfection of chronic bronchitis, or viral infection) are probably unhelpful outside hospital, since several studies have demonstrated that the sensitivity and specificity of clinical signs and symptoms are low for establishing such a classification. Therefore, the main goal of initial clinical evaluation is to determine whether the patient can be managed at home or whether there is evidence that suggests potential or immediate severity, or that the illness will follow a complicated course (table 1, fig. 2). All these features will guide the decision on hospital referral and admission (fig. 2).

Suggested questions for the management of a community-acquired LRTI

<table>
<thead>
<tr>
<th>Where to treat?</th>
<th>How to treat?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should hospital referral be considered? (table 1, fig. 2)</td>
<td>Should hospital admission be considered? (table 1, fig. 2)</td>
</tr>
<tr>
<td>Should ICU admission be considered? (table 3)</td>
<td>What investigations are required? (table 2, fig. 4)</td>
</tr>
<tr>
<td>Should antibiotics be considered? (fig. 5)</td>
<td>Which antibiotics should be considered? (fig. 3, 5 and 6)</td>
</tr>
<tr>
<td>How to assess response to antibiotic therapy and what investigations in case of non-response? (fig. 5, 6 and 7)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. – Suggested questions to be answered when managing a community-acquired lower respiratory tract infection (LRTI). ICU: intensive care unit.

1 Université de Paris René-Descartes, Service de Pneumologie, Hôpital Ambroise Paré, Boulogne, France. 2 Manchester Royal Infirmary, Manchester, UK. 3 Cattedra di Chemioterapia Università di Pavia, Pavia, Italy. 4 Université de Toulouse, Service de Pneumologie, Hôpital Rangueil, Toulouse, France. 5 Servei De Pneumologia, Hospital de Bellvitge, L'Hospitalet de Lloretgat, Barcelona, Spain. 6 Lungenchirurgie, Krankenhaus Zehlendorf, Berlin, Germany. 7 Servei de Pneumologia i Allèrgia Respiratòria, Hospital Clinic, Departament de Medicine, Universitat de Barcelona, Barcelona, Spain.

Correspondence: G. Huchon, Service de Pneumologie, Hôpital Ambroise Paré, 9 avenue Charles de Gaulle, F-92104 Boulogne, France. Fax: 33 1 49095806.

Endorsed by the Executive Committee of the ERS on December 7 1997

Received: January 21 1998

Accepted after revision January 28 1998
Most adults with LRTI in the community can be managed with no investigations. Investigations that are indicated in particular cases are shown in table 2.

### Table 1. – Risk factors for pneumonia occurrence, severity and particular micro-organisms in community-acquired lower respiratory tract infections

<table>
<thead>
<tr>
<th>Risk factor*</th>
<th>Micro-organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt;65 yrs</td>
<td>Streptococcus pneumoniae</td>
</tr>
<tr>
<td>Institutionalized patients</td>
<td>S. pneumoniae, S. aureus</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>S. pneumoniae, Staphylococcus aureus</td>
</tr>
<tr>
<td>Co-morbidity</td>
<td>S. pneumoniae, Haemophilus influenzae</td>
</tr>
<tr>
<td>COPD, cardio-vascular disease, neurological diseases, diabetes mellitus, chronic liver or renal failure, recent viral infection</td>
<td>S. pneumoniae, S. aureus, Anaerobes</td>
</tr>
<tr>
<td>Hospital admission</td>
<td>Gram-negative enteric bacilli</td>
</tr>
<tr>
<td>Within the previous year</td>
<td>S. pneumoniae, (especially penicillin-resistant strains in some areas)</td>
</tr>
<tr>
<td>Within the previous 2–4 weeks</td>
<td>S. pneumoniae, (especially penicillin-resistant strains in some areas), resistant micro-organisms</td>
</tr>
<tr>
<td>Recent treatment with penicillin or other antibiotics</td>
<td>Gram-negative bacilli</td>
</tr>
<tr>
<td>Aspiration</td>
<td>S. aureus, anaerobes</td>
</tr>
</tbody>
</table>

*: all these conditions also increase the risk of occurrence and severity of the disease. COPD: chronic obstructive pulmonary disease.

