

STANDARD TREATMENT GUIDELINES

Management of Management of common
Respiratory Infections in Children in India

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सत्यमेव जयते

Ministry of Health & Family Welfare
Government of India

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1. INTRODUCTION

Acute respiratory infections (ARI) encompass viral and bacterial infections of the respiratory tract. **NFHS 3 data** suggests that as many as 6% children under age five years in India showed symptoms of ARI at some time in the two weeks preceding the survey. While upper respiratory infections are often self-limiting, lower respiratory infections, in particular, pneumonias, pose a life-threatening situation. Most pneumonia deaths are caused by bacteria. Pneumonias are the number one cause of under-5 child mortality, responsible for nearly 400,000 deaths in India annually. These deaths can be prevented by appropriate treatment with antibiotics.

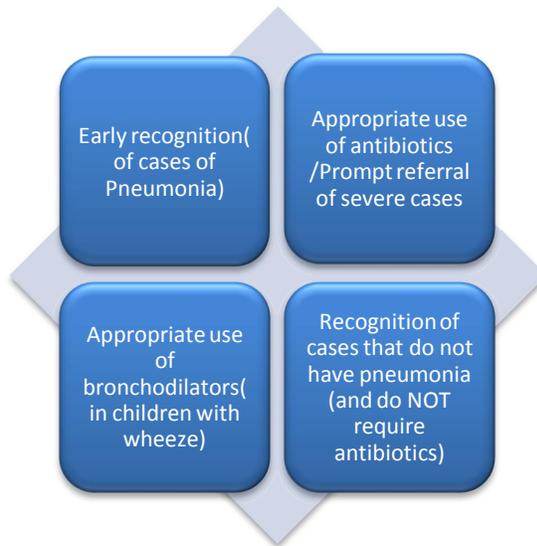
Pneumonia can be distinguished from other respiratory tract infections by the use of simple clinical signs such as respiratory rate and lower chest indrawing. Children with acute cough but who do not have any sign of pneumonia usually would commonly have viral upper respiratory infection and should not receive antibiotics. This is important as unnecessary exposure can lead to an increase in antimicrobial resistance in the community.

The objectives of this guideline are:

- Promote recognition of cases of pneumonia among children with suggestive symptoms like cough, and/or difficult breathing,
- Recognize the severity of illness and need for referral,
- Institute appropriate treatment of ARI using standard treatment protocol at community and facility level.

EFFECTIVE CASE MANAGEMENT OF ARI

Effective case management includes:



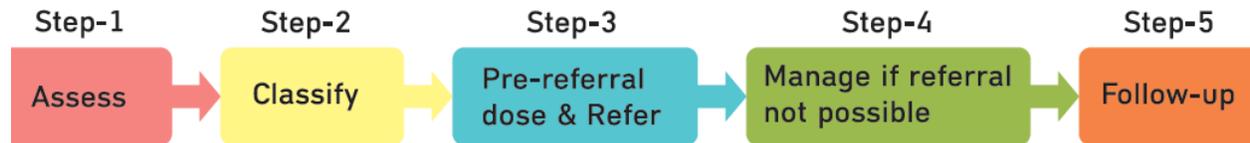
- Early recognition of cases of pneumonia,
- Appropriate use of antibiotics against the major causes of bacterial pneumonia, prompt referral of cases of severe pneumonia and providing pre-referral treatment,
- Providing good supportive care including appropriate and effective use of oxygen in health facilities to treat hypoxia which is usually in the causal pathway of pneumonia related death,
- Appropriate use of bronchodilators in children with wheeze at health facility and identification of pneumonia mimickers for their rational therapy,
- Recognition of cases that do not have pneumonia and do NOT require antibiotics but may benefit from supportive treatment.

2. Key Recommendations

Assessment and Treatment of Sick Young infant (age < 2 months):

i. At Community Level:

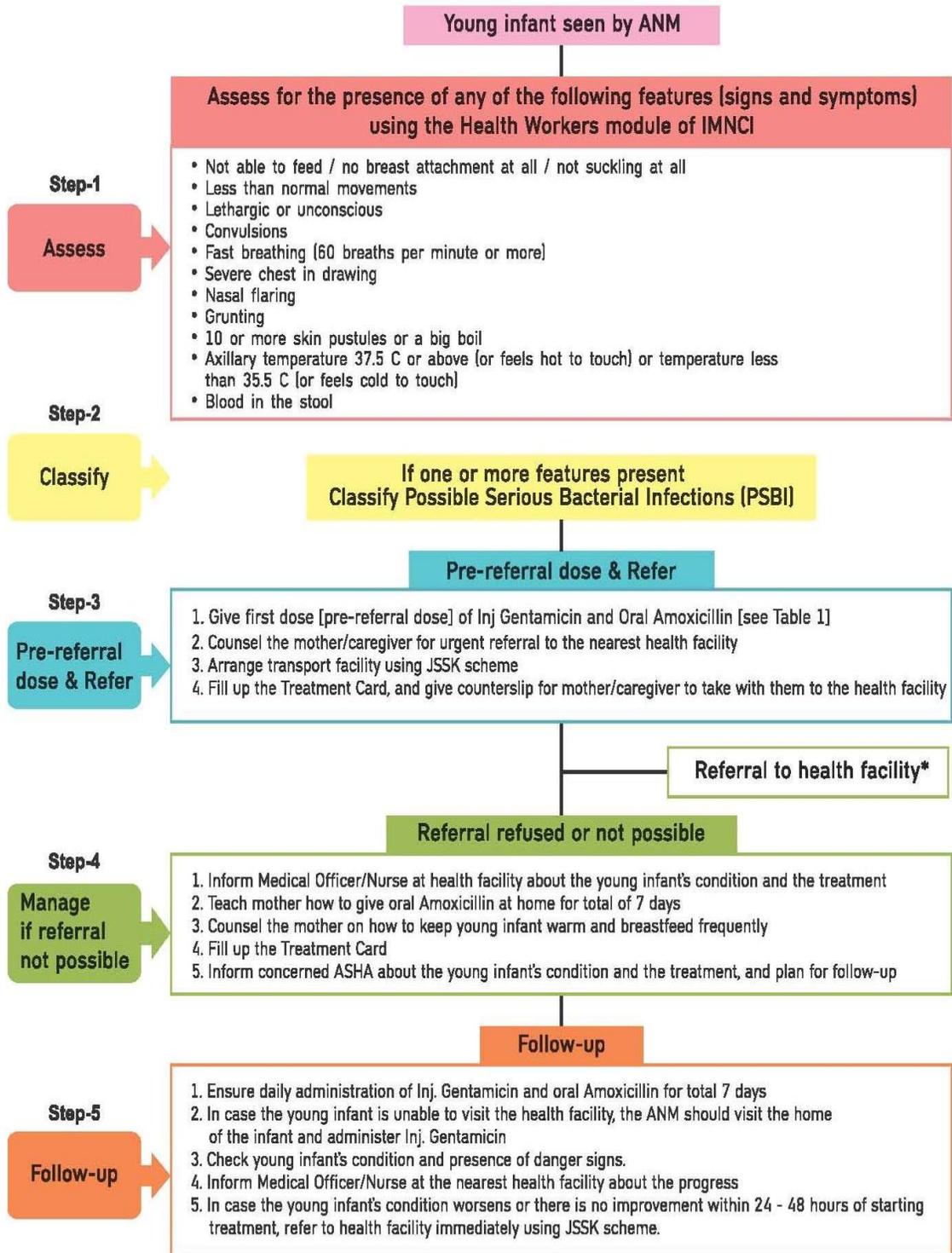
The ANM should follow the following five steps for diagnosing and treating sepsis in young infants:



The Flow Chart (on nextpage) outlines the five steps in detail.

Any young infant brought to ANM is assessed for presence of signs described in assessment. If one or more signs are present the infant is classified as PSBI. ANM will counsel the mother regarding referral of such a baby using free referral under JSSK and will start the pre referral dose of Injection Gentamicin and Syp Amoxicillin described in the Table XX based on the weight of the infant.

Flow Chart: Management of sepsis in young infants by the ANM



Summary of antibiotic treatment for sepsis in a young infant

Young infant's weight	Amount of Gentamicin to be given intramuscularly as Injection (contains 80 mg in 2 ml vial)	Amount of Amoxicillin to be given per-orally as Syrup (contains 125mg / 5 ml)
Less than 1.5 Kg	To be referred to higher facility	
Above 1.5 kg – upto 2.0 Kg	0.2 ml	2 ml
Above 2.0 kg – upto 3.0 Kg	0.3 ml	2.5 ml
Above 3.0 kg - upto 4.0 Kg	0.4 ml	3 ml
Above 4.0 kg - upto 5.0 Kg	0.5 ml	4 ml
Route of administration	intramuscular	oral
Dosage	5 mg/kg/dose * Once a day	25 mg/kg/dose** Twice a day

*Precaution: If the treatment is to be continued same vial can be reused for the entire course of 7days, provided it is stored properly and its contents do not change color or have turbidity. In case of any doubt it is better to use a new vial

**The ANM will instruct the mother how to reconstitute the syrup if it is in powder form

This table will help the ANM in giving the correct doses of both the syrup and injectable. She has to weigh the infant before starting the treatment. Similarly ASHA can also weigh the infant and start Syp Amoxicillin in case she classifies the infant as a case of fast breathing.

Steps to be taken by the ANM before and during referral to health facility

1. Warm the young infant by skin to skin contact with mother/care giver if temperature less than 35.5 (or feels cold to touch) while arranging referral and during transport.
2. Treat to prevent low blood sugar using Health Workers module of IMNCI
 - If the child is able to breastfeed: Ask the mother to breastfeed the child.
 - If the child is not able to breastfeed but is able to swallow: Give 20-50 ml (10 ml/kg) expressed breast milk or locally appropriate animal milk (with added sugar) before departure. If neither of these is available, give 20-50 ml (10 ml/kg) sugar water.
 - To make sugar water: Dissolve 4 level teaspoons of sugar (20 grams) in a 200-ml cup of clean water

ii. At the Facility Level:

Assessment and Treatment of Sick Young Infants (0-2 months of age) for evidence of Pneumonia with/without sepsis/meningitis (Serious bacterial infection) at a Healthcare Facility:

Pneumonia is classified as severe and very severe disease in young infants because of higher risk of hypoxia, apnea and death.

