SERIOUS PNEUMONONIAS

Pathogenicity
Virulence
Resistance
Inoculum

PATHOGEN ↔ HOST

Defences
Mechanical in situ
Aspecific cells
Specific cells

Inflammatory Reaction
In situ
Widespread

* Harmful effect at the end of aplasia or at immunity reappearance
SERIOUS ACUTE COMMUNITY-ACQUIRED PNEUMONIAS

1. DEFINITION: « PNEUMONIAS »

- Sudden or rapid onset
- Infectious syndrome with fever
- Respiratory symptoms
  + impression of seriousness
- Objective signs of lung tissue damage:
  - Focus of cracking rales
  - Recent appearance of opacities/opacity
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

Diagnostic difficulties in the elderly

<table>
<thead>
<tr>
<th>Major signs / symptoms</th>
<th>Detailed Anamnagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>20.8 %</td>
</tr>
<tr>
<td>Cough</td>
<td>22.9 %</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>12.5 %</td>
</tr>
<tr>
<td>Weakness</td>
<td>14.6 %</td>
</tr>
<tr>
<td>Thoracic pains</td>
<td>4.2 %</td>
</tr>
<tr>
<td>Anorexia</td>
<td>6.2 %</td>
</tr>
<tr>
<td>Asthenia</td>
<td>4.2 %</td>
</tr>
<tr>
<td>Falls</td>
<td>2.1 %</td>
</tr>
<tr>
<td>Confusion</td>
<td>0 %</td>
</tr>
</tbody>
</table>

SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONONIAS

1. DEFINITION = « COMMUNITY-ACQUIRED »

- Contamination in the community
- N.B.:  
  - Patients living in an old people’s home
  - Out-patients medically followed
  - Recently hospitalized patients
  - Patients with chronic obstructive bronchopulmonary disease
  - Patients with undiagnosed immunosuppression
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

1. DEFINITION = « SERIOUS »

- Very severe pneumonia
  . Signs of seriousness
  . Organ failure
  . Hemodynamic trouble
  . Mechanical ventilation
- Potentially serious pneumonia
  . Inhalation/bronchial obstacle
  . Associated diseases
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

2. IMPORTANCE OF THE SITUATION (USA DATA)

- 6th cause of death
- 1st cause of death of infectious origin
- 5.1% mortality in outpatients
- 13.6% mortality in hospitalized patients
- 36.5% mortality in intensive care unit
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

3. WHERE THEY MUST BE TREATED

One sign of seriousness = immediate hospitalization

- Damaged vital functions
  - Systolic blood pressure < 90 mm Hg
  - Pulse rate > 125/mn
  - Respiratory frequency > 30/mn
- Troubled consciousness
- Temperature < 35° C or > 40° C
- Inhalation or bronchial obstacle

AFSSAPS 2005
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

3. WHERE THEY MUST BE TREATED

Presence of two associated diseases = hospitalisation

- Age > 65 years
- Congestive cardiac failure
- Cerebrovascular disease
- Renal disease
- Hepatic disease
- Uncontrolled diabetes mellitus
- Chronic respiratory insufficiency
- Immunosuppression
- Hospitalisation within one year
- Patients living in an old people’s home

AFSSAPS 2005
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

3. WHERE THEY MUST BE TREATED

Biological signs of seriousness included in the PSI

- Leucopenia < 4000/ml
- Hyperleucocytosis > 30 000/ml
- Blood urea > 7 mmol/l
- PaO₂ < 60 mm Hg in AA
- PaCO₂ > 50 mm Hg in AA
- Bilateral radiologic opacities
  or > 2 lobes

FINE 2000 (PSI = Pneumonia Severity Index)
### SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

#### 3. WHERE THEY MUST BE TREATED

Values of PSI in order to avoid hospitalisation

<table>
<thead>
<tr>
<th>Class</th>
<th>(Points)</th>
<th>Mortality</th>
<th>Hospitalisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>(≤ 40-50)</td>
<td>0.1 – 0.4 %</td>
<td>Unnecessary</td>
</tr>
<tr>
<td>II</td>
<td>(≤ 70)</td>
<td>0.6 – 0.7 %</td>
<td>Unnecessary</td>
</tr>
<tr>
<td>III</td>
<td>(71-90)</td>
<td>0.9 – 2.8 %</td>
<td>STH*</td>
</tr>
<tr>
<td>IV</td>
<td>(91-130)</td>
<td>8.2 – 9.3 %</td>
<td>Hospitalisation</td>
</tr>
<tr>
<td>V</td>
<td>(≥ 131)</td>
<td>27 – 31.1 %</td>
<td>Hospitalisation</td>
</tr>
</tbody>
</table>

