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RESPIRATORY INFECTIONS IN CHILDREN: MANAGEMENT AT SMALL HOSPITALS

BACKGROUND NOTES AND A MANUAL FOR DOCTORS

WORLD HEALTH ORGANIZATION
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BACKGROUND NOTES

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1. INTRODUCTION

Acute respiratory infections and diarrhoea are the commonest causes of death in children. Of the 14 to 15 million children under 5 years of age who die each year, four million die of acute respiratory infections (ARI), and two-thirds of the children who die are infants. More than 90% of all these deaths occur in developing countries, where children under five represent about 15% of the total population and contribute over 50% of all deaths. Thus, a child dies from an acute respiratory infection every eight seconds. Most of the deaths from acute respiratory infection are caused by pneumonia (1,2).

Lung puncture studies in children in developing countries indicate that most cases of severe pneumonia are caused by bacteria (3,4). This contrasts with the situation in developed countries, where most cases of pneumonia appear to be caused by viruses. Clinical experience and a few studies in developing countries indicate that early treatment with antibiotics reduces the mortality from pneumonia (5,6,7).

Undoubtedly, more research is needed to determine the aetiology of pneumonia, how to prevent it, and how to manage it. However, it is now time to apply what is already known about the treatment of pneumonia in children. It is probable that the key to reducing mortality is to give antibiotics to children with pneumonia at an earlier stage of the illness; this will require a strengthening of peripheral health services.

Protocols have been developed, based on the best available scientific evidence, to guide health workers in the management of children with acute respiratory infections. Different guidelines have been developed for community health workers (less than 6 months training), for workers at first level health facilities (6 months to 2 years training), and for doctors working at small hospitals where x-ray and laboratory facilities are limited (8). The guidelines for doctors are summarised in Table 1. Detailed protocols are included in the Annex at the end of this document, and will also be available as a separate booklet entitled "A Manual for Doctors".

Table 1 - The main criteria for decision making in the case management of ARI in children in developing countries

1. Most children with cough do not need antibiotics.

2. Cough and fast breathing - give outpatient treatment with either intramuscular procaine penicillin, or oral amoxycillin, ampicillin or cotrimoxazole.

3. Cough with chest indrawing (but with no wheeze): admit to hospital and give benzyl penicillin intramuscularly every 6 hours.

4. Cough and cyanosis or not able to drink: admit and give chloramphenical intramuscularly, then orally.

2. THE CLINICAL FINDINGS THAT HELP TO DECIDE MANAGEMENT

Most fatalities from acute respiratory infections are caused by pneumonia, and most children with pneumonia present with cough. It is therefore important to be able to decide which children with cough need antibiotic therapy, and which children need to be admitted to hospital.

* The main purpose of the history and examination is not to make a diagnosis, but to decide on management.

* The smallest possible number of criteria should be used to make each decision about management.

For example, we ought not to make a list of all the clinical findings in pneumonia and then say that pneumonia is treated with antibiotics. We should say that most children with a cough do not need antibiotics, but if a child with a cough is breathing fast then he should be treated with an antibiotic.

2.1 Which children with cough should be treated with an antibiotic?

Cough is a very common symptom. Many children have at least a mild cough for a significant part of the first year of their life. Clearly, they should not all be given antibiotics: this would be expensive and wasteful, and would encourage the emergence of bacteria resistant to antibiotics.

A number of clinical signs have been suggested as an indication of the need for antibiotics in a child with cough: tachypnoea, fever, toxic appearance, purulent sputum, crepitations, nasal flaring, intercostal recession, grunting, poor feeding and cyanosis. There have been few prospective studies to determine which of these signs best predict the presence of pneumonia and the need for antibiotic therapy. Leventhal (9) studied clinical signs and chest X-ray findings in American children with respiratory illness. Shann (10) studied paediatric outpatients with cough in Papua New Guinea.

The findings of these two studies (9,10), in very different populations, were very similar: tachypnoea was the best clinical predictor of pneumonia, and a history of rapid breathing was almost as good as actually counting the respiratory rate. In the Papua New Guinea study, a respiratory rate of over 50 breaths per minute was found to be the best definition of tachypnoea. Nasal flaring, intercostal recession, cyanosis, grunting and failure to feed may all occur in severe pneumonia - a child with any of these signs certainly needs antibiotics, but tachypnoea should indicate the need for antibiotics before these other signs develop.

Certain signs should not be used to decide whether to give antibiotics to a child with a cough. Fever was not a good indication of the presence of pneumonia in either study: children with viral infections often have a high temperature, while many children with bacterial pneumonia do not have a fever. Toxic appearance is a rather vague sign and was inferior to tachypnoea as an index of pneumonia in both studies. The presence of purulent sputum is a very poor sign in young children, because they swallow their sputum rather than spit it out. Crepitations are difficult to hear in small children, and they are not the most reliable sign even for doctors skilled in the use of a stethoscope. Many health workers cannot use a stethoscope properly.

At this time, the presence of tachypnoea (over 50 breaths per minute) or a history of rapid breathing appear to be the best predictors of the need for antibiotic therpay in a child with cough. To count accurately how fast a child is breathing, he should be awake and quiet. This may seem difficult to achieve, but the necessary skill can be learned with practice.

2.2 Which children with cough should be admitted?

Children who present with chest indrawing are more likely to have serious bacterial pneumonia and they are more likely to die than are children without this sign. Evidence from Papua New Guinea suggests that chest indrawing indicates more reliably than tachypnoea, fever or crepitations which children need admission to hospital (10). Caution is necessary in evaluating chest indrawing when wheezing is present. Children with even a mild wheeze may have chest indrawing. So, if wheeze is present, respiratory rate (over 50 per minute) rather than chest indrawing should be used to select children who need referral or admission. Wheeze is not always audible without a stethoscope, but experience has shown that health workers can learn to recognize wheeze in most cases by watching the child breathe. Auscultation is not necessary. A child with wheeze takes longer to breathe out than normal, and has to make an effort to do so. Very young normal babies occasionally have slight chest indrawing because their chest wall is soft; however, with experience, health workers can identify these children because of the absence of other signs of illness.

The highest fatality occurs in children with pneumonia who are either cyanosed or not able to drink. The presence of either of these signs indicates an urgent need for admission and intensive therapy. These children almost always have chest indrawing.

3. WHICH ANTIBIOTIC SHOULD BE USED TO TREAT PNEUMONIA IN A CHILD LESS THAN FIVE YEARS OLD?

Lung aspirate studies of children with pneumonia have shown that the causative bacteria are usually Streptococcus pneumoniae or Haemophilus influenzae (3,4). Antibiotics used to treat pneumonia in children less than five years old must therefore be active against S. pneumoniae and H. influenzae. Staphylococcus aureus causes a small proportion of pneumonias in untreated children, and a larger proportion when the children studied have already had antibiotic treatment.

3.1 Oral antibiotics

If an oral antibiotic is to be used to treat a child with pneumonia at home, the best choice is cotrimoxazole or amoxycillin or ampicillin. Other drugs are less effective or have undesirable side effects.

Cotrimoxazole is usually effective against S. pneumoniae, H. influenzae and S. aureus. It is cheap and can be given twice a day, or perhaps even once a day at double the usual dose. Side effects are uncommon, but may be serious (agranulocytosis, Stevens-Johnson syndrome). Cotrimoxazole has the advantage that it is active against chlamydia anmd pneumocystis, which may be important causes of pneumonia in infants in developing countries (11). Cotrimoxazole has poor activity against Streptococcus pyogenes. Trimethoprim alone is slightly cheaper and causes fewer side-effects, but it is only bacteriostatic against some H. influenzae and there is concern that resistance might develop rapidly if trimethoprim alone were widely used. In many areas of the world, H. influenzae is now often resistant to sulphonamides.