Clinical category	Essential feature
Possible serious bacterial infection – (pneumonia, septicemia or meningitis)	<p>Convulsions or Fast breathing (Respiratory rate \geq 60 per minute) or Severe chest indrawing or Nasal flaring or Grunting or Not able to feed</p> <p>Bulging fontanelle or</p> <p>Lethargy or unconsciousness or Less than normal movement or Axillary temperature \geq 37.5°C or more or temperature $<$35.5°C)</p>

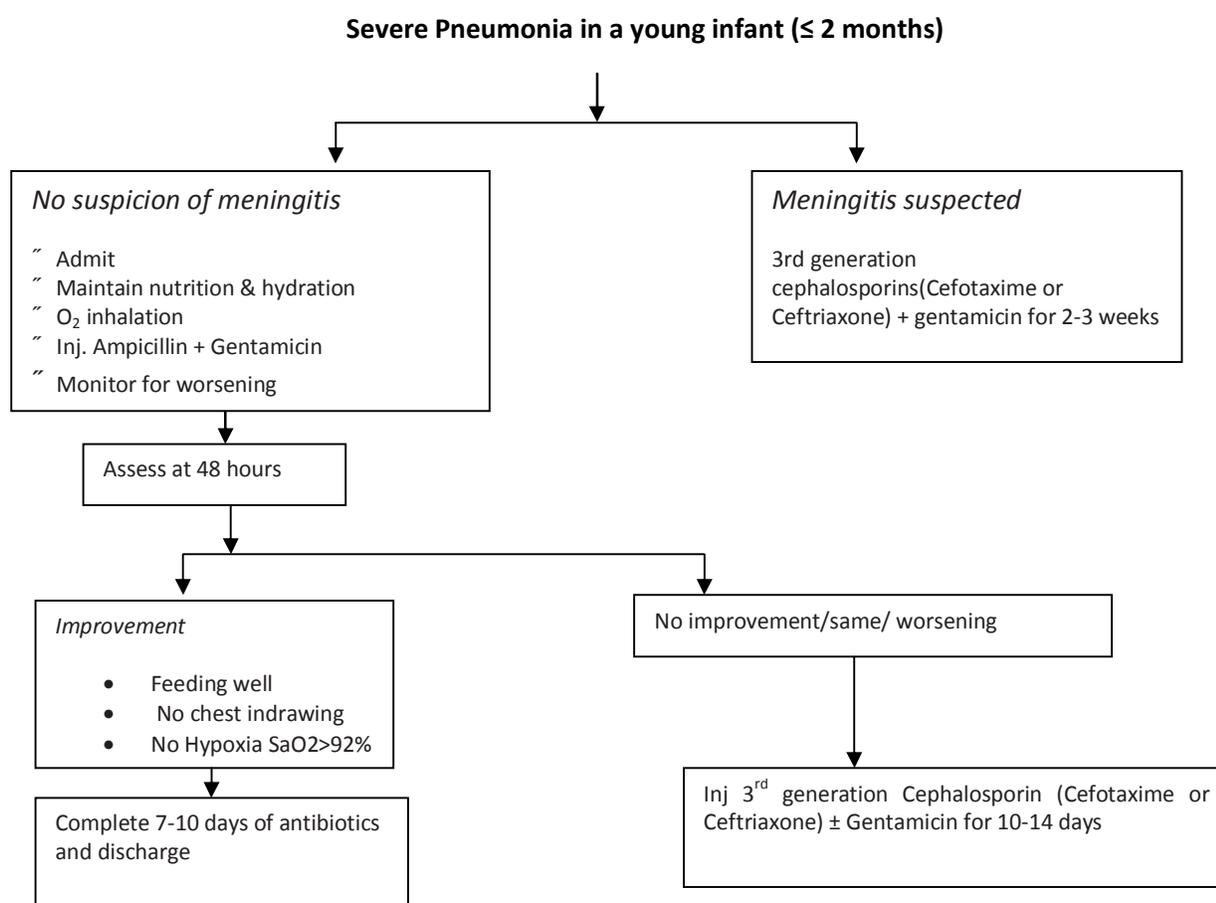
POINTS TO REMEMBER WHILE ASSESSING YOUNG INFANTS

- As cough may be absent, respiratory rate should be measured in all neonates thought to be ill by the mother or those who have acute feeding problems. Cough is not an essential criterion for screening for pneumonia in this age group.
- The normal resting respiratory rate is higher and more variable than in the older infant, therefore, the threshold for the diagnosis of pneumonia is 60 breaths per minute or more.
- In the young infant the respiratory rate should be measured for a full minute since they may have periods of apnea or irregular breathing normally. If the respiratory rate is fast, the rate should be counted for a second time; the fast breathing is significant only if second count is also $>$ 60 bpm. The respiratory rate should be counted when the baby is calm and not crying or feeding.
- When normal young infants are observed carefully, they often have mild chest indrawing because their chest wall is soft. However, severe chest indrawing, which is very deep and easy to see, is a sign of severe pneumonia. In case of doubt, the infant should be observed in different position, lying flat in the mother’s lap or on a bed. Chest indrawing is significant if it is

is present all the time, in all positions and not only when the child is crying or upset but also when calm and peaceful.

- It is important to consider the possibility of co-existing meningitis in sick young infants as the drug therapy (choice and duration of antibiotic) will be different for meningitis. Meningitis is suspected in the presence of bulging fontanelle, seizures or staring spells or altered sensorium. CSF examination should be done in such situations to confirm the diagnosis of meningitis.

Fig 4 : Management of Severe Pneumonia in children aged ≤ 2 months



NOTE

A blood culture and an X-ray chest should be obtained if feasible. Any findings suggestive of meningitis indicate the need for a cerebrospinal fluid examination. Blood sugar and calcium estimation may be required if convulsions occur. Decisions regarding choice of antibiotics can be made even when facilities for culture are not available particularly for babies born at home (Table 7). Hospital born babies may have infections with organisms peculiar to that setting and blood cultures are then more useful.

Table 7: Antibiotic therapy for pneumonia/sepsis in infants <2months

Antibiotic	Each Dose (mg/kg/dose)	Frequency		Route	Duration (Days)
		< 7 days age	> 7 days age		
Inj. Ampicillin*	50	12 hrly	8 hrly	IV, IM	7-10
And Inj. Gentamicin or	5	24 hrly	24 hrly	IV, IM	7-10
Inj. Amikacin	15	24 hrly	24 hrly	IV, IM	7-10

*If concomitant meningitis is suspected the drugs should be given IV and Inj cefotaxime 50 mg IV 8 hourly is used instead of Ampicillin. The total duration of therapy in meningitis is 2-3 weeks.
In case of suspected staphylococcal infection Injection Cloxacillin 50mg/kg 8hrly is to be added to the regime.

Assessment and Treatment of Children between 2months -5years

i. At Community Level:

- For all sick children, the community health worker should first check for general danger signs given in box below. Presence of any one of the general danger signs mandates quick assessment, pre-referral treatment and urgent referral to a hospital.

GENERAL DANGER SIGNS

- | | |
|---------------------------|-----------------------------|
| a) Convulsions, | b) Not able to feed /drink, |
| c) Lethargic/unconscious, | d) Vomiting everything |

In addition in children with cough or difficult breathing, the respiratory rate is counted and patient assessed for presence of lower chest indrawing.

- Respiratory rate should always be counted for full 1 minute when the baby is calm and not feeding. A respiratory rate of over 50 breaths per min in children between 2mo-1 year and over 40 breaths per minute in children 1-5 years of age is called as fast breathing and this simple clinical sign is used by the health worker to identify likely cases of pneumonia in the community.
- Presence of lower chest wall indrawing (LCI) - which is a definite inward movement of the lower chest wall on breathing in- identifies cases with severe disease in whom lung

now is getting stiffer. It is important to point out that the definition of chest indrawing does not include intercostal or supraclavicular retractions.

- Pulse oxymetry is an important tool to identify children with co-existent hypoxia (SpO₂ <92%) and should be used wherever the facilities exist with the worker.
- Children with history of recurrent wheezing (respiratory distress) can be identified by the health worker and should be given an initial trial with bronchodilators before starting antibiotics for rapid breathing. The worker should either give a single oral or equivalent inhaled doses of salbutamol (to be detailed depending on what formulation is available- mdi nebulizer etc) and look for response over next 1 hour. In case of a good response with respiratory rate coming down and indrawing disappearing, the child may be treated with bronchodilator alone and not given any antibiotics; else the bronchodilator (salbutamol) is added to the antibiotic regimen.
- The community health workers based on the assessment for danger signs, respiratory rate and chest indrawing and SpO₂ (where pulse oxymetry is possible) will classify these children into action oriented categories as given in Table 2 below.
- Children aged 2–59 months require immediate referral if they have signs of severe pneumonia (central cyanosis, stridor at rest inability to drink or breastfeed, convulsions, lethargy, or unconsciousness or SpO₂ of <92% (where facilities exist).

Table 2. Child (2 months to 59 months of age) with cough and or difficulty in breathing^a:
Presenting to a Health worker (ASHA, ANM)

Signs	Classify as	Management
<ul style="list-style-type: none"> • General danger signs (inability to breastfeed or drink, lethargy or reduced level of consciousness, convulsions) 	Severe pneumonia	Refer to health care facility after giving first dose of amoxicillin for assessment by doctor. If seen by ASHA, get assessment by ANM*
<ul style="list-style-type: none"> • Fast breathing: Respiratory rates <ul style="list-style-type: none"> ○ 2-11 months ≥50/min ○ 12-59 months ≥40/min • Chest Indrawing • No signs of severe pneumonia 	Pneumonia	Give cotrimoxazole* for 5 days and assess regularly
No signs of severe pneumonia or pneumonia	No pneumonia	<ul style="list-style-type: none"> • Soothe the throat and relieve cough with safe remedy). • Advise the mother when to return. • Follow up after 5 days if not improving, If coughing for more than 14 days refer to doctor for further investigation

^a Children with audible wheeze and/or history of wheezing in the past should be given a trial of bronchodilator and those who show good response may not need to be treated as pneumonia.

* In case the family is not willing for referral, the ANM should administer oral amoxicillin with daily monitoring while preparing/ convincing the family for referral

Please note:

- The mother is advised to continue feeding the child during the illness. Breast feeding may be continued.

