

## PNEUMONIA

### (PNEUMONIA AND BRONCHIOLITIS - LOWER RESPIRATORY TRACT - LRTI)

See also Neonates - Respiratory Distress (p.271) and WCC over 40,000 per cmm (p.386).

As in other parts of the world, epidemics of bronchiolitis caused by respiratory syncytial virus (RSV) occur in PNG. Very high carriage rates of respiratory pathogens in PNG children appear to contribute to the high incidence of secondary bacterial pneumonia in children with bronchiolitis.

Symptoms and signs of bronchiolitis and pneumonia are similar and the two illnesses are classified together as lower respiratory tract infections (LRTI) and in most cases are treated the same.

### SUMMARY

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|---------------------------|--|
| Mild pneumonia:           | <ul style="list-style-type: none"><li>• fast breathing (over 40/min) with no chest indrawing</li><li>• outpatient amoxicillin 3 times daily for 5 days</li></ul>   |
| Moderate pneumonia:       | <ul style="list-style-type: none"><li>• chest indrawing</li><li>• inpatient benzyl penicillin IM 6 hourly</li></ul>  |
| Severe pneumonia:         | <ul style="list-style-type: none"><li>• chest indrawing, with cyanosis or not able to drink</li><li>• inpatient chloramphenicol 6 hourly for 10-14 days, oxygen if cyanosed, digoxin for heart failure</li></ul>   |
| Staphylococcal pneumonia: | <ul style="list-style-type: none"><li>• IV cloxacillin, then oral cloxacillin 4-6weeks</li></ul>   |
| Persistent pneumonia:     | <ul style="list-style-type: none"><li>• trial of cotrimoxazole (trimethoprim 5 mg/kg QID) for 1-2 weeks (give for 3 weeks if responds)</li><li>• trial of erythromycin for 1-2 weeks (give for 3 weeks if responds)</li><li>• trial of TB therapy.</li></ul> |

Pneumonia is the commonest cause of death and the commonest cause of admission of children in Papua New Guinea. Most deaths from pneumonia occur in infants less than 12 months old. Worldwide, about 4 million children die from pneumonia every year.

Most cases of pneumonia in children are due to *Haemophilus influenzae* or *Streptococcus pneumoniae* or both. *H influenzae* is only moderately sensitive to benzyl penicillin, and pneumococci are becoming increasingly resistant to penicillin in many countries. However, amoxicillin and penicillin in large enough doses will usually cure children with mild or moderate pneumonia. Children with severe pneumonia should be treated with chloramphenicol, which has been shown to be just as effective as giving chloramphenicol and penicillin together. Chloramphenicol is active against haemophilus and pneumococcus. Ampicillin, tetracycline, aminoglycosides and cephalosporins should NOT be used routinely as the initial treatment of pneumonia. However, doctors should be aware that chloramphenicol-resistant *Haemophilus influenzae* has now been clearly documented in Papua New Guinea.

### DIAGNOSIS

In young children, pneumonia is diagnosed by WATCHING THE CHILD BREATHE. This is usually far more informative than auscultation and percussion. There are three important rules:

1. COUGH AND NORMAL BREATHING: NO ANTIBIOTIC
2. COUGH AND FAST BREATHING (OVER 40/MIN): GIVE AN ANTIBIOTIC
3. COUGH AND CHEST INDRAWING: ADMIT TO HOSPITAL.

### PNEUMONIA OR BRONCHIOLITIS - GUIDELINES

For children **1 month to 5 years** of age

Neonates (0-1 month) with fast breathing or chest indrawing: see Neonates - Infection (Neonatal Sepsis), p.251 and Neonates - Respiratory Distress, p.271.

Feature	Pneumonia		
	Mild	Moderate	Severe
Fast breathing (more than 40/min)	Yes	Yes	Yes
Chest indrawing present	No	Yes	Yes
1. Pulse more than 160/min with large liver, OR 2. Too sick to suck, OR 3. Cyanosis or restless	No	No	Yes
Admit or not?	No	Yes	Yes
Initial antibiotic	Amoxycillin	Crystapen IM 6/24	Chloramphenicol IM 6/24
Antibiotic when improved	Amoxycillin	Amoxycillin 6/24	Chloramphenicol oral
Total course duration	5 days	10 days	14 days
Other treatment	Nil	Suction PRN	<ul style="list-style-type: none"> <li>• Lanoxin oral</li> <li>• nasal oxygen</li> <li>• suction</li> <li>• ?N/G feeds</li> </ul>
Malaria treatment	Treatment A	Treatment A	Treatment B
Review frequency	Daily	6 hourly	Every hour
Check on review for	<ul style="list-style-type: none"> <li>• chest indrawing</li> </ul>	<ul style="list-style-type: none"> <li>• pulse rate</li> <li>• liver size</li> <li>• cyanosis</li> <li>• able to suck</li> </ul>	<ul style="list-style-type: none"> <li>• cyanosis</li> <li>• clear airway</li> <li>• fever resolution</li> </ul>