Both ampicillin and amoxycillin were almost always active against both S. pneumoniae and H. influenzae in the past. Although over 20% of H. influenzae are now resistant to these drugs in some developed countries, resistance may be less common in developing countries, where ampicillin has been less widely used (e.g. it is very uncommon in Papua New Guinea, despite the fact that pneumococci commonly have reduced sensitivity to penicillin in that country) (12). Amoxycillin is better absorbed than ampicillin: a lower dose can be used, it only needs to be given 3 times a day (ampicillin should be given 4 times a day), and gastrointestinal side-effects are slightly less common. Because of the lower daily dose of amoxycillin, the cost of a course of the two drugs is similar.

There has been little experience with erythromycin for the treatment of pneumonia in infants (13). Erythromycin is effective against Chlamydia trachomatis and Mycoplasma pneumoniae, which cause some cases of pneumonia in children (11), but it has poor activity against H. influenzae, it often causes gastrointestinal side-effects in children, it has to be given every six hours, it is only bacteriostatic, and resistance can emerge during therapy.

Chloramphenicol is bactericidal against H. influenzae and most strains of S. pneumoniae (14), and it is bacteriostatic against S. aureus. It should be used to treat only very severe pneumonia in hospital inpatients because of the risk of fatal agranulocytosis. In a severely ill patient the risk of agranulocytosis (less than one in 20,000) is acceptable.

The absorption of oral cloramphenicol may not be adequate in some malnourished children in developing countries, perhaps due to low levels of pancreatic lipase from malnutrition (15). Pancreatic lipase is needed to hydrolyse chloramphenicol palmitate to chloramphenicol before it can be absorbed.

The oral cephalosporins are expensive and most of them are ineffective against H. influenzae. The tetracyclines are effective against H. influenzae and most S. pneumoniae, but they should not be used in children under eight years of age because of their effect on teeth and bones. Phenoxymethylpenicillin (penicillin V), unlike benzyl penicillin, has little effect on H. influenzae and should not be used to treat pneumonia in infants (16).

3.2 Parenteral antibiotics

Benzyl penicillin is active against both S. pneumoniae and H. influenzae. S. pneumoniae was previously always very sensitive to penicillin (MIC 0.05 microgram/ml), and although S. pneumoniae shows reduced sensitivity to penicillin (MIC 0.1-1 microgram/ml) in some countries, complete resistance is still very rare. Although it is widely thought that H. influenzae is resistant to penicillin, it is actually almost as sensitive to benzyl penicillin as it is to ampicillin (16); but it is not sensitive to penicillin V. Strains of H. influenzae resistant to ampicillin are also resistant to benzyl penicillin but, as discussed above, betalactamase production by H. influenzae may not be common in developing countries. Procaine penicillin and benzathine penicillin are compounds that slowly release benzyl penicillin. The serum level achieved is lower. Penicillin levels with procaine penicillin are adequate (17), but with benzathine penicillin, levels are so low (18) that they are unlikely to be effective against H. influenzae (MIC usually 0.5-1 microgram/ml), or against strains of S. pneumoniae with reduced sensitivity to penicillin (MIC 0.1-1 microgram/ml). Furthermore, widespread use of benzathine penicillin might lead to the emergence of penicillin-resistant organisms, due to the prolonged low levels of penicillin. Resistance occurred in Papua New Guinea after widespread use of oily procaine penicillin with aluminium monosterate (19).

Chloramphenicol has already been discussed under oral antibiotics. Contrary to conventional wisdom, this drug is well absorbed after intramuscular administration (15). It can, of course, also be given intravenously.

The cephalosporins are expensive, and the few that are active against H. influenzae are very expensive indeed. The aminoglycosides (e.g. gentamicin) are ineffective against S. pneumoniae, they are expensive, and they may mask the diagnosis of tuberculosis. Methicillin, cloxacillin, nafcillin and oxacillin are expensive and have very poor activity against H. influenzae - they should only be used for staphylococcal pneumonia in centres where X-ray or culture facilities are available to establish the diagnosis.

3.3 Pneumonia - outpatient treatment

The choice seems to be between:

Procaine penicillin - 50,000 u/kg intramuscularly once each day for 5 days
Amoxycillin - 15 mg/kg/dose orally, three times a day for 5 days
Ampicillin - 25 mg/kg/dose orally, four times a day for 5 days
Cotrimoxazole - sulphamethoxazole 20 mg/kg/dose and trimethoprim 4 mg/kg/dose orally, two times a day for 5 days

Intramuscular injections of procaine penicillin are reliably absorbed even by an ill child who may vomit oral medication, each dose can be supervised by a health worker, and there is a reasonable chance of cure from just one or two doses if the child does not attend for further treatment. On the other hand, oral antibiotics can be used much more easily by peripheral health workers, because the skills and equipment for giving injections are not required.

3.4 Severe pneumonia (inpatients)

It seems sensible to give parenteral therapy to children with severe pneumonia, at least until they begin to improve. The logical choice is benzyl penicillin, at least 25,000 u/kg/dose (and preferably 50,000 u/kg/dose) IM every six hours. Intramuscular ampicillin is also effective, but it is more expensive. When a child starts to recover (usually after two to three days), therapy can be changed to procaine penicillin, or oral amoxycillin, ampicillin or cotrimoxazole and the child discharged from hospital.

3.5 Very severe pneumonia (inpatients)

Chloramphenicol is clearly the drug of choice for children over two months of age with very severe pneumonia. It is effective against both S. pneumoniae and H. infuenzae (14) and resistance is rare. Chloramphenicol is also effective for meningitis, which is common in

children with severe pneumonia (20). Large randomised prospective controlled trials in Papua New Guinea children have shown that chloramphenicol alone is as effective as combined therapy with chloramphenicol plus penicillin (21). Chloramphenicol is given as 25 mg/kg/dose every six hours. It is given intramuscularly until the child starts to recover (usually after 2-3 days), then orally as chloramphenicol palmitate suspension.

3.6 Staphylococcal pneumonia and neonatal pneumonia.

Chloramphenicol is often effective in Staphylococcal pneumonia. However, this pneumonia is most effectively treated with a penicillinase-resistant penicillin (e.g. cloxacillin, oxacillin or nafcillin) either alone or with gentamicin.

Neonatal pneumonia should be treated with penicillin (or ampicillin) plus an aminoglycoside (gentamicin) since chloramphenicol is toxic to neonates and only bacteriostatic against coliforms, which are a common cause of pneumonia in this age group.

3.7 Tuberculosis

The possibility of tuberculosis should be considered in any child with a cough that does not respond to penicillin, chloramphenicol or cotrimoxazole. Note that the diagnosis of tuberculosis may be masked by the use of an aminoglycoside.

4. SUPPORTIVE THERAPY

4.1 Oxygen

Oxygen is expensive and supplies are limited in many countries. If supplies are limited, oxygen should be given only to children who are certain to benefit; that is, children who are cyanosed, and children who have wheeze and a respiratory rate of 70/minute or more. If supplies are plentiful, oxygen can be given to other children who are severely ill with pneumonia - those who are too ill to drink, and those who have severe chest indrawing. It should NOT usually be given to children with stridor, because it may mask the signs of obstruction.

Oxygen should be given by intranasal catheter at one litre per minute. Special low-flow flowmeters are helpful to achieve this. A flow rate that is too high is wasteful and may cause gastric dilatation. The catheter should be inserted to a depth equal to the distance between the tragos (the small piece of cartilage just in front of the external auditory meatus) and the lateral edge of the nose. If the catheter is inserted too far, it may enter the oesophagus and cause gastric dilatation and respiratory embarrassment. If a nasogastric tube is required for feeding, it should be inserted through the same nostril as the oxygen catheter, and the other nostril should be kept clear of mucus. Humidification of the oxygen is desirable, but care must be taken that the water is changed each day, and the container and catheter should be carefully cleaned and dried at least twice a week to reduce the risk of bacterial contamination.

