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XXVIII CONGRESSO NAZIONALE SIMRI

Il respiro: scienza e terapia per la salute del bambino



Torino, 10-12 ottobre 2024



**Azienda
Ospedaliero
Universitaria
delle Marche**



QUANDO E COME DIMETTERE DALL'OSPEDALE: GESTIONE GENERALE E FOLLOW-UP

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Dichiarazione di assenza di conflitto d'interesse
-
affidamento incarico di collaborazione/consulenza

Il sottoscritto **Romagnoli Vittorio** Dirigente Medico S.O.D di Pediatria - Presidio Ospedaliero ad Alta Specializzazione «G. Salesi» - AOU delle Marche

Vista l'allegata normativa in materia, qui richiamata, sulle situazioni anche potenziali, di conflitto d'interesse

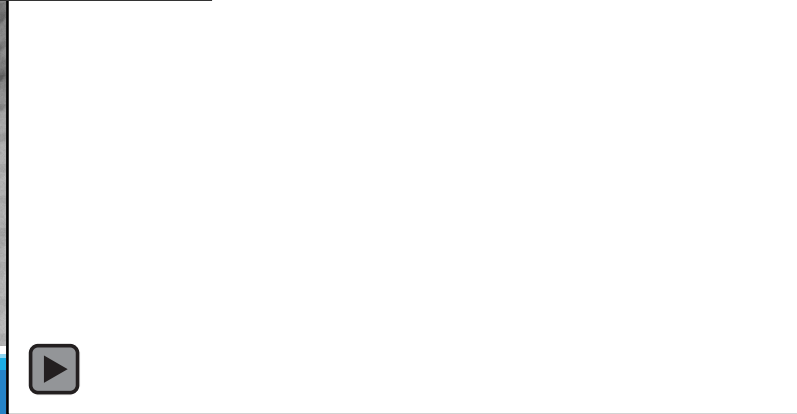
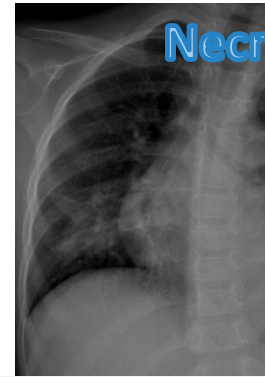
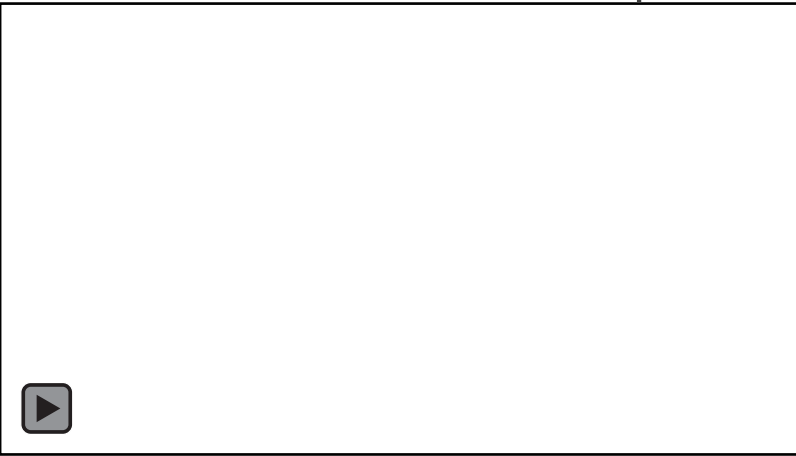
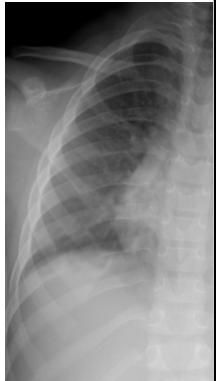
DICHIARA

Ai sensi e per gli effetti dell'art. 53, comma 14, del D.Lgs. n. 165/2001 e s.m.e.i, consapevole che chiunque rilascia dichiarazioni mendaci è punito ai sensi del Codice Penale e delle Leggi speciali in materia, per proprio conto l'insussistenza di situazioni, anche potenziali, di conflitto di interesse.