Table 3. RECOMMENDED HOME MADE COUGH REMEDIES		
1.	Sugar, Ginger, Lemon juice, Basil/ tulsi leaves	- Make hot drink*
2.	Sugar, Ginger, Lemon juice, Mint	- Make hot drink*
3.	<i>Saunf, Elaichi</i> , Ginger, Sugar	- Tea*

*Let it cool until it is lukewarm before giving to the child

Follow up care

The mother should also be advised on how to give drugs at home and to look for signs of worsening illness like inability to feed, breathing harder and faster, and / or child getting sicker than before. If any of these signs appear she should report immediately, or else, she should return after 2 days for follow up. At followup, the worker should check whether the child is improving (Cough is better) or worsening (Appearance of fast breathing, LCI or any sign of Very severe pneumonia) . Any child showing signs of worsening on follow-up should be referred immediately to a health facility. In case the child is found to have audible wheeze, oral salbutamol may be given before referral.

- ii. At Facility Level:

INITIAL ASSESSMENT:

- At the health facility it is important to make the distinction between pneumonia and other ALRIs and other clinical confounders. This requires a relevant history and appropriate examination including auscultation, to check for wheeze and complications of pneumonia.
- First of all an initial quick assessment is done to identify the children at immediate risk of death. Every child should be assessed for his airway, breathing and circulation and appropriately treated, if needed even before more detailed assessment. Oxygen should be given depending on severity of distress at admission. The patient should be assessed for *general danger signs* (history of convulsions, presence of lethargy/altered sensorium, inability to feed and vomiting everything).
- A detailed examination including:

Respiratory rate- Respiratory rate should always be counted for full 1 minute when the baby is calm and not feeding.

Chest indrawing - This is defined as definite inward movement of lower chest wall on breathing in. This should be looked for when the child is not feeding or crying.

Stridor – It is a harsh inspiratory sound which may be accompanied with supra-sternal recession.

Signs of severe respiratory distress – head nodding, grunting, irregular breathing, diaphoresis, cyanosis, apnoea, SpO₂< 92% etc.

Complete assessment includes complete examination to rule out other causes of respiratory distress and associated infections (e.g. diarrhoea, meningitis, measles, or malaria). Congestive heart failure can mimic the signs of pneumonia and the two problems can also co-exist.

Chest auscultation for signs of pneumonia including:

- decreased breath sounds
- bronchial breath sounds
- crackles
- abnormal vocal resonance (decreased over a pleural effusion, increased over consolidation)
- pleural rub
- Wheeze, can sometimes be associated with pneumonia in small children. It may even be audible without stethoscope in severe cases.

- Presence of severe malnutrition: If on examination the child’s weight for height is less than -3SD or has bilateral pedal oedema or visible severe wasting or MUAC <11.5cm, the patient is treated as a case of severe acute malnutrition as per standard protocols. Such children if treated only for their respiratory problem will continue to be at high risk of death. The underlying severe malnutrition also needs to be addressed appropriately.

CLASSIFICATION:

- It is recommended that a trial of rapid-acting bronchodilator is given to children with current wheeze and fast breathing before treating as pneumonia. This protocol will identify children with recurrent wheeze and curtail the unwarranted usage of antibiotics. Infants with first episode of wheeze, who usually have viral bronchiolitis, also do not need antibiotics though the response to initial bronchodilators may not be consistently seen in such a case. The treatment of children with wheeze thus needs to be based on the clinical evaluation of the patient as well as response to inhaled bronchodilators as per initial algorithm (Fig. 1).
- Among those finally now diagnosed as pneumonia, the physician should assess the severity of illness using the clinical signs of respiratory distress and hypoxia, as well as need for hospitalization as given in the Tables 4 and 5. Children with severe acute malnutrition may need different management and have been detailed separately later.

Table 4 - Indications for hospitalization in a child with Pneumonia	
1.	All children diagnosed as pneumonia with age < 2 months(PSBI)
2.	Age > 2 months with <ul style="list-style-type: none"> • Non-response or worsening on domicilliary therapy • Convulsions • Inability to drink/feed • Grunting/ head nodding • lethargy/altered sensorium • Oxygen saturaion < 92% • Cyanosis • Severe Acute Malnutrition

Cough and / or Difficult breathing

**Table 5. Child (2 months to 59 months of age) with cough and or difficulty in breathing:
Presenting to a facility (doctor)***

Signs	Classify as	Management
<ul style="list-style-type: none"> • General danger signs (inability to breastfeed or drink, lethargy or reduced level of consciousness, convulsions) • Chest indrawing with oxygen saturation <92% or SpO₂ facilities not available 	Severe pneumonia	Admit immediately Administer intravenous Ampicillin (or Penicillin) Plus Gentamicin Give oxygen if saturation < 92%. Manage airway, as appropriate.
<ul style="list-style-type: none"> • Fast breathing: Respiratory rates <ul style="list-style-type: none"> ○ 2-11 months ≥50/min ○ 12-59 months ≥40/min And/or <ul style="list-style-type: none"> • Chest indrawing (SpO₂ ≥ 92%) And No signs of severe pneumonia	Pneumonia	<ul style="list-style-type: none"> • Home treatment • Give Amoxicillin for 5 days • Soothe the throat and relieve cough with a safe remedy • Treat high fever if present • Treat wheeze if present • Assess regularly
No signs of severe pneumonia or pneumonia	No pneumonia	Soothe the throat and relieve cough with saferemedy). Advise the mother when to return. Follow up after 5 days if not improving. If coughing for more than 14 days refer to doctor for further investigation
* If the child has wheezing, Give 3 doses of inhaled salbutamol and reassess If there is no improvement in symptoms: classify as Severe pneumonia OR pneumonia		

MANAGEMENT:

OPD BASED TREATMENT OF NON-SEVERE PNEUMONIA IN CHILDREN 2MO-5 YRS OF AGE SEEN IN A HEALTH FACILITY

- If the child has only fast breathing and / or lower with chest indrawing without danger signs, having oxygen saturation >92% in room air and is able to feed, he can be treated at home with antibiotics (Fig.2). *The patients with wheeze should be assessed for fast breathing after a trial of rapidly acting bronchodilator as per initial algorithm (Fig. 1).* Many patients with history of recurrent wheeze may have signs suggestive of pneumonia on presentation which may resolve partially or completely after a trial of bronchodilator.
- The antibiotic of choice is amoxicillin (25mg/kg twice daily or 15 mg/kg per dose thrice daily for 5 days). While under the CCM co-trimoxazole is recommended for treating non-severe pneumonia by an ASHA worker but for children diagnosed by a physician at a facility level the preferred drug is oral amoxicillin. This is recommended due to the presence of high resistance to Co-trimoxazole.
- Earlier children with lower chest indrawing were considered to have severe disease. More recently studies have documented that pneumonia with chest indrawing without hypoxia/

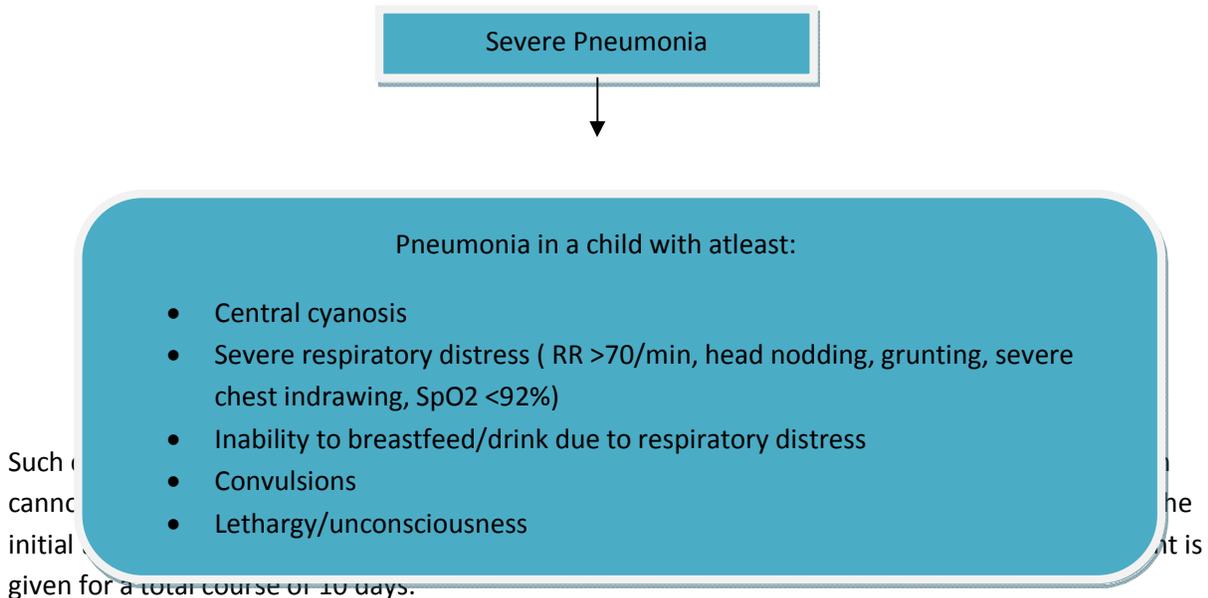
danger signs and are able to feed can be managed on ambulatory basis with oral amoxicillin (Lodha R, Kabra SK, Pandey RM. Antibiotics for community-acquired pneumonia in children. Cochrane Database Syst Rev. 2013 Jun 4;6:CD004874.) Therefore children with chest indrawing without danger signs, having oxygen saturation $\geq 92\%$ in room air and are able to feed, are now classified as pneumonia (non-severe) and are to be managed on ambulatory basis with oral amoxicillin for 5 days.

Follow up care

The mother should be advised on how to give drugs at home and how to look for signs of worsening illness like inability to feed, breathing becoming harder and/or child getting sicker than before. The patient is followed up after 2 days to check for signs of improvement and to review treatment as per algorithm detailed in Fig. 2.

The treatment is continued for 5 days if the patient improves. If patient worsens and shows signs of deterioration, he should be admitted, re-evaluated and treated as severe pneumonia. If the patient is same, and was taking his / her drugs appropriately, the same treatment is continued for 24 more hours. **Should these be for severe pneumonia sent home too?** The patient should also be checked again for wheeze and in case of auscultable wheeze or history of recurrent wheeze, the patient is treated with oral bronchodilator (Tab **Syp Salbutamol**) in addition. If there is still no improvement over next 24 hrs (i.e. after 72 hours of therapy), a change to second line drugs is recommended. All children whose cough has been persisting for over 2 weeks should be investigated for TB.