4.2 Feeding and fluids

Breast feeding should be continued. If the child is unable to suck because of dyspnoea, the mother should express her milk and feed it by cup and spoon.

Encourage the child to drink especially if he is thirsty, dehydrated, or also has diarrhoea.

Children with dyspnoea may be unwilling or unable to drink. If a child is dehydrated and not drinking, give intragastric fluids. Give intravenous fluids only if the child is in shock. It is very important not to give too much intragastric or intravenous fluid. Children with pneumonia may secrete more antidiuretic hormone than normal. They easily become overloaded with fluid, which can cause pulmonary oedema and contribute to respiratory failure (22,23).

Encourage the child to eat small, frequent feeds. However, anorexia is common with acute respiratory infections, and it may not be possible to persuade the child to eat more than a little. A child should not be forced to eat.

4.3 Clearing the nose

Many infants cannot breathe through their mouth and a simple blocked nose may cause respiratory distress, and some difficulty breast feeding. A child who has only a blocked nose tries to suck, however, and behaves differently from a child who is anorexic or too ill to feed:

- gently suck out the nose with a 10 FG catheter if you have a suction machine (do not use more than 200 mmHg pressure);
- or suck out the nose with a 10 ml syringe (make sure there is no needle on the syringe);
- cleaning the nostrils with cotton wool is not very effective. Putting salt solution in the nose may make the baby choke and is not very effective;
- mothers of children with mild ARI can be shown how to clear the child's nose at home with a piece of soft cloth or tissue twisted into a wick. The wick can be moistened if the nasal secretions are very dry.

4.4 Thermal environment

It is important not to overheat or chill a child with pneumonia. Heat stress and cold stress can both increase a child's oxygen consumption two or threefold (24), increase carbon dioxide production, and precipitate respiratory failure. It is widely appreciated that a child with a respiratory infection should not be allowed to become chilled, but it is just as dangerous to overdress and overwrap the child. An infant with pneumonia should be nursed lightly clothed in a warm room (20-25°C). Proper temperature control is much more important than humidification of the air.

4.5 Treating fever

Experimental evidence suggests that moderate elevation of body temperature (up to 39-40°C) improves the body's defences against infection (28,29). However, very high fever increases oxygen consumption and may cause convulsions. In a malarious areas, give antimalarials to any febrile child. The most effective way to reduce fever from other causes is paracetamol (30). It is not necessary to give paracetamol unless the child's temperature is over 38.5°C. Paracetamol is preferable to aspirin because it has fewer side effects and does not predispose children to Reye's syndrome.

Children should not be sponged with cold or tepid water, because this is very uncomfortable, not very effective and greatly increases oxygen consumption (which may precipitate respiratory failure in a child with pneumonia).

4.6 Humidification of the air

This has been shown not to influence the duration of hospitalization of children with pneumonia (25). This is not surprising, because inspired air is completely saturated with water vapour by the time it reaches the carina (26). However, warm water vapour may provide some symptomatic relief to a child with mild stridor.

4.7 Cough medicines

Expectorants, cough suppressants, mucolytics, decongestants and antihistamines are expensive and ineffective or even harmful in pneumonia (27). Yet most families expect their children to be given some medicine. If a cheap, safe cough mixture is required, mix 20 ml of concentrated peppermint water and 5 ml of solution of amaranth (or other suitable colouring) in 2 litres of 1% ammonium chloride; the dose is one teaspoon (5 ml) four times a day.

Ineffective supportive therapy should not be encouraged, since it may distract people from the helpful actions that might save a child's life.

5. SOME CAUSES OF COUGH OTHER THAN PNEUMONIA

5.1 Cough with wheeze (Bronchiolitis and asthma)

The first epidose of wheezing in a child under 12 months old is usually caused by bronchiolitis. Bronchiolitis is a viral infection of the bronchioli and mild cases should not be treated with antibiotics. More severe cases should probably receive antibiotics because of the difficulty in clinically excluding secondary bacterial infection, which may be common in developing countries.

Criteria for treatment with antibiotics should be the same as for pneumonia: give an antibiotic if there is tachypnoea. This will mean that some children with bronchiolitis will be given antibiotics unnecessarily, but this is probably worthwhile if it means that antibiotics are given to children with bronchiolitis plus bacterial secondary infection, and to children with pneumonia who have a wheeze. The most important treatment for severe bronchiolitis is oxygen (for children breathing more than 70 times a minute). The value of bronchodilators in the treatment of bronchiolitis is controversial, especially in children under one year of age (31).

The first episode of wheezing in a child over 18 months old is usually caused by asthma. Children with recurrent episodes of cough with wheeze, and children with chronic cough, may also have asthma. Asthma is an uncommon cause of death in children in developing countries. Asthma does not require treatment with antibiotics (32); the appropriate therapy is oral or nebulised bronchodilators, such as salbutamol - you can deliver nebulised sympathomimetics to a small child cheaply and effectively with a foot pump (33). Although most children with asthma can be treated as outpatients, a child with an acute attack may need to be referred to a health facility (often a hospital) where alternative bronchodilators are available, and where the child's response to treatment can be assessed.Failure to respond is an indication for admission for more intensive therapy - for example with intravenous aminophylline. Management protocols for severe asthma vary from country to country.

Another cause of acute or chronic wheeze which should be considered is a foreign body in the airway. A history of aspiration is usually obtained in these cases. The child should be referred to a surgeon who can do a bronchoscopy.

5.2 Croup

Stridor is caused by inflammation of the epiglottis, larynx or trachea.

In industrialised countries, stridor is usually due to simple viral croup, which is caused by parainfluenza, influenza, rhino or respiratory syncytial viruses. In most developing countries is less often caused by these viruses, and children with stridor usually have measles (in some countries), diphtheria (in some countries), bacterial croup (34), foreign body or a congenital malformation. Bacterial croup can involve the epiglottis (acute epiglottitis, which is usually caused by *H. influenzae*), or the trachea (tracheitis, which is usually caused by *S. aureus*, or *S. pneumoniae*). In bacterial croup, there may be copious purulent sputum, high fever, severe airways obstruction and a prolonged course. Children with bacterial croup should be treated with an antibiotic such as chloramphenicol; tracheostomy is usually necessary. Children with diphtheric croup should be given 40,000 units of diphtheria antitoxin and procaine penicillin intramuscularly; tracheostomy is often necessary. Since the common causes of stridor differ greatly from country to country, management protocols for stridor will also vary.

5.3 Pertussis (whooping cough)

The main emphasis should be on the prevention of this disease by immunization. Treatment of severe cases consists primarily of oxygen, gentle suction and maintenance of hydration and nutrition. There is no evidence that cough suppressants (such as phenobarbitone) or

antibiotic therapy alter the course of established pertussis. The place of salbutamol (35,36) and steroids (37,38) is unclear. Erythromycin estokite and chloramphenicol may modify the course of pertussis if they are given early in the illness (39) and may prevent transmission of the organism, provided they are given for 14 days (40). Ampicillin is ineffective in both treating the illness and preventing transmission.

5.4 Tuberculosis

Tuberculosis should be suspected in any child who has a chronic cough, persistent fever of unknown cause, enlarged lymph nodes or malnutrition. The presence of a household contact with tuberculosis gives strong support to the diagnosis. Appropriate investigations include a chest X-ray, tuberculin (Mantoux) test, and microscopy and culture of material such as lymph nodes, gastric aspirate, pleural fluid, ascites or cerebrospinal fluid. Children with tuberculosis usually have many fewer bacilli present than adults (41); consequently drug resistance rarely develops during therapy in children, but it is harder to isolate *M. tuberculosis* and prove the diagnosis.