BARTLETT. J (IDSA) 2000  
*STH = Short-term hospitalisation
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

3. WHERE THEY MUST BE TREATED

Use of 2001 ATS criteria for admission to intensive care unit

1. Two among four minor criteria on admission
   - Respiratory frequency $\geq 30$/mn
   - $\text{PaO}_2 / \text{FiO}_2 < 250$
   - Bilateral or multilobar opacities
   - $\text{SAP} \leq 90 \text{ mmHg or DAP} \leq 60 \text{ mmHg}$

Or

2. One among four major criteria on admission or during stay
   - Need for mechanical ventilation
   - Need for vasopressive drugs for more than 4 hours
   - Diuresis $< 80 \text{ ml/4 h}$ or creatinine $> 2 \text{ mg/dl}$
   - Radiological spreading $\geq 50\%$ within 48 hours

ATS. AJRCCM 2001
**ACUTE COMMUNITY-ACQUIRED PNEUMONIAS:**

### WHERE THEY MUST BE TREATED

Scores that help the decision

<table>
<thead>
<tr>
<th>CURB 65 simplified</th>
<th>CURB 65</th>
<th>SMART-COP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 65 years</td>
<td>+ 1</td>
<td>SAP &lt; 90</td>
</tr>
<tr>
<td>SAP &lt; 90 mmHg</td>
<td>+ 1</td>
<td>NR ≥ 30*</td>
</tr>
<tr>
<td>NR ≥ 30/mn</td>
<td>+ 1</td>
<td>Confusion</td>
</tr>
<tr>
<td>Confusion</td>
<td>+ 1</td>
<td>NC ≥ 125</td>
</tr>
<tr>
<td>Urea &gt; 7</td>
<td>+ 1</td>
<td>PaO2 &lt; 70 *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Albuminemia &lt; 35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pH &lt; 7.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multilobar opacities</td>
</tr>
</tbody>
</table>

- Emergency if ≥ 1
- Hosp if ≥ 2
- ICU if ≥ 5

* Or ≥ 25 if age < 50  
• Or < 60 if age < 50
### 4. TREATMENT TARGET

Pathogen Epidemiology of ACAP in Intensive Care Unit

<table>
<thead>
<tr>
<th>Authors</th>
<th>WOODHEAD (N = 50)</th>
<th>LEROY (N = 39)</th>
<th>MARIE (N = 129)</th>
<th>TORRES (N = 92)</th>
<th>MOINE (N = 132)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>82 %</td>
<td>74 %</td>
<td>65 %</td>
<td>52 %</td>
<td>72 %</td>
</tr>
<tr>
<td>S. Pneumoniae</td>
<td>39 %</td>
<td>50 %</td>
<td>18 %</td>
<td>29 %</td>
<td>41 %</td>
</tr>
<tr>
<td>Legionella spp.</td>
<td>37 %</td>
<td>3 %</td>
<td>-</td>
<td>27 %</td>
<td>4 %</td>
</tr>
<tr>
<td>Mycoplasma p.</td>
<td>2 %</td>
<td>6 %</td>
<td>-</td>
<td>13 %</td>
<td>1 %</td>
</tr>
<tr>
<td>Chlamydiae spp.</td>
<td>-</td>
<td>9 %</td>
<td>-</td>
<td>-</td>
<td>1 %</td>
</tr>
<tr>
<td>Virus</td>
<td>5 %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7 %</td>
</tr>
</tbody>
</table>
### 4. TREATMENT TARGET