FACILITY BASED TREATMENT OF SEVERE PNEUMONIA IN CHILDREN 2MO-5 YRS OF AGE



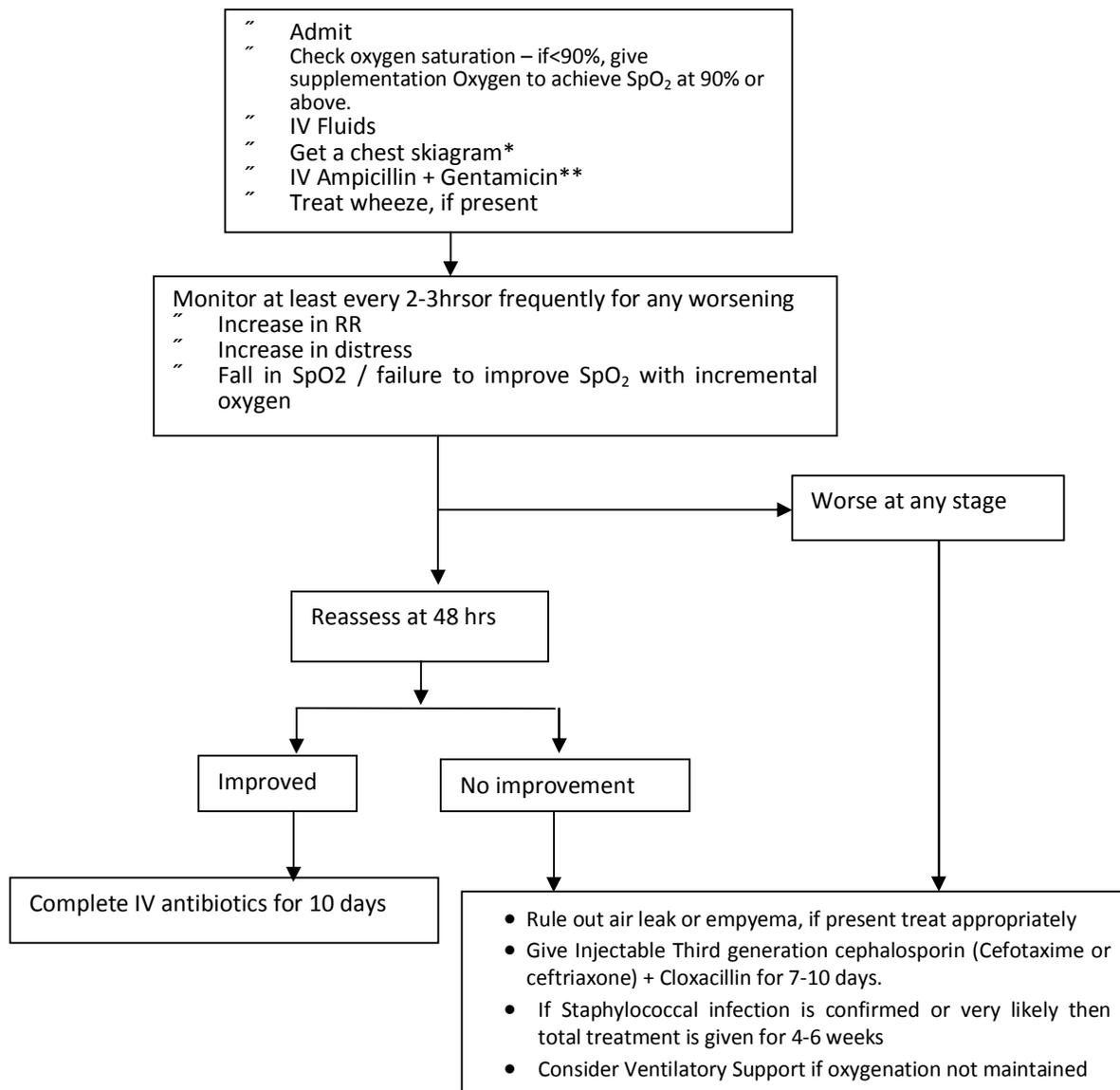
These children need a very close monitoring for distress and oxygen saturation as they are at higher risk of complications. All children with hypoxia (suspected on clinical signs or pulse oximetry SpO₂ <92%) should be given oxygen. The clinical signs are *per se* a poor predictor of hypoxemia and therefore using a pulse oximeter is always preferable. While Hypoxia is one of the major causes for high mortality in pneumonia, oxygen is otherwise a precious source and therefore the use of oxygen therapy as dictated by SpO₂ will ensure least wastage and directed therapy to the mostneedy cases.

It is important to have high index of suspicion for staphylococcal infection, particularly in cases with severe disease, as the initial choice of antibiotic does not adequately cover this albeit less common but more severeinfection. Staphylococcal pneumonia is suspected if any child with pneumonia has:

- Rapid progression of the disease, or
- Pneumatocoele, or Pneumothorax, or Effusion on chest X-ray, or
- Large skin boils or abscess or infected scabies or
- Post- Measles pneumonia, which is not responding within 48 hours to the initial therapy.

To cover for staphylococcal infection, Injection Cloxacillin should be added to the initial regime. Once the child improves, continue Cloxacillin orally 4 times a day for a total course of 3 weeks at least. Children with complicated pneumonia (e.g. Empyema) need longer therapy for 4-6 weeks.

Fig 3: Facility based treatment of Severe Pneumonia in a child of 2 months – 5 years age



**Chest X-ray should be done for all cases of very severe pneumonia to look for empyema, pneumothorax and other complications after stabilization*

***Suspecting Staphylococcus infection: Add Cloxacillin to the regimen.*

MANAGEMENT OF PNEUMONIA WITH COOMORBIDITIES

PNEUMONIA IN A CHILD WITH SEVERE ACUTE MALNUTRITION

Pneumonia is not only more common but is also more likely to be fatal in children with severe acute malnutrition. Besides it may be caused by wider range of bacteria including gram negative bacteria. Clinical presentation is less specific and may overlap with sepsis.

- The child should be admitted in view of severe acute malnutrition and be treated as severe pneumonia even though they may not have chest indrawing or signs of severe respiratory distress. Children with severe PEM sometimes can have pneumonia without fast breathing though will have other signs of respiratory distress like accessory muscle use and nasal flaring. A chest radiograph should be obtained, wherever possible.
- Inj Ampicillin and Gentamicin is the antibiotic of choice as it gives an extended cover for gram negative infections which are seen more often in cases with SAM. The antibiotics are to be given for 7-10 days. Inj Cloxacillin should be added whenever there is suspicion of staphylococcal infection (see above).
- Management of severe acute malnutrition i.e. maintaining temperature, prevention and treatment of hypoglycemia and appropriate feeding is essential additional treatment needed for favourable outcome.
- Pulmonary tuberculosis and HIV should be diagnostic consideration if the patient does not show expected response.

PNEUMONIA IN A CHILD WITH HIV

Incidence of pneumonia, including bacterial pneumonia, is much higher for HIV-infected children than for HIV-uninfected children. The common causes of bacterial pneumonia are similar but the range of bacterial pathogens is wider. Opportunistic infections such as *P. jiroveci* and cytomegalovirus are also seen and are associated with poor outcome. Pulmonary tuberculosis is common among HIV-infected infants and children presenting as severe pneumonia in tuberculosis-endemic regions and it may even present as an acute pneumonia. Mixed infections and treatment failure are common. Case-fatality rates are reported to be 3–8 times higher than in HIV-uninfected children.

Table 8: WHO recommendation for management of pneumonia in HIV-infected children	
Nonsevere pneumonia	Severe pneumonia
Oral amoxicillin for 7 days <ul style="list-style-type: none"> • Avoid trimethoprim-sulphamethoxazole in those taking it as prophylaxis • Regular follow-up to monitor progress 	Admit to hospital: <ul style="list-style-type: none"> • Intravenous (i.v.) ampicillin/penicillin and gentamicin • Treat <i>P.jirovecii</i> with i.v. co-trimoxazole and corticosteroids • Give oxygen if hypoxia • If not improving within 72 h change to second line antibiotic: ceftriaxone

ANNEXURE 1: SUPPORTIVE THERAPY FOR PNEUMONIA

1. OXYGEN THERAPY

Who to give - Hypoxemia is reported in upto 59% of children hospitalized with pneumonia. Children with hypoxemia are at 4 times increased risk of death as compared to those without hypoxia. The clinical signs suggestive of severe hypoxemia - central cyanosis, and severe respiratory distress (inability to breastfeed, nasal flaring, head nodding, severe chest indrawing, grunting and lethargy) indicate that child should be given oxygen immediately on admission and most of these will require high flow rates to start with. The clinical signs are useful but have variable sensitivity and specificity and do not accurately identify all hypoxaemic children. Children with severe pneumonia do not have signs of severe respiratory distress but a significant proportion of these too may have hypoxemia. The clinical examination of all hospitalized children with pneumonia should therefore be supplemented with the measurement of SaO₂ by pulse oximetry. At sea level SaO₂ of less than 90% is suggestive of hypoxemia and need for oxygenation in infants and children(see box).

Give oxygen to children with

- Central cyanosis or
- Severe respiratory distress
 - Resp rate >70/min
 - Inability to feed
 - Head nodding
 - Grunting
 - Nasal flaring
 - Lethargy
- Oxygen saturation <90%

OXYGEN DELIVERY:

Various devices can be used to deliver oxygen. Whatever be the device chosen, oxygen should be given to a child in the most non-threatening manner as anxiety and crying increases oxygen consumption and possibly respiratory distress. If a child is upset by one method of oxygen support, attempt should be made to deliver the oxygen by an alternative technique. It is important to have the proper flow meters to control oxygen flow rates and to use rates appropriate to the device selected and patient's condition.

DEVICES FOR OXYGEN DELIVERY:

Nasal catheter : A 8 FG catheter should be inserted to a depth equal to distance between the side of nostril to the inner margin of eyebrow. The catheter should be kept clear of mucus. In case nasogastric

tube is required for feeding, it should be inserted through same nostril as the oxygen catheter and the other nostril should be kept clear of all obstructions including mucous.

Nasal prongs: It consists of two short soft prongs that arise from oxygen supply tubing and are designed to lie just within the nostrils. After placement inside the nostrils, these should be secured with a piece of tape on the cheeks near the nose. Nasal prongs are preferred over nasal catheter for delivering oxygen to young infants and children with severe croup or pertussis as catheters can provoke paroxysms of coughing. **Face Mask:** It is a plastic mask connected to an oxygen source, fitting over the patient's nose and mouth with side-to-side perforations that allow room air entrance when placed over the infant's face. Usually high flow rates are needed (flow rates 5-6 litres/min) to avoid risk of carbon dioxide accumulation. It interferes with feeding and many infants refuse to keep the mask on. However, this is a good device to achieve oxygenation in severely distressed and in emergency situations when high flow oxygen is required.