Standard therapy for children with tuberculosis is isoniazid and thiacetazone daily for 12 months, plus streptomycin daily for the first 1 or 2 months. Short course therapy for tuberculosis is more expensive and there is little experience with it in children; however, a regimen that is likely to be effective is isoniazid, rifampicin and pyrazinamide daily for the first 2 months (42) followed by isoniazid and rifampicin daily or twice weekly for a further 4 months. An alternative regimen is isoniazid, rifampicin and pyrazinamide daily for the first 2 months then isoniazid and thiacetazone daily for 6 months. With either of these short course regimens, streptomycin should be given in addition to isoniazid, rifampicin and pyrazinamide for the first 2 months if the child is very sick, or if he comes from an area where isoniazid resistance is common (42).

6. COUGH FOR MORE THAN THIRTY DAYS

6.1 Persistent pneumonia

Occasionally pneumonia does not resolve despite a complete course of antibiotic therapy. Check that the treatment prescribed has actually been given. Exclude asthma (wheeze), which is a common cause of this problem.

Suspect tuberculosis (fever, lymphadenopathy, malnutrition, household contact), foreign body (history of ingestion, wheeze, stridor, haemoptysis), heart failure (murmur, cardiomegaly, hepatomegaly, tachycardia) or staphylococcal pneumonia (pneumatocoeles, lung abscess, empyema, history of measles). Chlamydia and pneumocystis may cause persistent pneumonia with tachypnoea, crepitations, hyperinflation and diffuse patchy chest X-ray changes; but rarely fever or wheeze (11).

If foreign body, heart failure and staphylococcal pneumonia seem unlikely, consider giving cotrimoxazole in high doses (trimethoprim 20 mg/kg/day and sulphamethoxazole 100 mg/kg/day in 3 or 4 divided doses). If there is no improvement after one or two weeks of cotrimoxazole, consider starting TB therapy.

6.2 Persistent cough (without signs of pneumonia)

Chronic cough such as this may be caused by tuberculosis, pertussis, chlamydia or pneumocystis, but most cases will be due to asthma. The cough may be worse at night, and wake up the child and his family.

Tuberculosis is suggested by the presence of unexplained continuing fever, lymphadenopathy, malnutrition or a household contact with tuberculosis. Consider arranging for a chest X-ray, tuberculin test and appropriate cultures.

Pertussis is suggested by the presence of paroxysmal coughing, which is often associated with apnoea, a whoop, vomiting or convulsions. Antibiotic therapy will not affect the course of the illness. Explain to the mother that the cough will continue for some weeks, and then slowly get better. Advise her to feed the child after each vomit.

A well child with a history of chronic cough at night probably has asthma, even if he does not have a wheeze at the time you examine him. Give the child salbutamol, and explain to the mother that this treatment should help the child's symptoms, but that it will not cure the disease. Treatment may be needed for months, or even years, but most children eventually "grow out" of their asthma. Antibiotics and antihistamines do not help.

7. OTHER RESPIRATORY INFECTIONS

7.1 The common cold

Antibiotic therapy for the common cold is ineffective and wasteful. Widespread abuse of antibiotics will lead to the emergence of resistant bacteria. Antihistamines and vasoconstrictors do not alter the course of the illness. If the parents demand some medicine, give the cough mixture discussed in Section 4.7 or immunize the child if he is due for it. A blocked nose may cause difficulty with breathing and breastfeeding. Show the mother how to clean out the child's nose with a piece of cloth or tissue twisted into a wick.

7.2 Purulent nasal discharge and sinusitis

Purulent nasal discharge is very common in developing countries. It is not known whether children with purulent nasal discharge have associated paranasal sinusitis. The diagnosis of purulent sinusitis is suggested by fever, cough, bad breath, headache and facial pain with tenderness over the sinuses. It is not known whether antibiotic treatment for purulent nasal discharge is beneficial; most antibiotics (including penicillin, ampicillin and erythromycin) often do not achieve adequate concentrations in nasal mucus, so they do not eradicate bacteria from the nose (43). Of the antibiotics that do reach an adequate concentration, sulphonamides are now often ineffective against pneumococcus and haemophilus, rifampicin is expensive and minocycline is contra-indicated in children. A course of procaine penicillin, ampicillin, amoxycillin or cotrimoxazole can be given, but treatment needs to be continued for two weeks.

7.3 Pharyngitis and tonsillitis

Clinical signs, even pharyngeal exudate, are not a reliable guide to the aetiology of pharyngitis (44). In fact, it is uncommon to see pharyngeal exudate in children under five years of age in developing countries. The presence of a cough makes the diagnosis of streptococcal pharyngitis unlikely.

Penicillin may affect the clinical course of streptococcal pharyngitis by shortening the duration of symptoms slightly, but this illness is usually self-limiting (44,45,46). Penicillin therapy probably has little or no effect on the incidence of post-streptococcal nephritis (47). The main justification for treating streptoccal pharyngitis with penicillin is therefore to prevent rheumatic fever. Rheumatic fever is rare in children under five years of age, even in developing countries (48,49).

There is therefore little justification for antibiotic treatment for pharyngitis in children less than five years of age, even if there is purulent exudate. Diphtheria is an exception. Most children with streptococcal pharyngitis do not have any exudate, and penicillin treatment for all children with pharyngitis (with or without exudate) would result in widespread use of penicillin for very limited returns. A reasonable compromise might be to give penicillin to a child of any age with pharyngeal exudate and tender cervical adenitis, and to children aged 5 years or more who have pharyngeal exudate with or without adenitis. Give one intramuscular injection of benzathine penicillin, or 10 days of treatment with procaine penicillin or penicillin V (50).

7.4 Otitis media

Acute otitis media is most commonly a bacterial infection of the middle ear space. The most common bacterial pathogens are S. pneumoniae and H. influenzae. Acute otitis media is best diagnosed with pneumatic otoscopy. When an otoscope is not available the health worker

should diagnose an ear infection if there is acute onset of ear discharge or sudden ear pain in an older child. The present consensus is that antibiotics should be used to treat acute otitis media. Ear rubbing in babies is not a reliable sign of otitis media, and is therefore not an indication for the use of antibiotics.

In developing countries, children with otitis media often present late with chronic discharge from one or other ears. In chronic otitis media with prolonged discharge (more than two weeks), secondary infection with pseudomonas or development of a cholesteatoma limit the efficacy of antibiotics (51). A chronically discharging ear can only heal if it is dry. At a health facility, aural toilet can be performed with mechanical suction (52), or the ear can be gently syringed with clean water. An alternative, which mothers can learn to do at home, is to roll absorbent paper into a thin wick which is placed in the ear (53). Cotton cloth can be used if absorbent paper is not available, but it is not as effective.

Antihistamines and vasoconstrictors are ineffective in both acute and chronic otitis media (52,54).

8. MANAGEMENT OF RESPIRATORY INFECTIONS BY PRIMARY HEALTH WORKERS

Respiratory infections are a complex group of diseases, caused by many pathogens, which doctors usually classify on the basis of anatomical location: upper respiratory tract infection, laryngitis, tracheitis, bronchiolitis, pneumonia and so on. It is difficult, even for doctors, to accurately classify each patient using this system. Furthermore, each syndrome has many manifestations, for which many different types of management are required.

Primary health workers should be taught a classification of acute respiratory infections that relates to the severity of the disease and the management required, rather than the anatomical region involved:

- cases that should be admitted to a health centre or a hospital (severe cases)
- cases that do not need to be admitted, but which should be treated with an antibiotic (moderate cases)
- cases that do not need antibiotic treatment (mild cases).

Guidelines have been developed for use by community health workers (Table 8.1) and for workers at first level health facilities (Table 8.2). The full protocols and their training manuals are available from the World Health Organization in Geneva.* Although the protocols for primary health workers have been kept as simple as possible, they are consistent with the protocols suggested here for use by doctors working in small hospitals.