Complicated community-acquired pneumonia (CCAP)

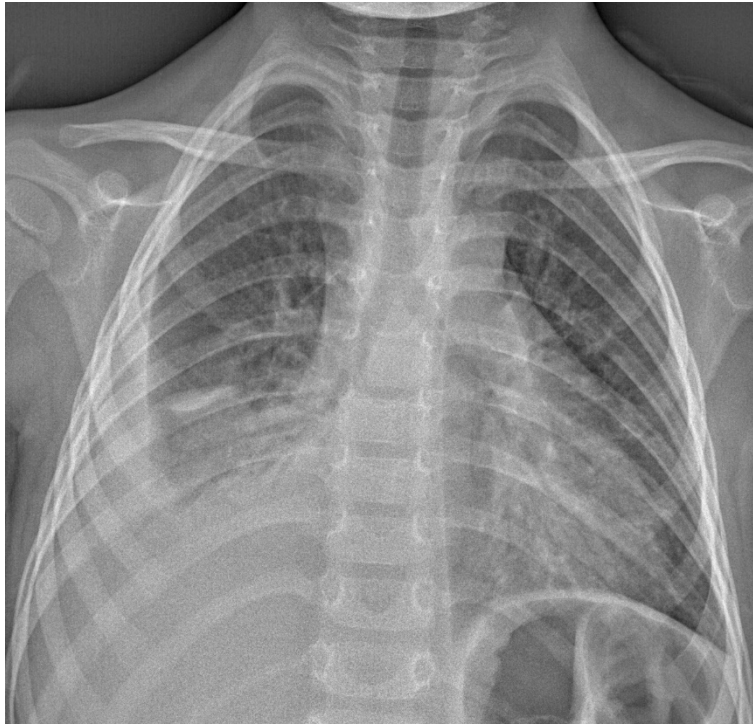
Complicated community-acquired pneumonia (CCAP) consists of one or more of parapneumonic effusion, empyema, necrotising pneumonia, and lung abscess, the local complications of

community-acquired pneumonia (CAP)



International survey on the management of CAP complicated by pleural empyema

A previously well, fully immunised 3-year-old girl presents with community-acquired pneumonia...

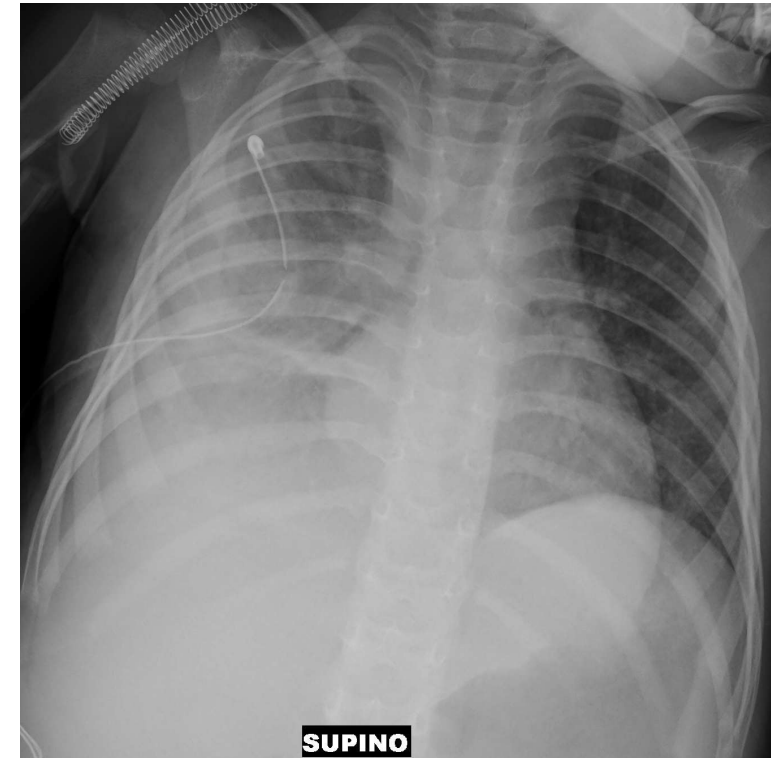


Ward case (moderately unwell)

- Fever, tachypnoea, tachycardia
- Hypoxic, requiring 2 L/min low-flow oxygen via nasal prongs
- Right lower lobe pneumonia with effusion on examination and chest X-ray
- Leukocytosis, neutrophilia, CRP > 100 mg/L, procalcitonin >2 ng/mL, not bacteraemic
- Procedural intervention on day 2 of admission (VATS or chest tube ± fibrinolysis not specified)

ICU case (critically ill)

- Fever, respiratory failure, septic shock
- Fluid resuscitation, pressors, intubation, near-maximal respiratory support (ECMO considered)
- Right-sided 'white-out' with a large effusion and possible early cavitation on chest X-ray
- Leukopenia, neutropenia, CRP > 100 mg/L, procalcitonin >2 ng/mL
- Bacteraemia (organism not specified)
- No evidence of extra-pulmonary septic foci
- Chest tube in ICU – Drainage of copious pus



International survey on the management of CAP complicated by pleural empyema

†Ward case: Day 5, 24 h post-chest tube removal, last fever or oxygen requirement; ICU case: Day 7, 48 h post-chest tube removal, intermittent low-grade fever, 0.5 L/min oxygen requirement.