Oxygen hood or Head box: It is a clear plastic or acrylic box placed surrounding the infant's head. It needs high flow rates (8-10 L/min) to prevent re-breathing of carbon dioxide. With its usage Infants' mobility and feedings get limited. Unlike nasal cannula, it does not have increased risk of gastric distension or airway obstruction, but it is a rather wasteful manner of oxygen delivery and should not be used routinely in the wards.

Wafting or blow by method - Children may not tolerate any of the above methods and get agitated by catheters or face mask. In such case oxygen can be administered by non-contact methods - giving high flow oxygen (8litre/min) through face mask or oxygen tubing kept aimed at the airway but held a little away from the face of the child. This method should be used initially for a short period and replaced with any other method of delivery discussed above as soon as the patient can tolerate it. This method can also be used as an alternative for patients on oxygen therapy as a short term measure of oxygen therapy during feeding or dressing.

Flow rate of oxygen- A flow meter should be used with oxygen delivery system to give a flow rate as below, when using nasal catheters/prongs.

Young infants upto 2 minutes 0.5 -1 litre per minute

2 months -5 years 1-2 litres per minute

Monitoring a child on oxygen therapy:The infant or child on oxygen should be monitored closely to identify and correct any problem in delivery of oxygen and for signs of improvement.

Check list for the patient on oxygen therapy:

- The position of prongs or catheter is checked to ensure that they are in place and are not blocked by mucus.
- Oxygen flow rate and connections are appropriate.

- Heart rate, respiratory rate and signs of respiratory distress are not increasing, suggesting a need for increasing FiO₂ and other measures as discussed before for worsening cases.
- Oxygen saturation by pulse oximeter aiming to maintain it above 90%.

Duration of oxygen therapy: Oxygen should be given continuously until the child is able to maintain a SaO₂>90% in room air. When the child is improving the oxygen flow rate is gradually reduced over a period of hours as long as the patient tolerates it. Once the patient is stable on very low flow rates (0.5-1lt/min) with no or minimal distress, the child is taken off oxygen for a few minutes. If the SaO₂ remains above 90%, oxygen can be discontinued. The saturation is checked again 1/2 hour later, and 3 hourly thereafter on the first day off-oxygen to ensure the child remains stable. Where pulse oximetry is not available, the duration of oxygen therapy is guided by clinical signs, but these are less reliable.

2. TREATMENT OF FEVER

If the child has fever give antipyretic such as paracetamol 15 mg/kg as and when required. Avoid nimuselide in infants and ibuprofen in children with wheeze.

3. SYMPTOMATIC TREATMENT OF COUGH

Cough is a protective reflex and should not be suppressed in children with ALRI. There is no role of cough suppressants, mucolytic agents and cough expectorants in ALRI. The parents should be counselled regarding the adverse effects of these agents in children.

4. FLUIDS

A child with pneumonia who is sick enough to receive oxygen is generally not fit to receive oral or nasogastric feeding. Such patients require intravenous fluids. These children usually have one or more of the following:

- Cyanosis
- Restlessness
- Severe lower chest indrawing
- Grunting
- Shock and dehydration
- Poor acceptance of oral fluids

If there are indications for use of maintenance IV fluids, amounts given below in Table 9 are used:

Table 9.Maintenance fluid requirement ml/day	
Body weight	Fluid ml/day
Upto 10 kg	100 ml/kg/ day
11-19 kg	1000ml + 50ml /kg for each kg bw in excess of 10kg./ day

Avoid giving IV fluids if the child is not in severe respiratory distress. Intravenous fluids should not be used merely to maintain the patency of IV catheter for administering antibiotics. Fluid administration in cases of pneumonia should be carefully monitored to prevent over-hydration caused by the syndrome of inappropriate antidiuretic hormone secretion.

If there are no signs of dehydration and no other indications for IV use, frequent breast feeding provides adequate fluid to exclusively breast fed infants < 6 months. Infants > 6 months accept breast feeds even when they are ill and it should be given more frequently during sickness. Non- breast fed infants should be given undiluted animal milk (approx 4 ml/kg/hour) and provided access to water as and when demanded. If the child cannot take orally, give IV maintenance fluids containing 5% dextrose with sodium (30 mmol/L and potassium (20 mmol/L).

5. FEEDING DURING PNEUMONIA

Infants < 6 months

- Breast milk is accepted, even by anorexic children. It should be given with greater than usual frequency.
- If the baby is unable to suck breast milk but is otherwise stable, breast milk should be expressed and given to infants who are too weak to suck by cup and spoon or by intragastric tube.

Children > 6 months

- Breast feeding is continued in breast fed infants. In children with pneumonia, not requiring oxygen, small calorie dense feeds (dalia, kheer, milk with bread, khichri or rice and dal) should be given every 2-3 hours.
- The child should be encouraged to feed.
- If the child is on oxygen, avoid feeding. Initiate oral or nasogastric feeding as soon as oxygen is not required.
- After recovery from pneumonia offer an additional feed at least for the next two weeks to ensure catch up growth.
- Extra emphasis should be given to feeding in children with measles pneumonia, whooping cough and in those with malnutrition. Counsel the mother about appropriate feeding depending upon age of the child.

ANNEXURE 2: MANAGING COMPLICATION OF PNEUMONIA

1. PLEURAL EFFUSION AND EMPYEMA

A child with pneumonia should be suspected to have pleural effusion or empyema if any one of the following is present.

- Pain in chest during breathing
- On examination, the chest is dull to percussion
- Breath sounds are reduced or absent over the affected area.
- A pleural rub may be heard at an early stage before the effusion is fully developed.
- Fever persists despite antibiotic therapy.

A chest X-ray shows fluid on one or both sides of the chest. Diagnostic pleural tap is a must to make a diagnosis. Frank pus (thick or thin) is aspirated in cases of Empyema. The aspirate should always be sent for Gram's staining and culture, Cytology, and for aspirate's Sugar, LDH and protein levels.

Treating Empyema

a. Chest drainage: Management of fluid in the pleural cavity depends on the character of the fluid obtained. If there is pus in the pleural cavity then a chest thoracotomy drain is must, unless the collection is very small. In case the disease is bilateral and significant, both sides may need drainage.

b. Antibiotic therapy: Staphylococcus aureus is a common causative organism of empyema. Give Cloxacillin and Gentamicin as anti-staphylococcal drugs. Usually intravenous antibiotic therapy shall be needed for 7-10 days. Unlike pneumonia the fever comes down a little later by 5-7 days. When the child improves, continue with cloxacillin orally, 4 times a day. Continue treatment for a total of 4-6 weeks. In case of a younger child (under 2 years) and/ or in the absence of staphylococcal stigmata (as described above) Penicillin or Ampicillin may be added to this regime to cover for pneumococcus and *H. Influenza* which are the other important causes for empyema.

c. Supportive therapy: Every child should receive oxygen and other supportive therapy as needed (nutritional support, and antipyretics/analgesic if required)

d. Failure to improve: If fever and other signs of illness continue beyond 5-7 days, despite adequate chest drainage and antimicrobial therapy, assess for reasons for non response like phlebitis, metastatic

pus lesion elsewhere in the body, resistant bacteria or less commonly tuberculosis. The antibiotics may then be revised to Inj Co-Amoxycyclavulanic Acid or as per the sensitivity of the pus isolate.

TUBERCULOSIS :

Consider the possibility of tuberculosis in a child with pneumonia if:

- Child has unremitting fever and cough for more than 2 weeks and cause of fever cannot be found
- Contact with a pulmonary TB case.
- Lack of response of respiratory symptoms and signs to broad-spectrum antibiotics.
- Weight loss or failure to thrive.

The diagnosis of tuberculosis in young children remains very problematic. Children can not usually bring out sputum and gastric aspirates are often negative with TB. Still, it is important to obtain early morning gastric aspirates, or sputum or pleural fluid for ZN (Ziehl-Neelsen) staining and examination for acid-fast bacilli, and, for culture. Radiological investigations may be useful, if tuberculosis is suspected. In addition a positive skin test is a useful pointer. Mantoux test can however be negative in military TB, severe malnutrition, or recent measles; It is important to distinguish tuberculosis from other causes of pneumonia.