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*Requests should be addressed to Chief, Respiratory Infections Programme, World Health Organization, CH-1211 Geneva 27, Switzerland.

Table 8.1 The management of respiratory infections by Community Health Workers (less than 6 months training)

The prime role of these workers in respect of respiratory infections is to make antibiotics more readily and quickly available to children with pneumonia, to prevent death. Community health workers do not need to learn to recognize wheezing, as they are unlikely to be able to give bronchodilators. They will normally not be able to examine the ear drum or throat.

Severe: give antibiotic and refer

Cough and CHEST INDRAWING or NOT ABLE TO DRINK

Also refer if a child:

- has convulsions or fits
- or sometimes stops breathing
- or is difficult to wake up
- or has severe dyhdration
- or has stridor at rest.

Also refer for assessment if a child's cough continues for more than 30 days.

Moderate: antibiotics at home

Cough and FAST BREATHING (over 50/min) but no chest indrawing.

Mild: no antibiotics, supportive measures only

Cough with NO fast breathing and NO chest indrawing
Sore throat
Ear discharge
Blocked or runny nose

Table 8.2 The management of respiratory infections by workers at first level health facilities (6 months to 2 years training)

In addition to preventing death from pneumonia, these workers may be trained to recognise and treat wheeze. They may learn to recognise and treat acute otitis media and they may be able to examine the throat (especially in areas where diphtheria is common).

Severe: give an antibiotic and refer

Cough and CHEST INDRAWING
Cough and NOT ABLE TO DRINK
Cough and WHEEZE AND FAST BREATHING (more than 50 per minute)
(give salbutamol if child more than 1 year old)

Also refer if a child:

- has convulsions or fits
- or sometimes stops breathing
- or is difficult to wake up
- or has severe dehydration
- or has stridor at rest
- or has a grey membrane on the throat (in areas where diphtheria is common)

Moderate: antibiotics at home

Cough and FAST BREATHING (over 50 per minute) but no chest indrawing.
Acute otitis media (ear pain with inflamed and bulging drum, or ear discharge for less than 2 weeks)
Pharyngitis with enlarged and tender neck glands

Mild: no antibiotics, supportive measures only

Cough with NO fast breathing (less than 50 per minute) and NO chest indrawing
Cough with wheeze with NO fast breathing. (Give salbutamol if child more than 1 year old)
Stridor which stops when the child is at rest
Red throat (with or without exudate) with NO enlarged and tender neck glands
Ear discharge for more than 2 weeks
Blocked or runny nose

Cough for more than 30 days

Suspect TB (refer), whooping cough (supportive treatment) and asthma (give salbutamol)

9. CONCLUSION

* Pneumonia is one of the commonest causes of death in children in the world: a child dies from pneumonia every eight seconds.

* Most deaths from pneumonia occur in children less than 12 months old in the rural areas of developing countries.

* Most fatal cases of pneumonia in children in developing countries are caused by bacteria.

* Most of the deaths from pneumonia in children could be prevented by antibiotic therapy.

* To prevent the emergence of resistant bacteria, it is most important that antibiotics only be given when they are really needed.

* The presence of tachypnoea (over 50 breaths per minute) is the best clinical indication that a child with a cough needs antibiotics.

We need to know more about how to treat children with pneumonia, and we urgently need vaccines that will protect young children against the disease, but we already know enough to substantially reduce the number of children dying from respiratory infections.

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ANNEX 1

RESPIRATORY INFECTIONS IN CHILDREN: MANAGEMENT AT SMALL HOSPITALS

A MANUAL FOR DOCTORS

INTRODUCTION

Acute respiratory infections and diarrhoea are the commonest causes of death in children. The protocols in this manual have been developed by the World Health Organization using the best scientific evidence available; it is hoped that they will enable more children to receive effective treatment for severe respiratory infections, and that they will reduce the unnecessary use of antibiotics in children with mild infections.

Most children dying from acute respiratory infections are less than five years old, and most die from pneumonia. Most deaths are due to infections with *H. influenzae* or *S. pneumoniae*, both of which are usually sensitive to benzyl and procaine penicillin, ampicillin, amoxycillin, cotrimoxazole and chloramphenicol. Other antibiotics are usually more expensive or have more side effects.

Prospective studies have shown that careful observation of breathing movements usually gives a more reliable indication of the severity of respiratory infection in a child than auscultation with a stethoscope; hence the emphasis on respiratory rate and chest indrawing in these protocols.

The treatment regimens in this manual have been designed for use in small hospitals where X-ray and bacteriology facilities are limited or non-existent. It is recognised that treatments other than those outlined here will be required for certain patients, depending on individual circumstances and the availability of facilities.

Further information about these protocols may be obtained from the Respiratory Infections Programme, World Health Organization, 1211 Geneva 27, Switzerland.

ACUTE RESPIRATORY INFECTIONS IN CHILDREN: SUMMARY OF CASE MANAGEMENT

Very severe: admit and give chloramphenicol

Cough or wheeze with CYANOSIS or NOT ABLE TO DRINK.

(If you do not have chloramphenicol: give benzyl penicillin or ampicillin or amoxycillin and gentamicin.)

Severe: admit and give benzyl penicillin

Cough with no wheeze: admit if CHEST INDRAWING.
Cough and wheeze: admit if respirations over 70/min

Also admit a child with:
- stridor at rest (croup, diphtheria, epiglottitis)
- an adherent grey pharyngeal membrane (diphtheria)
- or convulsions, apnoea, severe dehydration or drowsiness.

Moderate: antibiotics at home (plus supportive therapy)

Cough with wheeze and FAST BREATHING (over 50/70 min).
Red ear drum, or ear discharge less than 2 weeks.
Purulent pharyngitis with large and tender lymph nodes in the neck (cervical adenitis).

Mild: no antibiotics (give supportive therapy)

Cough or wheeze with respirations less than 50/min.
Stridor absent when child quiet.
Red throat.
Blocked or runny nose.
Ear discharge for more than two weeks.

SUPPORTIVE THERAPY

Supportive therapy is helpful in most cases of respiratory infection. However, do not encourage ineffective supportive therapy, because it may distract people from actions necessary to save a child's life.

Continue breast feeding. If the child is not able to suck, the mother should express her milk and give it by cup and spoon.

Encourage the child to drink especially if he is thirsty, dehydrated, or has diarrhoea. If the child is dehydrated and unable to drink, give intragastric fluids.
Avoid excessive fluids, especially intravenously.
Give IV fluids only if the child is in shock.

Encourage the child to eat small frequent feeds, but do not force the child to eat.

A neutral thermal environment should be maintained to minimise oxygen consumption and carbon dioxide production. Putting on too many clothes and overheating a child is just as dangerous as exposing the child to cold. The child should be nursed lightly clothed in a warm room.

Paracetamol should be given to reduce high fever (over 38.5°C). Sponging with tepid or cold water should be discouraged; it is not very effective, and it increases oxygen consumption and carbon dioxide production.

Clearing the nose with gentle suction is important. At home, the mother should use a moist, soft tissue or cloth in the form of a wick to clear out nasal secretions.

Cough suppressants, expectorants, mucolytics, decongestants and antihistamines should NOT be used. They are expensive and ineffective. Local home remedies are cheap and may be helpful. An inexpensive cough mixture can be made by

SUPPORTIVE THERAPY (CONTINUED)

mixing 20 ml concentrated peppermint water with 5 ml solution of amaranth (or another suitable colouring) in 2 litre 1% ammonium chloride; the dose is one teaspoonful (5 ml) every six hours.

Give oxygen to any child who is cyanosed, or who has wheezing and a respiratory rate over 70 per minute Oxygen should be administered by intranasal catheter at 1 litre per minute. Special low-flow meters are helpful to avoid waste and the risk of gastric dilatation. The catheter should be inserted to a depth equal to the distance between the tragus (the small piece of cartilage just in front of the external auditory meatus) and the lateral edge of the nose. Humidification of the oxygen is desirable, but care must be taken that the water is changed each day, and the container, tubing and catheter should be cleaned and dried twice a week to reduce the risk of bacterial contamination.