#### Pathogen Epidemiology of ACAP in Intensive Care Unit

<table>
<thead>
<tr>
<th>Author</th>
<th>WOODHEAD (N = 50)</th>
<th>LEROY (N = 30)</th>
<th>MARIE (N = 129)</th>
<th>TORRES (N = 92)</th>
<th>MOINE (N = 132)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S. Aureus</strong></td>
<td>12 %</td>
<td>9 %</td>
<td>13 %</td>
<td>2 %</td>
<td>5 %</td>
</tr>
<tr>
<td><strong>Hemophilus spp</strong></td>
<td>15 %</td>
<td>9 %</td>
<td>-</td>
<td>13 %</td>
<td>-</td>
</tr>
<tr>
<td><strong>Other G (-) B</strong></td>
<td>-</td>
<td>3 %</td>
<td>4 %</td>
<td>19 %</td>
<td>13 %</td>
</tr>
<tr>
<td><strong>M. Tuberculosis</strong></td>
<td>2 %</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>2 %</td>
<td>6 %</td>
<td>4 %</td>
<td>10 %</td>
<td>15 %</td>
</tr>
<tr>
<td><strong>Mixed</strong></td>
<td>-</td>
<td>-</td>
<td>24 %</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

4. TREATMENT TARGET

Pathogen Epidemiology of ACAP in Old People’s Home

- Higher incidence : associated diseases
  swallowing dysfunction; decrease in immunity.

- Human to human transmission epidemics or environmental infection.
  (virosis, tuberculosis, legionellosis).

- Resistant bacterial emergence
  (From and to old people’s home hospital).
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

4. TREATMENT TARGET

Diagnostic Implications of Clinical Data

- Associated diseases
- Hemoptysis ----------------------------- > Staphylococcus/BK
- Purulent sputum ---------------------- > Staphylococcus/G (-) B
- Fetid sputum ------------------------- > Anaerobic pathogens
- Extrapulmonary localizations
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

4. TREATMENT TARGET

Diagnostic Implications of Radiological Results

- Isolated lobar consolidation ------ > Pneumococcus
- Multiple consolidations -------------- > Atypical pathogens
- Consolidation(s) with excavation ------- > Staphylococcus/G - B /anaerobes
- Alveolar diffused opacities ----------- > Pneumocystis
- Miliary opacities ---------------------- > M. Tuberculosis
Legionella Pneumophyla
Klebsiella P.
Pneumocystis J.
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

4. TREATMENT TARGET

Diagnostic Contributions of Other Investigations

- Blood cell counts, CRP, Procalcitonine
- Sputum examination
- Blood cultures
- Pleural liquid sample examination
- Legionella antigen urinary research
- Pneumococcus antigen urinary research
- Immunofluorescence / viral PCR
- Transthoracic puncture with a fine needle
- Fiberoptic bronchoscopy, PDP BAL (cytology, pathogen research)
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

4. TREATMENT TARGET

Diagnostic Value and Limits of Microbiological Analysis

**Value:**
- Prognostic value of suitable initial antibiotherapy
- Decreased mortality in case of microbiologically documented pneumonia

**Limits:**
- Need for sampling within 4-6 hours
- Decreased yield after previous antibiotherapy
- Dangerous procedure if acute respiratory insufficiency?

SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

5. HOW TO TREAT?

Treatment Principles

- Adapted symptomatic treatment (SpO2 > 90%)
- Presumed antibiotherapy as an emergency within 4-6 hours after admission
- Necessity of combination of antibiotics taking into account extra- and intracellular pathogens (bi-therapy)
- Systematic reevaluation (clinically and bacteriologically) on the third day of antibiotherapy.
# SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIASES

## 5. HOW TO TREAT?

*Recommendations from Bichat-Claude Bernard 1997*

Usual Hospitalisation

<table>
<thead>
<tr>
<th>Patients</th>
<th>Extracellular Pathogens</th>
<th>Intracellular Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Adults</td>
<td>Amoxicillin i.v. (1-2/g x3d) +</td>
<td>Erythromycin i.v. (1g x3/d) or Fluoroquinolone</td>
</tr>
<tr>
<td>Patients with comorbidity</td>
<td>Ceftriaxone i.v. (1-2 g/d) + Cefotaxime (1 g x3/d)</td>
<td>Macrolide</td>
</tr>
<tr>
<td>Inhalation and/or Abcess</td>
<td>Amoxicillin – Clavulanic Acid i.v (1-1.5 g x 4/d)</td>
<td></td>
</tr>
</tbody>
</table>
Serious Community-Acquired Acute Pneumonias

5. How to Treat?

International Recommendations

<table>
<thead>
<tr>
<th>Sources</th>
<th>Extracellular Pathogens</th>
<th>Intracellular Pathogens</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATS 1993</td>
<td>C₃G, Imipenen or Cifloz</td>
<td>+</td>
</tr>
<tr>
<td>BTS 1993</td>
<td>C₂G or C₃G</td>
<td>+</td>
</tr>
<tr>
<td>IDSA 1998</td>
<td>Cefotaxime or Ceftriaxone</td>
<td>+</td>
</tr>
<tr>
<td>or Amoxicillin – Clav. Acid</td>
<td>or β Lactamine effective on Pseudomonas in patients at risk</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Macrolide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Erythromycin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Macrolide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or Quinolone</td>
</tr>
</tbody>
</table>
### 5. HOW TO TREAT?