### Clinical criteria for hospital referral of a community-acquired LRTI

- **Risk factors for severity**
  - Failure of first-line antibiotic therapy
  - Signs of immediate severity: home consultation, chest pain, confusion, drowsiness, cardiac frequency \( \geq 125 \text{ beats} \cdot \text{min}^{-1} \), temperature \( <35^\circ\text{C} \) or \( \geq 40^\circ\text{C} \), respiratory frequency \( \geq 30 \text{ breaths} \cdot \text{min}^{-1} \), cyanosis, blood pressure \( <90/60 \text{ mmHg} \)

- **Complication**: suspected pleural effusion or cavitation, metastatic infection

- **Home management appears impossible**: vomiting, social exclusion, extreme poverty, dependency, poor likelihood of good compliance, altered mental status

### Biological and radiological criteria for hospital management of a community-acquired LRTI

- Leukopenia (\(<4,000 \text{ WBC} \cdot \text{mL}^{-1}\)) or severe leucocytosis (\(>20,000 \text{ WBC} \cdot \text{mL}^{-1}\))
- Anaemia (haemoglobin \(<9 \text{ g} \cdot 100 \text{ mL}^{-1}\))
- Renal impairment (serum urea \(>7 \text{ mM} \) or \(20 \text{ mg} \cdot \text{dL}^{-1}\), creatinine \(>1.2 \text{ mg} \cdot \text{dL}^{-1}\))
- \(P_AO_2 <60 \text{ mmHg}\) or \(P_ACO_2 >50 \text{ mmHg}\) while breathing room air
- Acidosis (pH <7.3)
- Coagulation abnormalities suggesting disseminated intravascular coagulation
- Increase in thromboplastin and prothrombin times, thrombocytopenia, presence of fibrin split products
- Multilobar involvement or pleural effusion or cavitation on chest radiograph.

### Treatment

#### Therapeutic indications

In many adults with LRTI, the illness is self-limiting and its course will not be modified by antibiotic therapy. In addition, many LRTIs are due to viruses. Thus, such treatment should be considered only in patients with features suggesting the presence or risk factors of bacterial infection that is not self-limiting. These

### Home management

#### Investigations

Most adults with LRTI in the community can be managed with no investigations. Investigations that are indicated in particular cases are shown in table 2.
Table 2. – Investigations in community-acquired lower respiratory tract infections

<table>
<thead>
<tr>
<th></th>
<th>Chest radiograph</th>
<th>Microbiological examination of sputum</th>
<th>Blood white cell count, CRP blood cultures, serology, detection of pneumococcal and Legionella antigens</th>
<th>Pulmonary function testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient with no risk factors of severity or of unusual micro-organisms</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Risk factors for potential severity (see table 1)</td>
<td>NR</td>
<td>TBC</td>
<td>TBC</td>
<td>NR</td>
</tr>
<tr>
<td>Risk factors for unusual micro-organisms (see table 1)</td>
<td>NR</td>
<td>R</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Failure of first time empirical therapy</td>
<td>R</td>
<td>R</td>
<td>TBC</td>
<td>TBC</td>
</tr>
<tr>
<td>Focal chest signs</td>
<td>R</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Wheeze, atopy</td>
<td>NR</td>
<td>NR</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

CRP: C-reactive protein; NR: not recommended; R: recommended; TBC: to be considered.