**CHECK THE CHILD WITH MILD PNEUMONIA EVERY DAY  
- IF CHEST INDRAWING - ADMIT.**

**BEWARE OF THE CHILD WHO HAS MENINGITIS AS WELL AS PNEUMONIA.** The two diseases often go together. Do a lumbar puncture on any child with pneumonia who is drowsy, not feeding well, or has a stiff neck or bulging fontanelle, unless they are extremely ill (see p.223).

### **The definition of fast breathing**

There has been much controversy over the definition of fast breathing in young children. Current WHO guidelines indicate that below 2 months of age, a respiratory rate of more than 60/min is abnormal, from 2 months to 11 months above 50, and above 12 months above 40 is abnormal. If 50/min is taken, some infants with pneumonia will be excluded from treatment. If 40 is taken some children without pneumonia will be treated. In Papua New Guinea, it has been decided to stick to the long used cut off of 40/min. Electronic timers have been provided to health workers to enable them to count respiratory rate. The main benefit of these is that they do remind the health worker that looking at the child and assessing his respiratory rate is the key to diagnosing pneumonia. Interestingly, it has been shown that if the mother perceives that her child is breathing fast, the child is highly likely to have pneumonia.

## **TREATMENT**

### **Mild pneumonia**

Mild pneumonia is defined as cough and fast breathing (over breaths 40/min), with no chest indrawing. Give outpatient treatment with amoxycillin 3 times daily for 5 days.

## **Moderate pneumonia**

Moderate pneumonia is defined as cough and chest indrawing (intercostal or subcostal retraction), with no cyanosis and drinking well. Admit the child, and give benzyl penicillin IM 6 hourly until improvement occurs. Then give amoxycillin 3 times daily for 5-10 days.

## **Severe pneumonia**

This is defined as cough and chest indrawing with cyanosis or restlessness, inability to drink, or signs of heart failure. Admit the child.

### ***Antibiotic***

Give chloramphenicol IM or IV 6 hourly until improvement occurs, then chloramphenicol orally 6 hourly. A total of 10-14 days' chloramphenicol is usually needed.

### ***Oxygen***

Give oxygen if the child is cyanosed or very restless. Oxygen can be administered satisfactorily either by nasopharyngeal catheter or by nasal prongs. For nasopharyngeal administration put an 8 FG catheter into the nose to a depth equal to the distance from the side of the nose (ala nasi) to the front of the ear (tragus), and give 1 litre/min of oxygen. Do not push the catheter in too far, and do not give more than 1 litre/min of oxygen. The oxygen should be humidified using a bubble humidifier. The catheter should be removed and cleaned every day, and the water in the humidifier should be changed twice a week.

Nasal prongs are more difficult to obtain, but are effective and more convenient than nasopharyngeal catheters. The availability of pulse oximeters in some hospitals may facilitate rational use of oxygen, but their limitations should be understood. Recommendations concerning the oxygen saturations at which therapy should be instituted vary, and decisions will, to some extent, depend on the availability of oxygen - but a saturation of less than 90% in air would generally be an indication for oxygen therapy.

### ***Digoxin***

Give digoxin if the child has tachycardia at rest (a pulse over 160/min) and hepatomegaly (if liver is more than 2 cm below the costal margin).

### ***Other***

Give a transfusion of packed cells (and a dose of frusemide) if the Hb is 6 g/dl or less.  
Give antimalarials if you are in a malarious area.

## **Very severe pneumonia**

If there is very marked indrawing and cyanosis particularly if the child has recently had measles, consider staphylococcal pneumonia. In malnourished children, consider the possibility of gram negative pneumonia.

Staphylococcal pneumonia is suggested by finding pneumotocoeles, empyema or pyopneumothorax on chest x-ray (but both Haemophilus and pneumococcus can cause this). Take blood cultures if available, and if there is an effusion do a diagnostic tap (after explaining that the child is extremely ill and why you are doing the tap). Give IV benzyl penicillin, cloxacillin and gentamicin initially and then change to oral cloxacillin, to be continued for 4-6 WEEKS, when the child has improved. Oral probenecid increases serum levels of cloxacillin.

Children with gram negative pneumonia should be treated with ampicillin/amoxycillin and gentamicin for a minimum of 2 weeks.

Sudden deterioration may be due to a pneumothorax.

Children with severe pneumonia and a WCC over 40,000/cmm have a very high mortality (PNG Med J 22:55-8,1979). Consider giving IV benzyl penicillin in high doses plus gentamicin.