ANNEXURE 3: MANAGEMENT OF A CHILD WITH WHEEZE

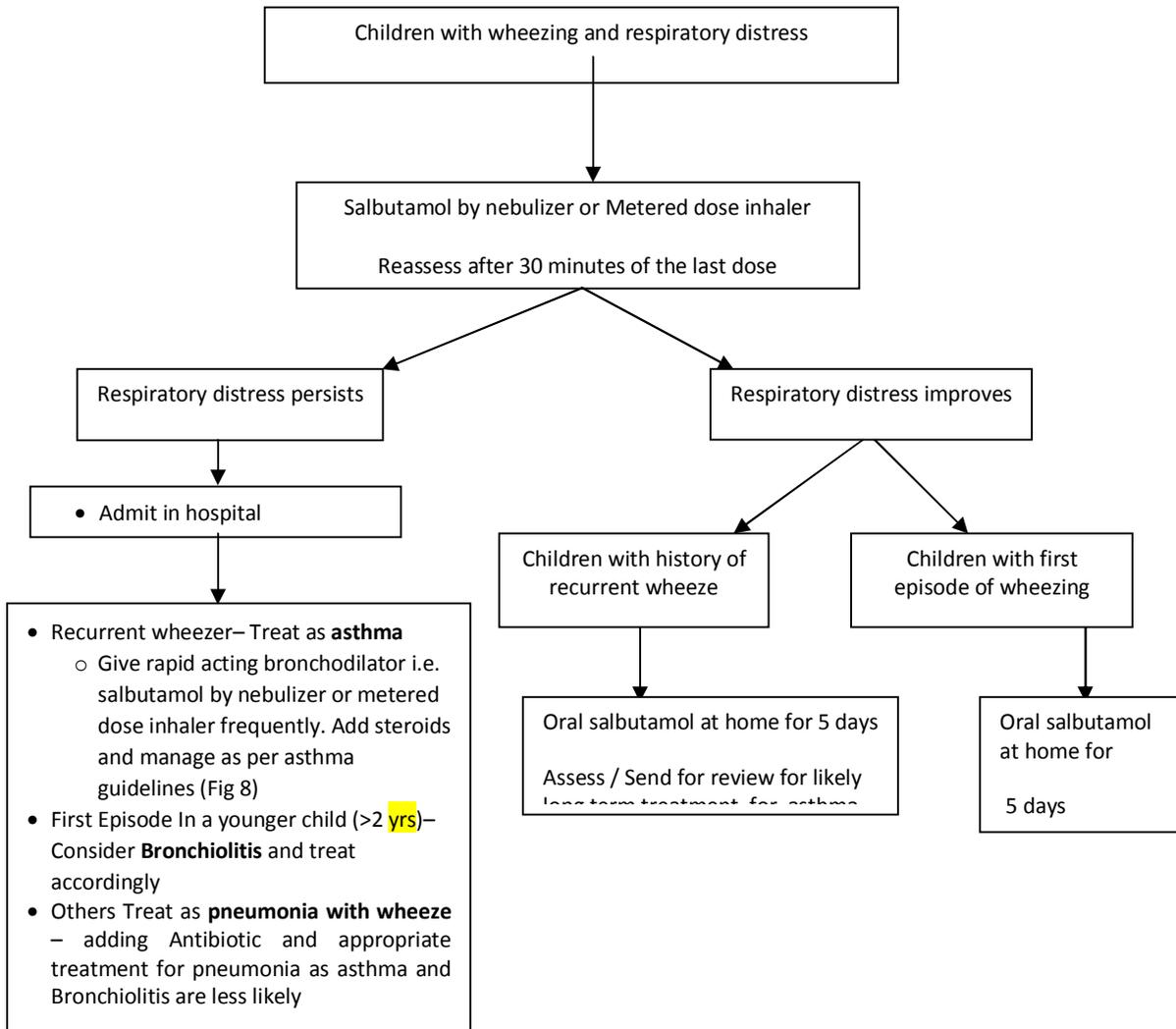
Wheezing occurs when the flow of air from lung is obstructed due to narrowing of small airways. Infection or an allergic response can cause narrowing of small airways. Due to the small size of their airways, small children are more prone to wheezing.

The common causes of wheezing are:

- *Bronchiolitis*
- *Asthma (recurrent episodes)*
- *Acute respiratory infections such as pneumonia/ bronchitis*
- *Inhaled foreign body*

A child with broncho- constriction can have audible or auscultable wheeze and signs of increased work of breathing such as fast breathing, chest indrawing. The expiratory phase of respiration is prolonged and a high pitched musical sound (wheeze) may be heard during expiration. The management of a child with acute wheezing associated with respiratory distress with or without past history of recurrent attacks of wheezing is detailed in Fig.7.

Fig 7: Algorithm for management of a child with acute wheezing associated with respiratory distress or past history of recurrent attacks of wheezing.



First episode of wheezing but no respiratory distress

These children can be treated at home with oral bronchodilator and supportive care only.

Children with wheezing and respiratory distress or those with recurrent wheezing

It is important to assess the response to a rapidly acting bronchodilator (salbutamol metered dose inhaler or nebulizer) repeated at 15-20 minutes as described in Table 10. Subcutaneous epinephrine can

be used as a substitute, if it is not possible to give salbutamol by metered dose inhaler or nebulizer, but the latter is safer.

Table 10: Doses of rapid acting bronchodilators (BD)	
Nebulized Salbutamol (5 mg/ml)	0.5 ml Salbutamol of nebulising solution (5mg/ml) plus 2.5 ml normal saline, nebulised over 10-15 minutes. Initial therapy is of 3 such doses in 1 st hour.
Salbutamol by MDI with spacer	2-4 puffs, 1 puff given every 3-5 minutes. (This makes it equivalent to 1 dose of nebulised salbutamol). Three such courses are given in initial 1 hour
Subcutaneous Epinephrine (adrenaline) 1:1000 dilution (1 mg/ml=0.1% solution)	0.01 ml per kg body weight; may be repeated after 20 minutes, 3doses in 1 st hour
<i>The subsequent dosage of BD depends on the diagnosis, severity and response. While more frequent doses may be needed and acceptable for children with asthma, children wheezing due to bronchitis or viral infections (WALRI) may not benefit from increased or frequent doses if the initial response is not very good.</i>	

The response to bronchodilator treatment is assessed 30 minutes after the last administration to decide whether the child needs inpatient care. Few children may respond within 10-15 minutes of initial therapy only to relapse again, hence there is a need for reassessment after 30 minutes of the last dose. If the child responds well, he can be treated at home with oral salbutamol. If the respiratory distress persists, further treatment is done as shown in algorithm (Fig. 7).

How to give Salbutamol by metered dose inhaler

Salbutamol by metered dose inhaler is as efficient as by a nebulizer. Infants and young children lack the coordination to use a metered dose inhaler by themselves. Metered dose inhalers with a spacer device can be used for such children. Spacer devices are available commercially (250-750 ml volume) or can be made by modifying locally available containers (750-1000 ml).

- Younger children, who are unable to use a mouthpiece, should be given inhaled salbutamol with a spacer device using a mask or with a homemade spacer with an opening that covers the child's nose and mouth. The metered dose inhaler is attached to the opposite end of the spacer device and one puff is actuated at one time. The patient is asked to breathe for 3-5 breaths. Then the next puff is repeated similarly as needed.

Salbutamol by nebulizer

Liquid salbutamol can be nebulized by means of a oxygen source or an electric air compressor. The gas flow should be at least 6-9 liters per minute. A continuous flow of oxygen wastes a large amount of oxygen.

- The top of the nebulizing chamber is unscrewed and 0.5 ml of the salbutamol respiratory solution and 2.5 ml of normal saline are filled in it.
- An oxygen tubing is attached to the bottom of the nebulizer and the other end is hooked to an electric air compressor or oxygen source.
- The nebulising chamber outlet at top is attached either to a mask or T-piece.
- For infants and young children who cannot cooperate, aerosol mask is preferred. It is not necessary for the mask to be tightly sealed to the child's face. Older children can inhale through mouth using the T-piece.
- The child should be treated until the liquid in the nebulizer has been nearly used up. This usually takes 10-15 minutes.
- The mask is washed with non-residue soap (such as dish washing detergent) prior to reuse. Similarly the tubing and nebulising chamber should also be washed daily. Boiling or autoclaving will destroy the tubing. Sterilization can be done by immersing in 2% Glutaldehyde solution (e.g. Cidex(r)) for 4 hours

BRONCHIOLITIS

Bronchiolitis, is a very common respiratory disease which like pneumonia presents as FB and LCI but is caused by a number of seasonal viruses, particularly respiratory syncytial virus (RSV). Infants with acute bronchiolitis may present with a wide range of clinical symptoms and severity, from mild distress to impending respiratory failure.

Characteristic clinical features of bronchiolitis include,

- Age less than 2 years
- Preceding upper respiratory illness and/or rhinorrhea, typically this coryza lasts 2-3 days
- Presenting with breathing difficulties, cough, poor feeding, and irritability, in the very young, apnoea.
- High fever is uncommon.
- Usually follows exposure to others with viral respiratory infection
- signs of respiratory illness which may include the following common ARI symptoms:
 - fast breathing, chest indrawing, wheeze and/or crepitations on auscultation

- shortness of breath, nasal flaring, low O₂ saturation
- Chest examination reveals signs of over inflation and the liver and spleen may be pushed down into the abdomen.

Management:

- The patients having severe / very severe disease as signified by presence of LCI and other signs of severe respiratory distress need to be admitted. Most of these have hypoxia and should be given oxygen, particularly if the SpO₂ is below 90%.
- Nebulised epinephrine (2 ml of inj. Epinephrine 1:1000 solution in 2 ml of normal saline) may decrease distress or improve oxygenation. The dose can be repeated 4 hourly for 1-2 days depending on the response. If no response, repeat dose should not be given.
- In case of severe disease, particularly if the child has personal or family history of atopy, beta 2 agonists like Salbutamol by nebulised route can be given. However, as the response to bronchodilators in bronchiolitis is not predictable continued or more frequent usage should be done, only if there is a clinical response after 15-30 minutes of inhalation with initial doses (c.f. asthma).
- Routine antibiotics have no role but may be used in young infants or in a really sick looking infant as the distinction from Pneumonia may be difficult. The risk of secondary infection is low and prophylactic antibiotics do not prevent it. Supportive care and monitoring should be done as for pneumonia.

ASTHMA

Asthma is a chronic inflammatory condition of the airways associated with variable airflow obstruction that is often reversible. It is characterized by recurrent episodes of wheezing, cough, and difficulty in breathing, which respond to treatment with bronchodilators and anti-inflammatory drugs. Any child with more than 3 episodes of wheezing is likely to have asthma particularly in the presence of personal or family history of atopy.

Treatment of acute asthma

Mainstay of drug therapy is bronchodilators and steroids.

The types of drug used, their doses are largely governed by the severity of the attack (Fig 8).

a. Mild attack – (Alert child with no signs of severe respiratory distress)

- Rapid-acting bronchodilators:
 - Nebulised Salbutamol 3 doses at 20 min interval.

OR

 - Salbutamol by metered dose inhaler (MDI) with spacer: Give 4-5 puffs, spacing out each at 2-3 min interval. This becomes equivalent to a single nebulized dose. Repeat 4-5 puff course as before every 20 min, three times, in this hour.

OR

 - Injection Adrenaline (0.01 ml of 1:1000 solution per kg per dose) subcutaneously every 20 min three times.
- The child is reassessed after 1 hour:
 - In case the respiratory distress resolves completely, and there are occasional or no rhonchi on auscultation, this is considered as a good response. The patient should be kept under observation for the next 4 hrs to see that the response is sustained. If the child continues to stay well and does not have fast breathing, the mother can be advised on home care with inhaled or oral salbutamol.
 - If the response is partial, but the child is stable and able to take orally, oral steroids (Prednisone 1-2 mg/kg/day in 2-3 divided doses) should be started. The child is kept under observation for the next 4 hours to look for any deterioration. Such patients can then be sent home on oral steroids and oral/inhaled salbutamol.
 - Patients with deterioration are treated as moderate to severe attack.

b. Moderate to severe attack (Presence of severe respiratory distress or cyanosis)

- The patient should be admitted
 - Free flow oxygen should be given to keep saturations $\geq 90\%$
 - Rapid-acting bronchodilators should be given
 - Nebulised Salbutamol 3 doses at 20 min interval;

OR

 - Salbutamol by MDI with spacer: 4-5 puffs are given, spacing out each at 2-3 min interval. This becomes equivalent to a single nebulized dose. A repeat 4-5 puff course can be given as before every 20 min- three times, in first hour.