COUGH WITH WHEEZE

The first attack of wheezing in a child less than 12 months old is probably due to bronchiolitis. In young infants, bronchiolitis may present as episodes of apnoea. Recurrent episodes of wheeze suggest asthma. Sometimes wheeze is due to an inhaled foreign body (see page 21).

If there is no audible wheeze, watch the child breathe. A child with wheeze takes longer than normal to breathe out, and seems to make an effort.

Almost all children with wheeze have chest indrawing, so indrawing in a child with wheeze is not an indication for admission.

Very severe bronchiolitis

Wheeze and CYANOSIS OR NOT ABLE TO DRINK.

1. Admit to hospital.
2. Give intranasal oxygen at 1 litre/minute.
3. Give chloramphenicol 25 mg/kg/dose IM 6 hourly.
4. Suck out the child's nose gently when necessary to clear the airway.
5. Give oral or nebulised salbutamol if the child is over 12 months old:
   - oral - (1 to 5 years): 1 mg 3 times a day
   - nebulised: 0.5 ml 0.5% solution + 1.5 ml saline

Avoid intravenous fluid, unless child is in shock.

Severe bronchiolitis

Wheezing and VERY FAST BREATHING (over 70/minute), but not cyanosed and still able to drink.

1. Admit to hospital.
2. Give intranasal oxygen at 1 litre/minute.
3. Give benzyl penicillin 50,000 u/kg IM 6 hourly

COUGH WITH WHEEZE (CONTINUED)

4. Suck out the child's nose gently when necessary.
5. Give oral or nebulised salbutamol if the child is over 12 months old:
   - oral - (1 to 5 years): 1 mg 3 times a day
   - nebulised: 0.5 ml 0.5% solution + 1.5 ml saline.

Moderate bronchiolitis

Wheezing and FAST BREATHING (more than 50 breaths/min), but not cyanosed and still able to drink.

1. Treat as an outpatient.
2. Give an antibiotic for at least 5 days:
   - either procaine penicillin 50,000 u/kg IM once each day
   - or amoxycillin 15 mg/kg/dose orally 8 hourly
   - or ampicillin 25 mg/kg/dose orally 6 hourly
   - or cotrimoxazole 4 mg/kg (of trimethoprim) orally every 12 hours.
3. Give oral salbutamol if the child is over 12 months old:
   - 1 to 5 years: 1 mg every 8 hours

Mild bronchiolitis

Wheezing with no fast breathing (less than 50/min), not cyanosed and still able to drink.

1. Treat as an outpatient.
2. Do NOT give an antibiotic.
3. Give oral salbutamol if the child is over 12 months old:
   - 1 to 5 years: 1 mg every 8 hours
4. Advise the mother:
   - continue breast feeding
   - encourage child to drink
   - encourage child to eat
   - come back if the child gets worse.

RECURRENT COUGH WITH WHEEZE - ASTHMA

Most of these children are more than 1 year old. Chest indrawing and respiratory rate are not reliable for deciding about management. A mildly ill child may have chest indrawing; a seriously ill child may breathe slowly. Antibiotics and antihistamines do not help.

Mild asthma

1. Treat as an outpatient.
2. Give salbutamol orally:
   - 1 to 5 years: 1 mg 3 times daily
   - over 5 years: 2 mg 3 times daily

   OR: Give adrenaline (1/1000) 0.01 ml/kg subcutaneously followed by oral salbutamol.
3. Advise the mother to encourage fluids and small frequent feeds, and to come back if the child gets worse.

Moderate or severe asthma

If the child does not respond to adrenaline or salbutamol rapidly:

1. Admit the child to hospital.
2. Give oxygen.
3. Give nebulised salbutamol (0.5 ml 0.5% solution + 1.5 ml saline)
4. Give aminophylline IV (using burette if possible): 0.4 ml/kg of 250 mg/100 ml ampoule IV slowly over 15 minutes; followed by 0.2 ml/kg given over 1 hour every 6 hours.

NOTE: Further details of the treatment of asthma vary from country to country, and they are beyond the scope of this manual.

COUGH FOR MORE THAN THIRTY DAYS

Tuberculosis

Look for evidence of tuberculosis
- fever
- large lymph nodes
- malnutrition
- someone in the household with tuberculosis.

If there is any suggestion of tuberculosis, arrange for the child to have a chest X-ray and an intradermal tuberculin test (Mantoux test).

Pertussis

A child with pertussis has a cough for many weeks. Pertussis (whooping cough) causes bouts of very severe coughing. Often the child whoops or vomits at the end of the coughing.

Tell the mother that the cough should slowly get better after several weeks. Do NOT give an antibiotic (unless the child is breathing fast or has chest indrawing when he is not coughing).

Asthma

Most children with chronic cough have asthma. A child with asthma may have a wheeze and difficulty breathing out, but these signs may not be present when you see the child. The cough is often worse at night.

Give salbutamol (page 7) - you may need to give it for many weeks. Explain to the mother that the medicine will help the cough, but that it will not cure it. The child will probably "grow out" of his cough when he is older. Do NOT give antibiotics or antihistamines, they do not help.

Inhaled foreign body

There is usually a history suggesting inhalation (page 21).

FEVER

The common causes of fever in children are:

- upper respiratory tract infection
- malaria
- otitis media
- measles
- pneumonia
- meningitis
- diarrhoea
- abscesses
- urinary tract infection

Take a history and do a physical examination to find the cause of the fever. Treat this cause. If fever persists and other causes are excluded, examine the urine.

1. Treat the cause of the fever.
2. Give paracetamol to reduce the fever if the axillary temperature is over 38.5°C. Give 10-15 mg/kg of paracetamol orally every 6 hours.
3. Give antimalarials in malarious areas.
4. Encourage the child to drink and to eat small, frequent feeds. Continue breast feeding.

FIND THE CAUSE OF THE FEVER

ALWAYS TREAT THIS CAUSE

MEASLES

Measles is a viral infection. Treatment with antibiotics is NOT helpful in most cases and does not prevent bacterial complications. Give antibiotics only if there is pneumonia (p.15) or otitis media (p.11).

Most children with measles can be treated as outpatients. Children should be admitted to hospital if they have:

- pneumonia with chest indrawing
- severe dehydration
- convulsions
- or a dark staining rash

1. Give paracetamol if the axillary temperature is over 38.5°C.
2. Encourage the mother to give extra fluids if her child is thirsty.
3. Give antibiotic eye ointment for conjunctivitis only if there is pus in the eye.
4. Treat pneumonia (p.15) or otitis media (p.11), if present, with procaine penicillin, amoxycillin, ampicillin or cotrimoxazole.

REMEMBER: PREVENTION IS BEST

MEASLES IS PREVENTED BY IMMUNIZATION

OTITIS MEDIA - ACUTE

Inflammation of the ear drum, or pus discharging from a ruptured drum for less than two weeks.

Mild redness of the tympanic membrane (eardrum) is not sufficient evidence for otitis media. There must be bulging of the drum or decreased mobility of the drum.

1. Give an antibiotic for at least five days:

   - either procaine penicillin 50,000 u/kg IM each day
   - or amoxycillin 15 mg/kg/dose oral 8 hourly
   - or ampicillin 25 mg/kg/dose oral 6 hourly
   - or cotrimoxazole 4 mg/kg (of trimethoprim) oral every 12 hours

2. Give paracetamol 10-15 mg/kg if the axillary temperature is over 38.5°C, or if the child is in pain.

OTITIS MEDIA - CHRONIC

Pus discharging from the ear drum for more than two weeks. The ear will only heal when it is dry. Do NOT give antibiotics.