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## **PNEUMONIA - PROLONGED**

This is defined as pneumonia persisting despite 2 weeks of antibiotic in adequate doses. Exclude bronchiolitis and asthma (wheeze). Check that the treatment prescribed has actually been given.

### **SUSPECT**

1. tuberculosis if there is a family history, failure to thrive or a pleural effusion
2. foreign body if the child is aged 1 to 5 years and there is a history of aspiration, wheeze, stridor or haemoptysis
3. primary cardiac failure if there is a murmur or a large heart (exclude pericardial effusion) with a high JVP, hepatomegaly or tachycardia
4. staphylococcal pneumonia if there are pneumatoceles, a lung abscess or an empyema
5. chlamydia trachomatis, chlamydia pneumoniae, mycoplasma, ureaplasma and pneumocystis have all been shown to cause pneumonia in children. Chlamydia, mycoplasma, and ureaplasma are sensitive to erythromycin. Pneumocystis and chlamydia are sensitive to cotrimoxazole, although treatment of pneumocystis pneumonia needs high doses of cotrimoxazole. All these organisms cause a similar non-specific clinical picture with tachypnoea, crepitations, hyperinflation and diffuse patchy chest x-ray change. Fever and wheeze are uncommon. With the increasing prevalence of HIV infection, doctors can expect to see an increasing prevalence of pneumocystis pneumonia.

### **MANAGEMENT**

Do progress chest x-rays, a Mantoux (5u PPD), and three gastric aspirates. Take blood and pharyngeal aspirate for culture.

#### **RECORD THE RESTING RESPIRATORY RATE EACH DAY.**

If a foreign body, heart failure and staphylococcal pneumonia are unlikely:

1. Give erythromycin 0.5 ml/kg (maximum 10 ml) orally 6 hourly. If there has been improvement after 1 week of erythromycin, continue it for another 2 weeks (a total of 3 weeks).
2. If there has been no improvement with erythromycin, give cotrimoxazole in high dose (trimethoprim 20 mg/kg/day in 3-4 divided doses). If there has been improvement after 1 week of cotrimoxazole, continue it for another 2 weeks (a total of 3 weeks). High doses of cotrimoxazole may cause megaloblastic anaemia or cyanosis due to methaemoglobinaemia; both resolve if the drug is stopped.
3. If there is still no improvement after erythromycin and cotrimoxazole, start TB treatment (In some instances, eg strong contact history, it would be reasonable to start TB treatment earlier).

## **PNEUMOTHORAX**

In neonates, this is often due to meconium aspiration. In older children, it is often due to staphylococcal pneumonia, foreign body or tracheostomy.

1. The classical signs of pneumothorax are sudden deterioration of clinical state with tachypnoea and cyanosis. Examination may show mediastinal shift, resonant percussion, reduced breath sounds, and amphoric breathing if there is a fistula into the pleural cavity. However, these signs are often absent in neonates and infants.
2. In staphylococcal pneumonia, pneumothorax should be differentiated from lung cyst. Do NOT insert a chest drain into a lung cyst.
3. A small pneumothorax without respiratory embarrassment does NOT need to be drained. Observe the child closely, and try to prevent excessive crying.
4. If there is a large pneumothorax causing respiratory embarrassment, give oxygen by nasopharyngeal catheter at 2 litre/min (oxygen helps reabsorption of the pneumothorax) and try to confirm the diagnosis by chest x-ray. Then insert an underwater seal pleural drain.
5. If the child is too sick to wait for an x-ray, a needle thoracocentesis should be performed. A large "over the needle" plastic cannula is fitted onto a 10 or 20 ml syringe. It is then inserted into the chest just above the rib into the third to fifth intercostal space in the mid-axillary line on the affected side, with gentle aspiration applied. If a pneumothorax is present, air will be easily aspirated as the needle enters the pleural cavity. The needle is removed and the cannula secured in place. The cannula can be left open until an underwater seal pleural is inserted (Note: the cannula may become occluded and a tension pneumothorax may reaccumulate).