Table 4 Intravenous-to-oral switch and duration of antibiotic therapy

	Ward (n = 183), n (%)	ICU (n = 169), n (%)	P
Intravenous-to-oral switch†			
Entire course IV			
At least 2 weeks IV			
Switch when WBC/CRP normal			
Switch now			
Stop all antibiotics			



International survey on the management of CAP complicated by pleural empyema

‡Ward case: Day 10, continuing clinical improvement, normal inflammatory markers;
ICU case: Day 14, continuing clinical improvement, near-normal inflammatory markers. No reference to causative organism

Table 4 Intravenous-to-oral switch and duration of antibiotic therapy

	Ward (n = 183), n (%)	ICU (n = 169), n (%)	P
Total antibiotic duration, days‡			
14			
21			
28			
42			



Three main questions

Choice and duration of oral ATBs

Follow-up

(clinical and radiological)

Shift from i.v. to os

(and hospital discharge)

2

1

3

Pediatric guidelines on Pleural Effusions and Empyema

BTS GUIDELINES

BTS guidelines for the management of pleural infection in children

I M Balfour-Lynn, E Abrahamson, G Cohen, J Hartley, S King, D Parikh, D Spencer, A H Thomson, D Urquhart, on behalf of the Paediatric Pleural Diseases Subcommittee of the BTS Standards of Care Committee



Thorax 2005;60(Suppl 1):i1-i21. doi: 10.1136/thx.2004.030676

Journal of Pediatric Surgery (2012) 47, 2101-2110



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Journal of
Pediatric
Surgery

www.elsevier.com/locate/jpedisurg

Review Articles

The diagnosis and management of empyema in children: a comprehensive review from the APSA Outcomes and Clinical Trials Committee



Paediatric Empyema Thoracis: Recommendations for Management

Position statement from the Thoracic Society of Australia and New Zealand.

ESPID REPORTS AND REVIEWS

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Current Management of Pediatric Parapneumonic Pleural Effusions and Pleural Empyema

EDITORS

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Current Management of Pediatric Parapneumonic Pleural Effusions and Pleural Empyema

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Empyema question 3: Shift from i.v. to os (and hospital discharge)



Continue with intravenous antibiotics until the child is afebrile or at least until the chest drain is removed



Intravenous antibiotics can be changed to oral antibiotics once a child has been afebrile for 24 hours - Once a patient has no oxygen requirement and has been on oral antibiotics for 24 hours then he/she can be discharged

Table 1. Comparison between early and later video-assisted thoracoscopic surgery (VATS)

Characteristics	Group 1 Mean (range)	Group 2 Mean (range)	<i>p</i> Value
Operative time (min)	78 (50–120)	104 (55–150)	0.03
Oxygen therapy (days)	2.1 (0–6)	3.2 (1–10)	> 0.05
Time to afebrile status (days)	4.2 (0–20)	5.4 (1–11)	> 0.05
Duration of drainage (days)	5.3 (3–13)	9.4 (3–34)	> 0.05
Antibiotherapy (days)	14.5 (6–23)	22.8 (4–56)	> 0.05

Empyema question 3: Shift from i.v. to os (and hospital discharge)



Continue with intravenous antibiotics until the child is afebrile or at least until the chest drain is removed



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TABLE 2. Characteristics of Hospitalization and Follow-up

Parameters	Missing Data (n)	Cohort (n = 136)	Conservative Treatment (n = 117)	Drainage (n = 19)	Difference	95% CI*	P†
Hospitalization characteristics							
Hospitalization, n (%)	0	105 (77.2%)	86 (73.5%)	19 (100%)	26.5%	18.5%–34.5%	0.011
hLOS (days), median (IQR)	36	7 (4–16)	5 (4–12)	19 (15–24)	14.0	–	<0.001
Duration IV antibiotics (days), median (IQR)	0	12 (4–16)	8 (4–14)	22 (14–32)	14.0	–	<0.001

Empyema question 2: Choice and duration of oral ATBs



Oral antibiotics such as co-amoxiclav are given at discharge for 1–4 weeks, but longer if there is residual disease



No consensus on the length of oral antibiotic treatment which varies from at least 1 to 6 weeks. Common choices include co-amoxiclav or a cephalosporin



Continue therapy for 2 to 4 weeks ... expert recommendation is to continue treatment for approximately 10 days after fever resolution

Empyema question 1:

Follow-up (clinical and radiological)

Prognosis is generally good, fatal cases are rare (0.7%) and most children will completely recover.