1. Wash out the ear

Cut the end off a clean size 8 feeding tube, so that it is only 2.5 cm (1 inch) long. Attach this to a clean 2 ml syringe.

Hold the child's head FIRMLY. Draw up 0.5 ml clean water into the syringe. Put the cut end of the feeding tube GENTLY into the ear and SLOWLY inject the 0.5 ml of water. Then suck out the water and pus from the ear into the syringe. Throw away the dirty water.

Refill the syringe with 0.5 ml clean water, and repeat the treatment until no more pus comes out. You may have to do this once a day for several days. After use, clean the syringe and feeding tube very well. Then soak them in antiseptic solution.

REMEMBER: If you force the feeding tube deep into the ear, you will damage the ear drum.

2. Dry the ear, and show the mother how to dry it

Show the mother how to roll a piece of absorbent paper into a wick and put it in the ear. Leave the wick in the ear for one minute. Then remove it and replace it with a clean wick. Watch the mother keep doing this until the paper is dry when it comes out (about 10-15 minutes). The mother should do this at home at least four times a day, until the ear stays dry. This usually takes about a week. Do not leave anything in the ear between treatments. The child should not go swimming until the ear is dry.

PERTUSSIS (WHOOPING COUGH)

Nasal discharge and fever are followed by coughing, which gets progressively worse. In babies, the main symptom may be apnoea, but in older children there are paroxysms of coughing followed by a whoop, cyanosis, vomiting or a convulsion. Between paroxysms of coughing the child may look quite well.

Admit the child to hospital:

- if the child is less than 6 months old
- or if there are complications such as pneumonia with fast breathing, convulsions, dehydration or malnutrition.

Outpatient treatment

1. Give paracetamol if the axillary temperature is over 38.5°C. Cough suppressants, sedatives, mucolytics and antihistamines are probably NOT effective, and they may be harmful.

2. Give advice to the mother:
   - warn her that the illness may last 6-8 weeks
   - encourage her to feed her child immediately after each vomit
   - tell her to return if her child starts to breathe fast or has a convulsion

3. Prevent the spread of pertussis - immunize any unimmunized brothers or sisters.

Inpatient treatment

1. If the child becomes cyanosed with coughing, give oxygen and GENTLE, BRIEF suction.

2. Give chloramphenicol 25 mg/kg/dose 6 hourly IM or oral to prevent the child from infecting other patients and to treat pneumonia.

PERTUSSIS (CONTINUED)

3. If the child has a convulsion, give phenobarbitone 15 mg/kg IM or oral once, then give 5 mg/kg each day for at least 10 days.

4. Encourage the mother to feed her child immediately after each vomit.

REMEMBER: PREVENTION IS BEST

PERTUSSIS IS PREVENTED BY IMMUNIZATION

PNEUMONIA

Cough and FAST BREATHING (over 50 breaths/minute) with no chest indrawing.

If the child has chest indrawing, see page 15. Look for wheeze (p.5) and stridor (p.20).

Note that careful observation of a child's respiratory rate and chest movements when he is quiet usually provides more reliable information about the severity of respiratory tract infection than does auscultation with a stethoscope.

1. Treat as an outpatient.
2. Give an antibiotic for at least 5 days:
   - either procaine penicillin 50,000 u/kg IM once each day
   - or amoxycillin 15 mg/kg/dose orally 8 hourly
   - or ampicillin 25 mg/kg/dose orally 6 hourly
   - or cotrimoxazole 4 mg/kg (of trimethoprim) orally every 12 hours.
3. Advise the mother:
   - to continue breast feeding
   - to encourage her child to drink
   - to encourage her child to eat small, frequent feeds
   - to come back if her child gets worse.

COUGH AND CHEST INDRAWING

– ADMIT TO HOSPITAL

PNEUMONIA - SEVERE

Cough and CHEST INDRAWING, but not cyanosed and still able to drink.

If the child is cyanosed or not able to drink, treat for very severe pneumonia (p.17).

Look for wheeze (p.5) and stridor (p.20).

1. Admit to hospital.
2. Give benzyl penicillin (crystalline penicillin, penicillin G) 50,000 u/kg/dose IM every 6 hours.
3. Gently suck out the child's nose when necessary to clear the airway.
4. Treat for very severe pneumonia if the child does not improve after 24 hours, or if he becomes cyanosed or unable to drink at any time.

COUGH AND CYANOSIS OR NOT ABLE TO DRINK

- GIVE CHLORAMPHENICOL

PNEUMONIA - VERY SEVERE

Cough and chest indrawing plus CYANOSIS or NOT ABLE TO DRINK.

Look for wheeze (p.5) and stridor (p.20).
If the child is less than 4 weeks old, see page 19.
If the child is drowsy, or has convulsions, do a lumbar puncture.

1. Admit to hospital.
2. Give intranasal oxygen at 1 litre/minute if the child is cyanosed.
3. Give chloramphenicol 25 mg/kg/dose (maximum 1 gram per dose) intramuscularly every 6 hours. When the child has improved (usually after 3 to 5 days), change to oral chloramphenicol. Give chloramphenicol for at least 10 days. If you have no chloramphenicol, give benzyl penicillin plus an aminoglycoside (e.g. gentamicin).
   Children with staphylococcal pneumonia can be treated with chloramphenicol, or with cloxacillin (or oxacillin) plus gentamicin.
4. Gently suck out the child's nose when necessary to clear the airway.
5. If the child is dehydrated and unable to drink, give fluids intragastrically.
   If the child is in shock, give intravenous fluids.
   DO NOT GIVE TOO MUCH FLUID. These children easily develop pulmonary oedema and respiratory failure.

PNEUMONIA - PERSISTENT

An occasional child with pneumonia remains ill despite 10 to 14 days of treatment with adequate doses of chloramphenicol. There is usually chest indrawing, rapid respiratory rate and a low grade fever. Possible causes are:

- tuberculosis: seek history of contact, do Mantoux test and gastric aspirates
- asthma: look for prolonged expiratory phase, listen for wheeze and rhonchi
- foreign body: sudden onset of symptoms while feeding or playing, take inspiratory and expiratory chest X-rays
- heart failure: large heart (greater than 60% of the thoracic diameter in infants), murmur, high venous pressure, hepatomegaly, tachycardia
- chlamydia or pneumocystis infection: may occur even in immunologically normal infants.

1. Record the resting respiration rate each day.
2. If foreign body, heart failure and asthma seem unlikely, consider a trial of high dose cotrimoxazole (trimethoprim 10 mg/kg/dose 12 hourly) to treat chlamydia and pneumocystis. If there is improvement after 1-2 weeks of cotrimoxazole, give it for a total of 3 weeks.
3. If tuberculosis seems likely, or if there is no improvement after 2 weeks of cotrimoxazole, consider a trial of tuberculosis therapy (see page 22).

PNEUMONIA IN NEONATES

A neonate is a baby less than 4 weeks old. However, the same case management is applicable to infants below 2 months old.

It may be difficult to diagnose pneumonia in a neonate - he may not have a cough. A baby should be treated for pneumonia if he is over 4 hours old and has any 2 of the following:

- respiratory rate over 60/minute
- chest indrawing
- grunting.

1. Admit to hospital
2. Give benzyl penicillin 50,000 u/kg IM every 12 hours for at least 5 days AND either
   - streptomycin 25 mg/kg IM once a day
   - or kanamycin 10 mg/kg IM every 12 hours
   - or gentamicin 2.5 mg/kg IM every 12 hours
3. Give intranasal oxygen 0.5 litre/minute if the baby is cyanosed.

STRIDOR

Croup

The main sign of croup is a harsh inspiratory noise called stridor. There is typically an upper respiratory tract infection for one or two days, then the child develops a harsh, barking cough and a hoarse voice. The symptoms are often worse at night.