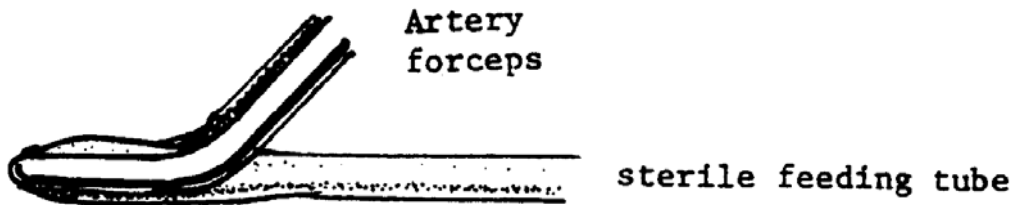
## **TEMPORARY UNDERWATER SEAL DRAIN**

In some situations (eg a neonate with a tension pneumothorax), a temporary underwater seal pleural drain can be easily set up using a large bore plastic cannula and an inverted intravenous giving set with the venous end attached to the plastic cannula and the flask end in a container of water below the patient

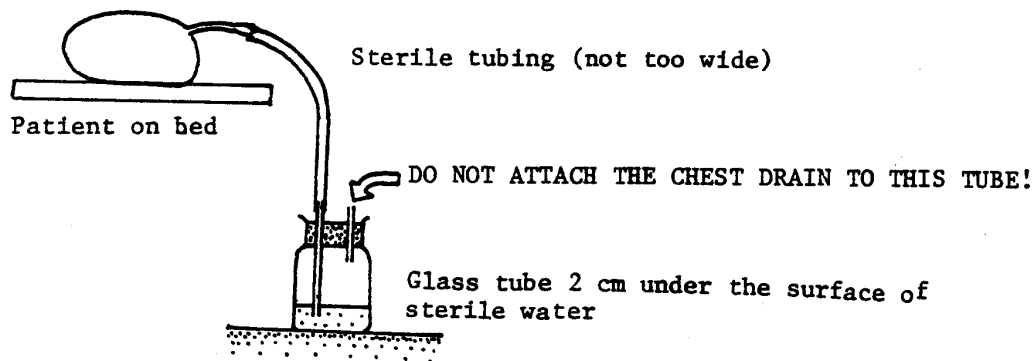
## **INSERTION OF AN UNDERWATER PLEURAL DRAIN**

1. Have the child on nasopharyngeal oxygen at 1 litre per minute and firmly held sitting up with hands above the head.
2. Scrub your hands and put on sterile gloves.
3. The tube should be inserted in the third to the fifth intercostal space in the mid axillary line. Clean the skin with iodine over a 10 cm radius and drape the area. Inject 1% plain lignocaine through a 23 gauge needle.
4. Make an incision in the skin 1 cm long with a sterile scalpel blade.
5. Take a pair of closed artery forceps and grasp them near the end you are going to push into the chest (so you cannot push them in too far). With the forceps held at right angles to the chest wall, push the point through the chest wall and into the pleural cavity. You will have to push quite hard, and they will go through the pleura with a pop. Open the forceps to make a slightly bigger hole into the pleural cavity, then close them and remove them.

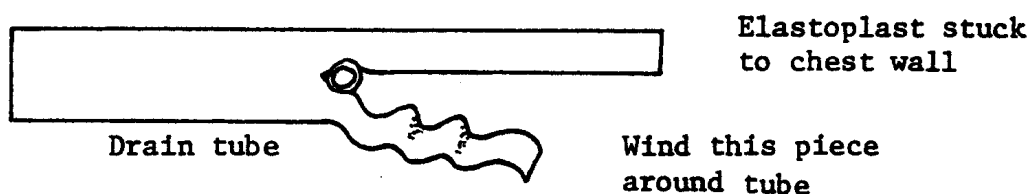
6. Take a sterile 12 gauge infant feeding tube and make a mark on the tube 5 cm from the tip. Grasp the tip with a pair of artery forceps. Push it through the chest wall along the hole you have just made. Angle the tube anteriorly towards the xiphisternum (J Pediatr 99:629,1981).



7. Remove the forceps, but leave the tube inside the chest.
8. Push the tube in until 4 cm is inside the chest. Do NOT push it in too far because this will cause it to kink or block. Clamp the tube until you have connected it to an underwater seal.
9. Connect the tube with sterile tubing to an underwater seal. MAKE SURE THAT ALL JOINS IN THE TUBING ARE AIRTIGHT. It is best if the tubing is of clear plastic. You may have to adjust the position of the tip of the intercostal tube so that either air bubbles out through the underwater drain, or so that the fluid level in the glass tube swings freely.



10. Firmly suture the wound closed - so that it is airtight. Suture the tube firmly to the skin. Put Elastoplast across the wound and around the tube.



11. The tube is only patent if air bubbles out or the fluid level in the tube swings as the child breathes. If the bubbles stop and the fluid does not swing with respiration, examine the child carefully and get another chest x-ray:
  - a. the tube may be blocked and the pneumothorax reaccumulating. You will have to replace the tube
  - b. the tube may not be correctly connected to the underwater drain bottle (it must be connected to the tube going under the water)
  - c. the air may have all drained out and the lung re-expanded. Clamp the tube for 4 to 6 hours, then take a chest x-ray. Undo the clamp on the tube; if there is still no swing or bubbles of air and you are sure the pneumothorax has not reaccumulated, remove the drain tube.