Antibiotics in community-acquired LRTIs managed at home (see text for the indications for antibiotic treatment)

First choice*  
Aminopenicillin

Alternatives*
Tetracycline, oral cephalosporin, 3rd generation quinolones, oral streptogramins, macrolide

Particular cases
Nonsevere diseases in young adults, especially at time of *Mycoplasma pneumoniae* epidemic
High frequency beta-lactamase-producing *Haemophilus influenzae* in the area. Chronic lung disease, recent treatment or failure of aminopenicillin

Usual practice is to treat for 5–7 days*

Fig. 3. – Choice of antibiotics and duration of treatment in home-managed community-acquired lower respiratory tract infections (LRTIs). Third generation quinolones. *e.g.*, sparfloxacin, trovafloxacin. *°*: choice of first line strategy should depend on local resistances of micro-organisms, patient's allergies and costs and side-effect profiles of antibiotics. *°*: patients should be told to return to the general practitioner if fever does not resolve within 48 h. They should also be told that cough may last longer than the duration of antibiotic treatment.

Investigations in community-acquired LRTIs managed in the hospital

Routine
Chest radiograph (postero-anterior in all patients, lateral if postero-anterior is normal and CAP is suspected)
Peripheral blood white cell count, serum biochemistry (sodium, potassium, glucose, urea, creatinine)
Arterial blood gases or pulse oximetry ± sputum sampling

Clinical criteria of immediate severity
Thromboplastin and prothrombin time, fibrin split products, platelet count
Arterial blood gases
Sputum sampling

Temperature >38°C or CAP
Two serial blood cultures
Serology for atypical agents, detection of pneumococcal antigen in sputum or urine and *L. pneumophila* antigen in urine

Severe LRTI under mechanical ventilation (CAP, exacerbation of chronic bronchitis)
Endotracheal aspirate fibrocopic bronchoscopy:
Protected specimen brush
Detection of pneumococcal and *L. pneumophila* antigens
BAL if opportunistic agents are suspected

Pleural effusion
Pleural fluid examination

Fig. 4. – Investigations in community-acquired lower respiratory tract infection (LRTIs) managed in the hospital. *°*: sputum sampling should be performed after mouth-washing. Results of Gram-stain should be considered only when there are >25 polymorphonuclear cells and <10 squamous epithelial cells per high power field. Results of culture should be considered only when there is a pure culture of a single microbial agent or when a micro-organism is present in an amount greater than 107 cells/mL. *°*: cost-effective only in patients with underlying risks (table 1). *°*: if available. *°* for Gram-stain and quantitative culture. *°*: *Legionella pneumophila* antigen detection is indicated only in patients with pneumonia. *°*: pleural fluid examination: biochemistry (pH, proteins, glucose, and lactate dehydrogenase if available), microbiology (Gram-stain, culture, pneumococcal antigen detection if available). CAP: community-acquired pneumonia; BAL: bronchoalveolar lavage.
features include suspected pneumonia, and superinfection of chronic bronchitis in the presence of increased dyspnoea, sputum volume and sputum purulence.

**Choice of antibiotics.** Antibiotic therapy should always be active against *Streptococcus pneumoniae*, which is the most frequently encountered pathogen. Other frequent microorganisms are *Mycoplasma pneumoniae*, *Moraxella catarrhalis* and *Haemophilus influenzae*, whereas *Staphylococcus aureus*, *Legionella pneumophila* and Gram-negative enteric bacilli, are very rare. The role of *Chlamydia pneumoniae* remains to be determined. Based on these data, recommended antibiotics are shown in figure 3.

**Duration of antibiotic therapy.** The recommended duration of antibiotic therapy is 5–7 days.

### Hospital management

#### Investigations

In hospitalized patients, investigations are needed to ensure that treatment is adequate, and to look for additional criteria of severity (fig. 4).

**Criteria for admission to the intensive care unit**

Persistence or worsening of at least one of the conditions shown in table 3 justifies consideration of admission of the patient to an intensive care unit.

**Treatment and assessment of response**

The initial decision to give antibiotics and their choice depends on the clinical situation and on results of chest radiography and microbiological investigations (figs. 5 and 6). This decision and choice may be modified according to risk factors of particular micro-organisms (table 1) and have to be reconsidered after the results of microbiological examinations.