Children with mild croup can be treated at home. Symptoms may be reduced by inhalation of warm vapour from boiling water (NOT steam). The child should sit on the lap of an adult near a kettle of boiling water. Do not give antibiotics.

Children who have stridor and chest indrawing when they are resting quietly may develop complete obstruction. They should be admitted to hospital because they may need a tracheostomy. Do NOT give oxygen, because it may mask the signs of obstruction. Cold steam, cough suppressants and mucolytics are ineffective. Disturb the child as little as possible, but watch carefully for signs of obstruction: severe chest indrawing, restlessness or pallor. Do not wait until the child develops cyanosis to do a tracheostomy. Give chloramphenicol (see page 17). Tracheostomy is very difficult to perform in small children - transfer the child to an experienced surgeon BEFORE severe symptoms develop if you can.

Diphtheria

Laryngeal diphtheria is one cause of croup, and it may present with inspiratory stridor, a harsh cough and a hoarse voice. Examine the child's throat, and look for a greyish adherent pharyngeal membrane Be very gentle when you examine the throat, because it is very easy to cause the child to get complete airway obstruction. Give 40,000 units of diphtheria antitoxin IM or IV, and procaine penicillin 50,000 u/kg IM each day for 7 days. Tracheostomy may be required for airways obstruction.

STRIDOR (CONTINUED)

Foreign body

An inhaled foreign body may cause stridor and cough of sudden onset.
It is also an occasional cause of wheeze (p.5), of persistent pneumonia (p.18), and of cough for more than 30 days (p.8). There is no preceding illness and the child usually has a normal voice. There is usually a history which suggests inhalation of a foreign body - for example the symptoms began suddenly while the child was eating or playing.
If you suspect a foreign body, refer the child to a surgeon who can do a bronchoscopy.
If the child has fast breathing (more than 50/minute) give an antibiotic (there may be secondary infection).

TUBERCULOSIS

Suspect tuberculosis (TB) in a child with:
- cough for more than 30 days
- persistent fever without an obvious cause
- large lymph nodes
- malnutrition
- someone in the household with tuberculosis.

Investigations:
- chest X-ray
- intradermal tuberculin test (Mantoux test) with 2 TU PPD (RT23 Tween 80); 10 mm or more of induration is positive. The tuberculin test may be negative in children with malnutrition or tuberculous meningitis
- microscopy and culture of lymph node, gastric aspirate, pleural fluid, ascites or cerebrospinal fluid.

Give the TB treatment recommended for children in your country. The standard treatment for TB in children is isoniazid and thiacetazone daily for 12 months, plus streptomycin daily for the first 1–2 months. Short curse chemotherapy is now used in some countries. Two short course regimens are:
- isoniazid, rifampicin and pyrazinamide daily for the first 2 months then isoniazid and thiacetazone daily for the next 6 months
- isoniazid, rifampicin and pyrazinamide daily for 2 months, then isoniazid and rifampicin daily or twice a week for 4 months.

The usual doses of drugs for TB in children are:

Isoniazid	10	mg/kg/day	(maximum	300	mg/day)
Pyrazinamide	25	"	("	2,000	")
Rifampicin	10	"	("	600	")
Streptomycin	15	"	("	1,000	")
Thiacetazone	2.5	"	("	150	")

UPPER RESPIRATORY TRACT INFECTION

Colds, pharyngitis, tonsillitis

Pneumonia (fast breathing, chest indrawing): See pp.15-17
Bronchiolitis (wheeze): see pp.5-6
Otitis media: see pp.11-12

Most children with an upper respiratory tract infection should NOT be given an antibiotic. Do NOT give an antibiotic just because the child has a high fever, purulent nasal discharge or a red throat.

1. Give paracetamol if the axillary temperature is above 38.5°C.
2. Immunize the child if he is due for it.
3. Advise the mother to encourage her child to eat and drink, and to come back if he starts to breathe fast.
4. Do NOT give cough suppressants, mucolytics, vasoconstrictors and antihistamines. They are NOT effective, and they may be harmful

Purulent pharyngitis or tonsillitis

Children under the age of 5 years:

Give antibiotics for purulent pharyngitis ONLY if there are enlarged and tender lymph nodes in the neck.

Give one dose of benzathine penicillin 50,000 u/kg, or 10 days of:
- 50,000 u/kg procaine penicillin IM daily
- or amoxycilin 15 mg/kg/dose oral 8 hourly
- or ampicillin 25 mg/kg/dose oral 6 hourly
- or cotrimoxazole 4 mg/kg/dose (of trimethoprim) oral every 12 hours.

Children aged 5 years or older:

Give antibiotics if pharyngitis is purulent, even if there are no enlarged and tender neck glands:
- one intramuscular injection of benzathine penicillin
- or procaine penicillin, once a day, for ten days
- or oral penicillin V for ten days

TABLE OF DRUG DOSES		WEIGHT (KILOGRAMS)						
		3-5	6-9	10-14	15-19	20-29	30-49	Adult
AMOXYCILLIN 15 mg/kg 8 hourly								
- tab. 250 mg, oral, 8 hourly.....	tab	0.25	0.5	0.5	1	1	1	1-2
AMPICILLIN 25 mg/kg 6 hourly								
- tab. 250 mg, oral, 6 hourly.....	tab	0.5	0.5	1	1	1	2	2
CHLORAMPHENICOL 25 mg/kg/dose 6 hourly								
- vial 1 gram (add 4ml sterile water) IM or IV, 6 hourly.....	ml	0.5	1	1.5	2	2.5	3	4
- susp. 125mg/5ml, oral, 6 hourly.....	ml	6	8	12	15	-	-	-
- cap. 250mg, oral, 6 hourly.....	cap	-	-	1	1	2	3	4

TABLE OF DRUG DOSES

		WEIGHT (KILOGRAMS)						
		3-5	6-9	10-14	15-19	20-29	30-49	Adult
CLOXACILLIN 25-50 mg/kg/dose 6 hourly								
- vial 250 mg (add 1ml sterile water), IV or IM, 6 hourly.....	ml	0.5	0.5	1	1	1.5	2	2
- cap. 250 mg, oral, 6 hourly.....	cap	-	-	1	1	1	2	2
COTRIMOXAZOLE 4 mg/kg/dose trimethoprim								
- tab. 80mg trimethoprim, oral, 12 hrly.	tab	0.25	0.5	0.5	0.5	1	1.5	2
GENTAMICIN 2.5 mg/kg/dose 8 hourly								
- vial 20mg(20,000iu)/ml, IM or IV.....	ml	....0.25 ml/kg....			-	-	-	-
- vial 80mg(80,000iu)/ml, IM or IV								
- 6ml sterile water added.....	ml	1/4 ml/kg (DILUTE)			1	-	-	-
- undiluted.....	ml	....1/16 ml/kg....			1	1.5	1.5	2

TABLE OF DRUG DOSES		WEIGHT (KILOGRAMS)						
		3-5	6-9	10-14	15-19	20-29	30-49	Adult
PARACETAMOL 10-15 mg/kg/dose 6 hourly								
- tab. 100mg, oral.....	tab	0.5	1	1	1.5	Aspirin 10 mg/kg		
- tab. 500mg, oral.....	tab	-	0.25	0.25	0.5	Aspirin 10 mg/kg		
PENICILLIN								
- BENZYL (PEN G) 50,000 u/kg/dose 6 hrly								
Vial 1,000,000u (add 2ml sterile water)	ml	0.5	1	1	2	2	2	2
- PROCAINE 50,000 u/kg daily								
Vial 4,000,000u (add 5ml sterile water)	ml	0.5	0.75	1	1	1.5	1.5	2
SALBUTAMOL								
- tab. 2 mg, oral, 3 times a day.....	tab	-	-	0.5	1	1	2	2
- tab. 4 mg, oral, 3 times a day.....	tab	-	-	0.25	0.5	0.5	1	1

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