Children should be **followed up** until they have recovered completely and chest X-ray is normal.

Follow up within **4–6 weeks** of discharge, with timing depending on the child's clinical status at discharge.



Clinical examination will inevitably reveal quiet breath sounds and a degree of dullness over the affected area, but this is due to pleural thickening and is not a cause for concern.



Chest X-ray will be abnormal at discharge and a follow up chest X-ray should be done at 4–6 weeks.



This will not be normal in most instances despite complete clinical recovery with most chest X-ray will return to normal by 3–6 months with some residual thickening till 6 months after discharge.

Timing of further fup depends on whether the child is back to full health (almost all will be by 4 weeks) and radiographic appearance.

In severe cases, LUS and PFT to evaluate residual effusion, diaphragm movement and lung function.

Empyema question 1:

Follow-up (*clinical and radiological*)

Underlying diagnoses—i.e., immunodeficiency, cystic fibrosis—may need to be considered



It has been recommended that tests of immune function should be carried out in all children at follow up as previously undiagnosed abnormalities have been revealed.



However, a well grown child who has had no previous significant bacterial infections is unlikely to have a significant immunodeficiency, so testing should be reserved for selected cases.



In children with very severe cases and complications such as lung abscess or necrotizing pneumonia, an underlying condition as immunodeficiency should be ruled out.



It is prudent to carry out a sweat test to exclude cystic fibrosis when *S. Aureus* or *P. Aeruginosa* was the infecting organism, especially in infants and young children.

Three main questions

Empyema

Choice and duration of oral ATBs

Oral antibiotics are given at discharge for **1–6 weeks**

Common choices include **co-amoxiclav** or a cephalosporin

Follow-up

(clinical and radiological)

Follow up within 4–6 weeks of discharge

Most chest radiographs will return to normal by **3–6 months**

Underlying diagnoses—i.e., immunodeficiency, cystic fibrosis—may need to be considered

Shift from i.v. to os

(and hospital discharge)

afebrile for 24 hours, the chest drain removed

no oxygen requirement and oral antibiotics for 24 hours

1 to 3 weeks

2

1

3

Three main questions

Necrotising pneumonia

Choice and duration of oral ATBs

Follow-up

(clinical and radiological)

Shift from i.v. to os

(and hospital discharge)

2

1

3

Necrotising pneumonia question 3 & 2: Shift from i.v. to os (and hospital discharge) Choice and duration of oral ATBs

High rate of resolution after conservative clinical treatment with high doses of i.v. antibiotics

- If bacteria have not been identified, antibiotic therapy should cover pneumococci and staphylococci, and **amoxicillin + clavulanic acid** would be a good choice, but does depend on local data.
- When NP is caused by *S. aureus* PVL+, early aggressive empiric antibiotic therapy with a toxin-suppressing agent is essential (protein synthesis inhibiting antibiotics such as clindamycin or linezolid, vancomycin used for MRSA does not reduce toxin production).

Retrospective studies report that **antibiotics are often administered for prolonged periods**, ranging from 21 to 42 days.

The average length:

- **intravenous antibiotics ranges from 14 to 19 days**
- **oral antibiotics are generally prescribed for around 21 days after i.v. therapy is stopped**

Necrotising pneumonia question 1: Follow-up (clinical and radiological)

Clinical outcomes

Despite the severe acute illness, patients tend to have a good outcome.

- Chest asymmetry (31 %) and a decrease in respiratory sounds (45 %) one month after hospitalization disappeared by 6 months – no long-term effects on growth, development, or exercise capacity.
- 12.5% had sporadic episodes of wheezing after NP
- 12.5% presented with new uncomplicated pneumonia but did not require hospitalization

Necrotising pneumonia question 1: Follow-up (clinical and radiological)

Imaging findings

327 patients were included in 13 studies which evaluated 239 children for a period of 1 to 6 months.

The **necrotic areas disappeared within 3 to 6 months** (median 3 months, range 1–8).