OR

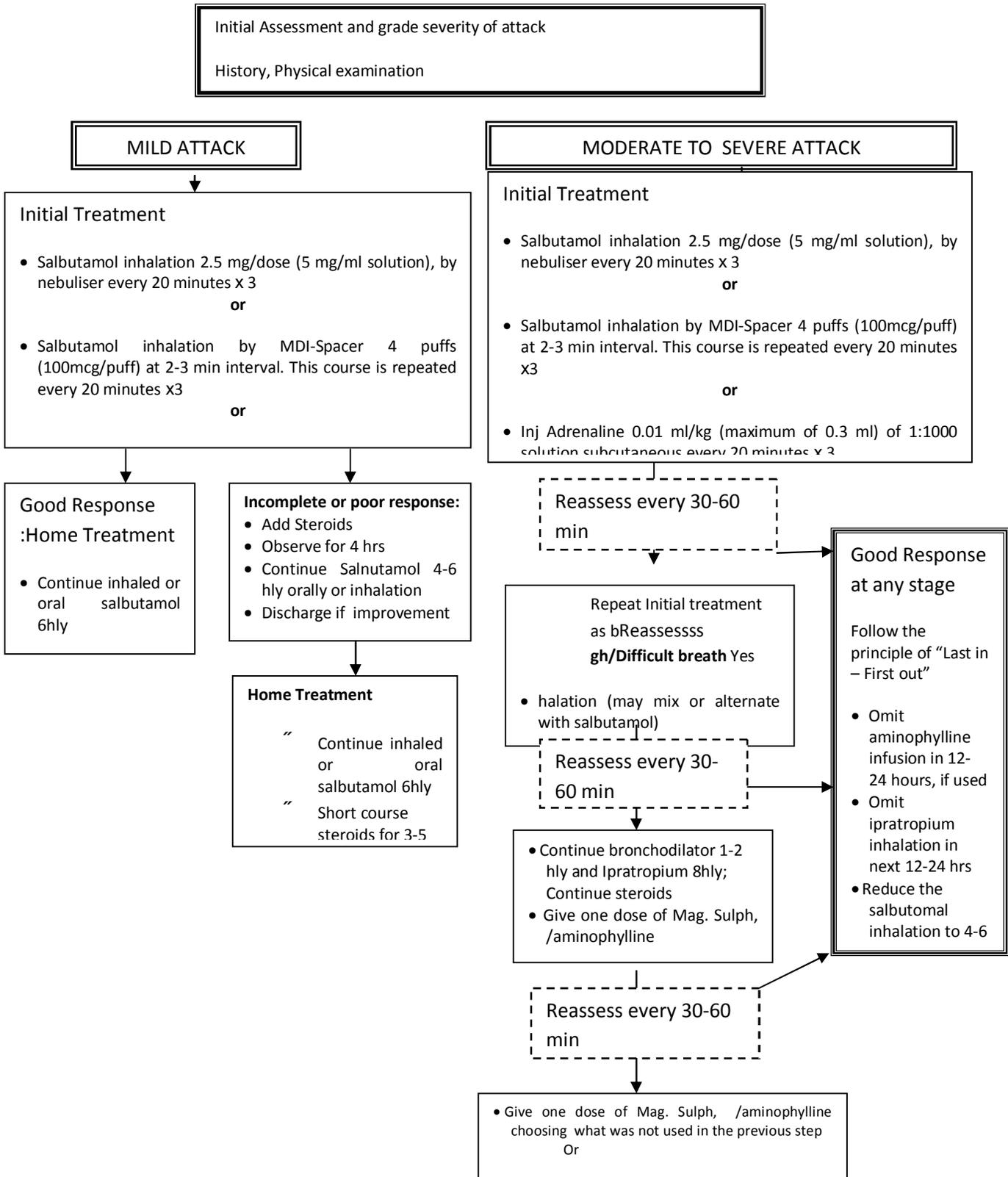
 - Injection Adrenaline subcutaneously every 20 min three times. This is preferred when there is very severe wheeze as in a silent chest.

- First dose of steroids (oral Prednisolone 1mg/kg) should be given promptly, if not started so far.
- Continuous monitoring of the sensorium, respiratory rate, oxygenation, chest finding is very important in this potentially life-threatening situation. The patient is reassessed after every 20-30 min initially and every 1-2 hrs once the patient starts responding. Nebulized beta agonists and systemic steroids are the mainstay of treatment and other drugs are added if only the response is poor or ill sustained.
- If on reassessment, the response is partial or poor:
 - inhaled Salbutamol is continued as before for another hour.
 - Inhaled Ipratropium bromide can be added, where available. This can be mixed with Salbutamol nebulized solution and 3 initial doses are given at 20 min interval.
 - Systemic steroids should be continued.
- If the child starts improving or is stable, Salbutamol inhalations are continued at 1 or 2 or 4 hourly interval depending upon the time for which the response to initial treatment is sustained. Ipratropium bromide should however be continued only at 8 hourly intervals.

Once good response is seen, Ipratropium inhalation is stopped and then gradually the interval between Salbutamol inhalations is increased till it's being given every 6 hrs or so. At this stage discharge can be planned.

- In case of poor or no response after initial treatment with Salbutamol and Ipratropium:
 - 0.05-0.1ml/ kg body weight of 50% Magnesium Sulphate (taken with a 1ml syringe) is added to about 30-50 ml of normal saline and the solution is then given as intravenous infusion over 30 min or so.
 - Frequent Reassessment every 30 min to 1 hr is done.
- if the response is still not good; Injection Aminophylline in a loading dose (5-6 mg/kg up to a maximum of 300 mg) followed by maintenance infusion in a dose of 5 mg/kg every 6 hrs should be added.
- Monitoring is continued intensively. Transfer may be planned to a higher facility continuing the current level of treatment in case of any deterioration or if no response is seen in next 4-6 hours.
- Whenever patient shows good response and response is sustained for 4-6 hours, medications can be decreased.

Fig 8:Management algorithm for treating acute asthma in a hospital



The “last in-first out” principle is used to withdraw medications. Aminophylline infusion is usually stopped in 24 hours followed by Ipratropium inhalation in next 24 hours. Then the frequency of Salbutamol inhalation should be decreased to about 4-6 hourly. (The details of the asthma medication are given at the end as Annexure).

Antibiotics

Antibiotics should not be given routinely for acute asthma. Antimicrobial treatment is indicated, however, when there is persistent fever and other signs of pneumonia such as bronchial breathing. Mere presence of crackles is not an evidence of pneumonia and does not warrant antibiotics.

Supportive care

The child is given daily maintenance fluids appropriate for his / her age. Provision of adequate feeding for the child is encouraged as soon as food can be taken.

Monitoring of the child

A hospitalized child should be assessed by a nurse every 3 hrs even when improving, or every 6 hrs when stable and by a doctor at least twice a day. Respiratory rate and signs of impending respiratory failure are monitored. Oxygen therapy should also be checked periodically.

Discharge planning

The patient is considered for discharge when:

- Is able to take medication orally,
- does not need oxygen therapy, and
- is on 4-6 hrly salbutamol inhalations.

Follow-up care for asthma

Asthma is a chronic and recurrent condition. A long-term treatment plan should be made based on the frequency and severity of symptoms.

Any child with persistent symptoms or frequent episodes (>1 / month) or symptoms of cough and breathlessness following exercise should be assessed for the need for long-term preventive therapy with inhaled corticosteroids. Standard Asthma management guidelines for children should be used for further assessment and management of these cases.

MANAGEMENT OF A CHILD WITH STRIDOR

Stridor is a harsh noise during inspiration, which is due to narrowing of the air passage in the oropharynx, subglottis or trachea. Stridor is most often caused by viral croup which is due to parainfluenzae virus, measles and RSV. Bacterial infections of epiglottitis (epiglottitis due to *H. influenzae* B), trachea (bacterial tracheitis) and larynx (e.g Diphtheria) are far less common. The other less common causes of stridor are - foreign body, polyps, and retropharyngeal abscess. The child with stridor should

be assessed for fever, hoarseness of voice, barking cough, any history of difficulty in feeding or history of choking episode. The patient is examined for signs of obstructed breathing and respiratory distress. A child who has stridor when calm should be urgently referred to a hospital for management.

VIRAL CROUP

Croup is a common childhood disease marked by sudden onset of a distinctive barking cough that is usually accompanied by stridor, hoarse voice, and respiratory distress resulting from upper-airway obstruction. It predominantly affects young children (6mo- 3 years) and the symptoms are usually worse during the night or early hours of the morning. It is usually preceded by non-specific upper respiratory tract symptoms before development of the barking cough and difficult breathing. Para influenza virus (type 1 and 3) is the most common causative agent.

Mild croup is characterized by hoarse voice, harsh barking cough and stridor only when the child gets upset. There is no chest indrawing at rest. SpO₂ is more than 90% in room air.

Treatment of Mild croup

- Can be managed at home.
- Admission needed if croup is associated with measles
- Oral Corticosteroids—(single dose of dexamethasone or equivalent) can be given if patient is brought/referred to hospital.

Severe croup

It is a serious condition, which can be fatal and is characterized by stridor in a calm child and lower chest indrawing. Fast breathing may or may not be present. Child is assessed for signs of airway obstruction – severe chest indrawing, agitation, and cyanosis. Oxygen should generally be administered, without causing the child to be agitated, via an oxygen tube with the opening held within a few centimetres of the nose and mouth (blow-by oxygen or wafting method, see above).

It is important to maintain a patent airway in such children. Even slight agitation in such severely compromised children can lead to a complete obstruction. Antibiotics are not routinely indicated in croup (Table 11).

Table 11: Treatment of moderate - severe croup

- Admission to hospital is needed
- Airway should be maintained
- Steroid – Single dose dexamethasone (0.6 mg/kg) or oral prednisolone (1-2 mg/kg) should be given
- Epinephrine (adrenaline) – Mixing 2 ml of inj. Epinephrine 1:1000 solution (in 2 ml of normal saline and given by nebulised route). May need few to several doses every 4 hours
- Oxygen should be given by blow by method or any other method tolerated by the patient

Intubation or Tracheostomy may be needed in children with incipient complete obstruction.