**Pneumonia.** Antibiotics are recommended in all patients with pneumonia. The most frequent pathogens are *S. pneumoniae, H. influenzae*, anaerobes, *L. pneumophila*, Gram-negative enteric bacilli, *S. aureus*, *C. pneumoniae* and *M. pneumoniae*. In patients admitted to the intensive care unit *S. pneumoniae* and *L. pneumophila* are the leading causes of severe pneumonia. The clinical presentation cannot accurately predict the microbiological aetiology.

Recommended antibiotics are shown in figure 6. The duration of treatment should be: 7–10 days in classical bacterial infection or uncomplicated community-acquired pneumonia (CAP); 10–14 days in suspected or proven *M. pneumoniae* or *C. pneumoniae* infection; and 21 days in suspected or proven *L. pneumophila* or *S. aureus* infection or severe CAP. The route of administration should be switched from i.v. to oral when fever has resolved and clinical condition is stable.

Assessment of response and investigations in nonresponding patients. The main criterion of response to antibiotic therapy is body temperature; fever should resolve within 2–3 days after initiation of antibiotic treatment. Progression of pulmonary infiltrates is also predictive of poor outcome in severe CAP.

In nonresponding patients, investigations, as shown in figure 7, should be considered.

**Exacerbation of chronic bronchitis.** Indications for antibiotics. When the exacerbation is due to a bacterial infection, the most frequent pathogens are *H. influenzae*, *S. pneumoniae* and *M. catarrhalis*. Gram-negative bacilli, *S. aureus*, *C. pneumoniae* and *M. pneumoniae* are less frequently involved. Antibiotics are recommended in all patients with severe chronic obstructive pulmonary disease (COPD) exacerbations, and in nonsevere exacerbations when there is increased purulence of sputum and increased sputum volume and increased dyspnoea; valuable alternative regimens are described in figure 5.

Duration of antibiotic treatment. Antibiotics (except clari-thromycin and azithromycin) should be administered for at least 7 days. Treatment should last 21 days when infection with *L. pneumophila* is suspected.

Assessment of response and investigations in nonresponding patients. Symptoms of exacerbation should resolve

### Table 3. – Intensive care unit (ICU) admission

<table>
<thead>
<tr>
<th>Severe respiratory failure</th>
<th>Respiratory frequency &gt;30 breaths·min⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>P</em>&lt;sub&gt;O₂&lt;/sub&gt;/F&lt;sub&gt;İO₂&lt;/sub&gt; &lt;250 mmHg (&lt;200 mmHg if COPD)</td>
<td></td>
</tr>
<tr>
<td>Need of mechanical ventilation</td>
<td></td>
</tr>
<tr>
<td>Radiographic spread of pneumonia (increase in size of opacity by 50% or greater within 48 h of admission)</td>
<td></td>
</tr>
<tr>
<td>Severe haemodynamic instability:</td>
<td></td>
</tr>
<tr>
<td>Systolic blood pressure &lt;90 mmHg or diastolic &lt;60 mmHg</td>
<td></td>
</tr>
<tr>
<td>Need of vasoactive drugs for more than 4 h</td>
<td></td>
</tr>
<tr>
<td>Urine output &lt;20 mL·h⁻¹ (in absence of hypovolaemia)</td>
<td></td>
</tr>
<tr>
<td>Metabolic or haematologic criteria</td>
<td></td>
</tr>
<tr>
<td>Severe acidosis (pH &lt;7.30)</td>
<td></td>
</tr>
<tr>
<td>Severe disseminated intravascular coagulation</td>
<td></td>
</tr>
<tr>
<td>Acute renal failure requiring dialysis</td>
<td></td>
</tr>
<tr>
<td>Other severe organ failures</td>
<td></td>
</tr>
</tbody>
</table>