**Recommendations of the 2006 Consensus Conference (Intensive Care Units)**

<table>
<thead>
<tr>
<th>Patients</th>
<th>Extracellular Infection</th>
<th>Intracellular Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Adults</td>
<td>Cefotaxime (1-2 g x 3/d) + or Ceftriaxone (1-2 g/d) i.v.</td>
<td>Macrolide i.v. or Fluoroquinolone i.v.</td>
</tr>
<tr>
<td>Elderly patients or comorbidities</td>
<td>Cefotaxime i.v. + or Ceftriaxone i.v.</td>
<td>Fluoroquinolone i.v.</td>
</tr>
<tr>
<td>Elderly patients or comorbidities + β-lactamine in prior 30 days</td>
<td>Piperacillin-Tazobactam (4 g x 3/d) i.v. or Imipeneme (1 g x 3/d) i.v. + Aminoside</td>
<td>Macrolide i.v. or Fluoroquinolone i.v.</td>
</tr>
</tbody>
</table>
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

5. HOW TO TREAT?

Treatment Principles

- Retrospective adaptation of antibiotherapy according to microbiological data (restricting spectrum of efficacy)
- Strict dosages (IMC adapted) and strict rhythm of injections (time-dependent β-Lactamines)
- Strict durations of antibiotherapies (which of them?)
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

6. WHAT PATIENT COURSES

Criteria of « recovery » available at 48 – 72 hours

- Decrease in temperature curve
- No spreading of opacities
- Stabilization of hemodynamic situation
- Stabilization of ventilatory status
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

6. WHAT PATIENT COURSES?

Situations of Failure in the Course

- Worsening of respiratory condition with signs of sepsis
- Worsening of respiratory condition without signs of sepsis
6. WHAT PATIENT COURSES?

In case of worsening of respiratory condition with signs of sepsis:

hypotheses to consider

1) Are there other localizations of initial bacterial infection that need specific treatment (pleural effusion, pericarditis, sinusitis, endocarditis…) ?

2) Is the prescribed antibiotherapy adapted to the causal bacteria (spectrum, resistance, treatment modalities... ) ?

3) Is there an associated nosocomial infection ?
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

6. WHAT DISEASE COURSES?

Worsening of respiratory condition with signs of sepsis:
Assessment must be made

- Clinical examination including ear, nose & throat
- Thoracic imaging
- Sinus imaging
- Cardiac echography
- Bacterial samplings
  (before antibiotic change)
M SIN, 57 Years Old, 02/02/03
Pneumococcus-induced septic shock
Persistent Fever at Day 4
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

6. WHAT IS THE DISEASE COURSE?

Worsening of respiratory condition without sepsis

1) Is there a non-infectious pneumonitis?
   (hypersensitivity, drug side effects, systemic collagen disease)
   (eosinophilic or fibrosing pneumonitis) ?

2) Is there an unusual bacterial pneumonia?
   (Pneumocystosis, Tuberculosis, emerging virosis) ?

3) Is there an additional respiratory disease?
   (Nosocomial infection, pulmonary edema, embolism, atelectasia) ?
   (Drug-induced pneumonitis) ?
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

6. WHAT IS THE DISEASE COURSE?

Worsening of respiratory condition with no sign of sepsis: 
Assessment must be made

- Clinical examination
- Blood cell count, CRP, PCT
- Cardiac evaluation
- Renal evaluation
- Coagulation evaluation
- (Angiography) Thoracic CT scan
- Fiberoptic bronchoscopy + PDP + BAL
EOSINOPHILIC PNEUMONITIS (CIIIG)
SERIOUS COMMUNITY-ACQUIRED ACUTE PNEUMONIAS

6. WHAT IS THE DISEASE COURSE?

1) Does a post-pneumonia fibro-proliferative phase exist leading to an organized pneumonia?

2) Is there any need for a postponed corticosteroid therapy? If so, what are the criteria for it? (Radio-clinical data + BAL, or open-lung biopsy)