- 73 % complete or almost complete resolution
- 15 % minimal residual lesions – i.e. 3.7% small pneumothoraces after discharge resolved within 2 months
- 5 % necrosis

Residual fibrous bands and atelectasis may persist for 1 to 3.5 years, the clinical impact of residual pleural thickening and parenchymal abnormalities is poorly understood.

The radiographic resolution of cystic areas must be documented to resolve a potential differential diagnosis of congenital cystic lung malformations and to follow the size and possible consequences of large pneumatoceles.

Necrotising pneumonia question 1: Follow-up (clinical and radiological)

Lung function

Only 3 studies have evaluated long-term lung function in 72 children with NP.

- 24 patients despite chest drainage or pneumothorax/fistula: 4% FVC at the lower limit of normal
- 36 patients with lung parenchymal resection for NP, 40 % functional impairment in spirometry (3.5 years after surgery)
- 12 patients, 25% mild obstructive disease, 8% mild restrictive defect.

Three main questions Necrotising pneumonia

Choice and duration of oral ATBs

oral antibiotics generally
prescribed for around **21 days**
after i.v. therapy

common choices include **co-
amoxiclav**

Follow-up

(clinical and radiological)

clinical changes: up to 6 months

imaging necrotic areas: 3 to 6
months

lung function: rare, mild,
especially after surgery

Shift from i.v. to os

(and hospital discharge)

intravenous antibiotics ranges
from **14 to 19 days**

2

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Three main questions

Lung abscess

Choice and duration of oral ATBs

Follow-up

(clinical and radiological)

Shift from i.v. to os

(and hospital discharge)

2

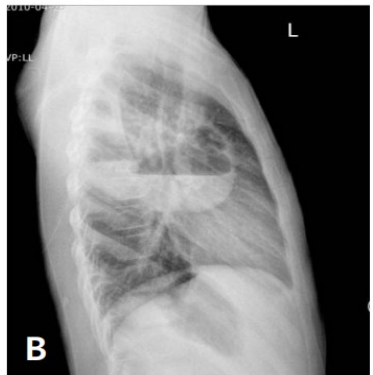
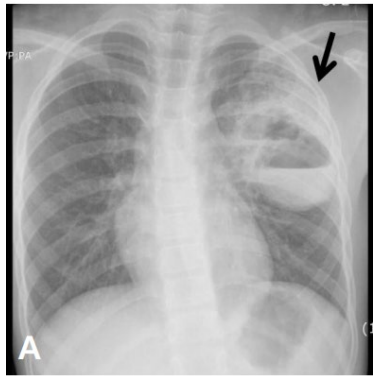
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Lung abscess question 3 & 2:

Shift from i.v. to os (and hospital discharge)

Choice and duration of oral ATBs



Retrospective review: 39 patients with lung abscess (30 treated with medical therapy alone, 9 also required surgical interventions) included

- **Fever duration:** Medical **11 days** VS Surgical **28 days**
- **Length of IV treatment:** **24.6 days** (range 3 to 51 days)

Retrospective review: 49 cases were complicated with lung abscess.

- **Median total duration of antibiotic treatment was 41.5 days** (range 15 to 116)
- Most frequently used antibiotics: 3rd generation **cephalosporins**, vancomycin, clindamycin, carbapenems and **amoxicillin with clavulanic acid**

Lung abscess question 1: Follow-up (clinical and radiological)

Retrospective review: 49 cases were complicated with lung abscess.

- **Time to radiological abnormality regression: (mean ± SD) 84.14 ± 51.57 days**
- Follow up (61.6 ± 28.3 months, response rate 30.6%)
- **Lung ultrasound** revealed in 73.3% minor residual abnormalities: pleural thickening, subpleural consolidations and line B artefacts
- **PFT** results were abnormal in eight 53.3% patients, most frequently hyperinflation

Retrospective cohort study: 68 patients with lung abscess

- 14,7% persistent radiological changes
(e.g., lung scarring, pleural thickening, persistent lung collapse or impaired aeration)
- 8,8 % bronchopleural fistula
- 2,9 % newly diagnosed bronchiectasis

Three main questions

Lung abscess

Choice and duration of oral ATBs

oral antibiotics at least **21 days**
after i.v. therapy

common choices include **co-
amoxiclav**

Follow-up

(clinical and radiological)

Time to **radiological** abnormality
regression: 84.14 ± 51.57 days

Lung ultrasound & PFT minor
residual abnormalities

Higher rate of **complications**

Shift from i.v. to os

(and hospital discharge)

Length of IV treatment 24.6 days

2

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*Grazie per l'attenzione ...
domande ?*



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