ANNEXURE 3: ACUTE UPPER RESPIRATORY TRACT INFECTION:

Upper respiratory infections such as cough and cold or rhinitis, pharyngitis /tonsillitis, sinusitis are common causes of morbidity in children. These are mostly caused by viruses and are self-limiting conditions. Important bacterial infections of upper respiratory tract include streptococcal sore throat and diphtheria.

Common cold- This is the most common infection of infants and children. The patient presents with nasal discharge or nasal congestion with low to moderate degree of fever. There may be history of similar illness in siblings or parents. Etiological agents of common cold include rhinovirus, corona virus, and influenza virus. Viral infection of the nasal mucosa results in vasodilatation and increased vascular permeability, which in turn cause nasal obstruction and rhinorrhoea - the main clinical symptoms of the common cold. It is usually a self-limiting illness of short duration, and is occasionally accompanied by a bacterial complication. Most common bacterial complication is acute otitis media, which occurs in about 20% of children with viral upper respiratory infections. Other complications include sinusitis and pneumonia.

Treatment

No specific treatment is required. However, the mother is counselled to bring the child immediately if she notices fast breathing or difficulty in feeding or if child becomes sicker.

The following measures can be taken by the mother of any child with cough or cold.

- Saline nose drops can be tried for relief of nasal congestion when it interferes with feeding.
- Paracetamol can be used for reduction of high fever when this distresses the child and for relief of pain.
- Safe remedies for cold /sore throat:

Cough syrups or antihistaminics or decongestants are not recommended to be given. Safe, soothing remedies are useful for both a cough and sore throat. Remedies which are safe, culturally acceptable and available at home should be given. Common safe remedies for cough and sore throat include ginger, honey, tulsi or herbal tea. These can be given to infants age > 6 months. For younger infants breast milk is the best remedy.

It is important to educate the mother that a child's cough performs a useful function in clearing secretions from the airway and is not an illness in itself, which must be treated. OTC Cough or cold remedies contain atropine, codeine, alcohol or high doses of antihistamines which may sedate the child sufficiently to interfere with feeding and the child's ability to clear secretions from the lungs.

PHARYNGITIS

Pharyngitis or sore throat is common in the community, and occurs throughout the world, especially during childhood. Most cases are due to viruses.

Viral pharyngitis: There is redness of pharynx along with other upper respiratory tract symptoms such as nasal obstruction or discharge. However in contrast to streptococcal sore throat, pus points or membrane is not seen. Cervical lymph nodes are generally not enlarged or tender

Streptococcal sore throat:

It is primarily a disease of school children but in crowded populations often affects preschool children as well. Untreated streptococcal sore throat can lead to rheumatic fever and acute post streptococcal glomerulonephritis and therefore, appropriate case management is important to reduce the complications like rheumatic fever.

Commonly presents with

- Fever (high grade)
- Sore throat
- Severe pain on swallowing, and

On examination, patients have

- Tonsillopharyngeal erythema, with or without exudates, and
- Tender, enlarged anterior cervical lymph nodes.
- Absence of cough, coryza, and conjunctivitis. (the presence of these point towards viral sore throat)

The signs and symptoms of viral and bacterial sore throat overlap and it is often difficult to distinguish the two. WHO suggests a clinical decision rule for children under 5 years of age; acute streptococcal pharyngitis should be suspected and presumptively treated when pharyngeal exudate plus enlarged, tender cervical lymph nodes are found in children with symptoms of sore throat. Those with exudates plus enlarged tender cervical lymph nodes are treated as likely streptococcal pharyngitis with antibiotics. This rule has high specificity (94.0%), but low sensitivity (16%). Considering that streptococcal sore throat is not common in preschool children, the current guidelines recommend the WHO suggested clinical decision rule. In appropriate level health facilities, the clinical diagnosis can be supplemented by throat swab culture.

Streptococcal sore throat is treated with 10 days course of Oral penicillin V or amoxicillin (50mg/kg/day). Shorter duration of treatment have been found to be as effective but are currently not recommended in countries with high rates of Rheumatic fever.

DIPHTHERIA:

Diphtheria is an acute infectious disease caused by *Corynebacterium diphtheria* which mostly occurs in unimmunized or partially immunized children. The usual presentation is fever, toxemia and sore throat. Throat examination shows a greyish white patch on tonsils and /or pharynx which bleeds when the membrane is removed. Cervical lymph nodes are enlarged leading to bull neck appearance. The diagnosis is confirmed by staining the throat swab with Albert stain which reveals club shaped organisms which have a 'Chinese letter pattern'.

Treatment:

- The patient should be admitted and isolated from other patients.
- Diphtheria antitoxin 40,000 units is given i.m. or i.v.
- Crystalline penicillin is given to eradicate the bacteria (100,000 IU/kg q 6hrly for 10- 14 days).
- Good supportive care is required to maintain nutrition and airway.
- Monitoring for complications especially myocarditis and neuropathy should be done.

EAR INFECTIONS:

Ear infections rarely cause death. However, they cause significant morbidity. Ear infections are the main cause of deafness in developing countries. Acute otitis media (AOM) is caused by *S. pneumoniae*, non-typable *H. influenzae* and *M. catarrhalis*. When a child has an acute ear infection, pus collects behind the tympanic membrane in the middle ear and causes pain and often fever. The fever and pain subsides if there is perforation, but the child suffers from conductive hearing loss. These infections may extend and spread to the head and neck structures and to the brain.

Acute Otitis Media (AOM) usually present with a history of rapid onset of signs and symptoms such as pain in ear, irritability (especially in infants), otorrhea, and/or fever. These findings other than otorrhea, are nonspecific and frequently overlap those of an uncomplicated viral upper respiratory infection. Middle ear infection is suggested by presence of ear discharge or fullness or bulging of the tympanic membrane on otoscopy. Pain is prominent in acute phase but subsides if there is perforation of tympanic membrane. The diagnosis of acute otitis media can be made on otoscopy in hospitals.

In the field situation, the assessment of a child with ear problem can be based on clinical examination without use of otoscopy. It takes into account the following three key features:

- Ear pain
- Ear discharge and duration of discharge.
- Swelling and tenderness of mastoid which indicates mastoiditis

Treatment:

- Oral amoxicillin should be given for 5 days.
- Fever and pain usually subsides with Paracetamol
- The ear should be dried by wicking with clean cloth if there is pus draining from the ear.

Chronic otitis media: An ear discharge that has been present for 2 weeks or more is treated as a chronic ear infection and is usually caused by *Pseudomonas sp.* and *Staph. aureus*. Topical quinolone ear drops should be instilled after wicking the ear dry. Systemic antibiotics are not required for chronic ear infection. There is no role of antihistaminics or decongestants in treatment of acute /chronic ear infections

Mastoiditis : Children with mastoiditis need specialized care and should be admitted in a hospital which has ENT specialist. Mastoiditis may be complicated by meningitis or brain abscess and such patients should be assessed and treated for these complications.

ANNEXURE 4: Dosages of drugs used for ARI:

	Dosage	Form	Dose according to body weight (kg)			
			3-<6 kg	6-<10	10-<15	15-<20
Aminophylline For asthma	Loading dose: IV: 5-6 mg/kg (max. 300 mg) slowly over 20-60 minutes	250 mg/10 ml vial	1 ml	1.5 ml	2.5 ml	3.5 ml
	Maintenance dose: IV: 5 mg/kg up to every 6 hours OR by continuous infusion 0.9 mg/kg/hour		1 ml Calculate EXACT dose	1.5 ml	2.5 ml	3.5 ml
Amoxicillin For pneumonia	25 mg/kg two times a day	250 mg tablet	½	1	1 ½	2
	Or 15mg/kg/dose thrice a day	Syrup (containing 125 mg/5 ml)	5 ml	10 ml	15 ml	-
Ampicillin	IM/IV: 50 mg/kg every 6 hours	Vial of 500 mg mixed with 2.1 ml sterile water to give 500 mg/2.5 ml	1 ml	2 ml	3 ml	5 ml
Cefotaxime	IM/IV:50 mg/kg every 6 hours	Vial of 500 mg mixed with 2 ml sterile water OR vial of 1 g mixed with 4 ml sterile water OR vial of 2 g mixed with 8 ml sterile water	0.8 ml	1.5 ml	2.5 ml	3.5 ml
Ceftriaxone	IM/IV:50 mg/kg every 12 hours (max single dose 4 g) OR		2 ml	4 ml	6 ml	9 ml
	IM/IV:100 mg/kg once daily		4 ml	8 ml	12 ml	18 ml
Cloxacillin	IV:25-50 mg/kg every 6 hours	Vial of 500 mg mixed with 8 ml sterile water to give 500 mg/10 mls	2-(4) ml	4-(8) ml	6-(12) ml	8-(16) ml
	IM	Vial of 250 mg mixed with 1.3 ml sterile water to give	0.6		1.8 (3.6)	2.5 (5)

Gentamicin	7.5 mg/kg once per day	IM/IV: vial containing 20 mg (2 ml at 10 mg/ml) undiluted	2.25-3.75 ml	4.5-6.75 ml	7.5-10.5 ml	-
		IM/IV: vial containing 80 mg (2 ml at 40 mg/ml) mixed with 6 ml sterile water	2.25-3.75 ml	4.5-6.75 ml	7.5-10.5 ml	-
		IM/IV: vial containing 80 mg (2 ml at 40 mg/ml) undiluted	0.5-0.9 ml	1.1-1.7 ml	1.9-2.6 ml	2.8-3.5 ml
Benzylpenicillin (penicillin G) General dosage	IV: 50000 units/kg e very 6 hours IM	Vial of 600 mg mixed with 9.6 ml sterile water to give 1000000 units/10 ml	2 ml	3.75 ml	6 ml	8.5 ml
		Vial of 600 mg (1000000 units) Mixed with 1.6 ml sterile water to give 1,000,000 units/2 ml	0.4 ml	0.75 ml	1.2 ml	1.7 ml
Salbutamol	Oral: 1 mg per dose <1 yr	Syrup: 2 mg/5 ml	2.5 ml	2.5 ml	5 ml	5 ml
	2 mg per dose 1-4 yrs	Tablets: 2 mg	½	½	1	1
	Acute episode 6-8 hrly	Tablets: 4mg	¼	¼	½	½
	Inhaler with spacer: 2 doses contains 200 µg Nebulizer: 2.5 mg/dose	Metered dose inhaler containing 200 doses 5 mg/ml solution 2.5 mg in 2.5 ml single dose units				