*P*<sub>O₂</sub>: arterial oxygen tension; *F*<sub>O₂</sub>: inspiratory oxygen fraction; COPD: chronic obstructive pulmonary disease. 1 mmHg = 0.133 kPa.
Antibiotics in community-acquired LRTIs managed in the hospital

**Pneumonia**

- Beta-lactam (e.g. amoxycillin 500–1,000 mg·8 h⁻¹ orally)
- Or beta-lactam + betalactamase inhibitor* (e.g. amoxycillin + clavulanate 1 g·8 h⁻¹ orally)
- Or new macrolide° (e.g. oral azithromycin 500 mg·24 h⁻¹ for 3 days or 500 mg at day 1 then 250 mg·24 h⁻¹ for 5 days, or oral clarithromycin 250–500 mg·12 h⁻¹ for at least 5 days)
- Or second generation fluoroquinolone (e.g. ciprofloxacin 500 mg·12 h⁻¹ or ofloxacin 400 mg·12 h⁻¹ orally)
- Or Cefuroxime axetil° (750 mg·12 h⁻¹ orally)
- Or doxycyclin° (100 mg·12 h⁻¹ orally)

**Exacerbation of chronic bronchitis**

- If severe condition or purulent sputum

**Acute bronchitis**

- Suspected influenza

If onset of symptoms <48 h before assessment

- Consider amantadine (100 mg·12 h⁻¹ for 5 days)

**Antibiotics in community-acquired pneumonia managed in the hospital**

- Medical ward
- Particular cases
- Intensive care unit

**First choices**

Second generation cephalosporin (e.g. i.v. cefuroxime 750–1500 mg·8 h⁻¹)
- or
- Third generation cephalosporin (e.g. i.v. cefotaxime 1 g·8 h⁻¹ or i.v. ceftriaxone 1 g·24 h⁻¹)
- or
- Betalactam-betalactamase inhibitor (e.g. oral or i.v. amoxycillin-clavulanate 1 g·8 h⁻¹)
- or
- i.v. benzyl penicillin 1–4×10⁶ units every 2–4 h or i.v. amoxicillin 1 g·6 h⁻¹ or i.v. ampicillin 1 g·6 h⁻¹

**Second generation quinolone** (e.g. ofloxacine, ciprofloxacine) OR
- Third generation quinolone (e.g. trovafloxacine, sparfloxacine)

**Pulmonary abscess**

- Cavitated pneumonia or suspicion of aspiration
- i.v. amoxycillin-clavulanate 2 g·6 h⁻¹

**Second or third generation cephalosporin** (e.g. i.v. cefotaxime 2 g·8 h⁻¹ i.v. ceftriaxone 2 g·24 h⁻¹)
- And
- Second generation quinolone (ofloxacine ciprofloxacine) or macrolide (i.v. erythromycin 1 g·6 h⁻¹)
- Or
- i.v. rifampicin (600 mg·12 h⁻¹)

Assess response at day 2–3 (fever, lack of progression of pulmonary infiltrates)

Fig. 5. — Choice of antibiotics, duration of treatment and assessment of response in community-acquired lower respiratory tract infection (LRTI) managed in the hospital (except community acquired pneumonia; see figure 6). *: only in areas where the frequency of betalactamase-producing *H. influenzae* is low; °: in areas with low rates of resistant *S. pneumoniae*.

Fig. 6. — Choice of antibiotics and assessment of response in community-acquired pneumonia managed in the hospital. *: only in areas where the frequency of betalactamase-producing *H. influenzae* is low.
within 5–7 days after initiation of antibiotics. In nonresponding patients, bronchoscopy with protected specimen brush for Gram stain and quantitative culture should be considered.

**Acute bronchitis or influenza.** Hospitalized patients are those with an unstable underlying condition which puts them at risk of severity. Indications of antibiotics and amantadine are shown in figure 5.

### Prevention

Table 4 summarizes the indications for preventive measures, based on their proven efficacy.