CHAPTER 9

Respiratory Tract Infections in the Tropics

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9.1   INTRODUCTION

Acute respiratory infections are the single most common infective cause of death worldwide. This is also the case in the tropics, where they are a major cause of death in children under five. Bacterial pneumonia is particularly common in children in the tropics, and is more often lethal. Pulmonary tuberculosis is the single most common fatal infection and is more prevalent in many parts of the tropics due to a combination of endemic HIV infection and widespread poverty. A lack of diagnostic tests, limited access to effective treatment and some traditional healing practices exacerbate the impact of respiratory infection in tropical communities. The rapid urbanisation of populations in the tropics has increased the risk of transmitting respiratory pathogens. A combination of poverty and overcrowding in the peri-urban zones of rapidly expanding tropical cities promotes the epidemic spread of acute respiratory infection.

PART A.   INFECTIONS OF THE LOWER RESPIRATORY TRACT

9.2   PNEUMONIA

9.2.1   Frequency

Over four million people die from acute respiratory infection per annum, mostly in developing countries. There is considerable overlap between these respiratory deaths and deaths due to tuberculosis, the single commonest fatal infection. The frequency of acute respiratory infection differs with location due to host, pathogen and environmental factors. Detailed figures are difficult to find and often need to be interpreted carefully, even for tuberculosis where data collection is more consistent. But in urban settings the enormity of respiratory infection is clearly evident. Up to half the patients attending hospital outpatient departments in developing countries have an acute respiratory infection.

9.2.2   Severity

Bacterial pneumonias are more common, more severe and more often fatal in the tropics, particularly in children. This reflects the contributory host and environmental factors noted below. In many places limited access to diagnostic services and a lack of effective therapeutic agents may contribute to a higher severity of pneumonia. Severe community-acquired pneumonia is recognised when the respiratory rate is more than 30 per minute, the systolic blood pressure is less than 9 mmHg, urine output is less than 20 mL per hour and significant deterioration occurs in less than 48 hours. If blood gases and chest X-ray can be performed, PaO_2 is less than 50-60 mmHg and the X-ray may show a bilateral multi-lobar pattern. A

pneumonia severity index (PSI) has been developed to help clinical decisions in well-equipped medical centres. The PSI is discussed further in pneumonia in adults below.

9.2.3 Population health

Pneumonia in the tropics is mainly a disease of children and young adults and has its greatest impact on children under five. City-dwelling children have more episodes of acute respiratory infection than rural children. Important contributory factors are poor nutrition, overcrowding, poor sanitation, indoor smoke (e.g. from cooking fires). There are notable seasonal trends in parts of the tropics but these are mainly due to social rather than climatic factors.

9.2.4 Pathogenesis

The origins of pneumonia lie in the damage caused by entry of infective particles into the lower respiratory tract. The most common means of entry is by inhalation of small infective particles, but aspiration of larger infective particles from the oropharynx, blood borne spread from a distant infective focus or direct spread from adjacent tissues are less common routes of infective agents that cause pneumonia. For infective particles to threaten the lungs they must contain enough infective agent, become airborne while the agent remains infective, remain infective while suspended in the air and then reach tissues where they are capable of initiating infection. This combination of required conditions helps to explain why pneumonia does not occur more frequently and why some locations are a greater risk than others. Particles suspended in air will lose volume due to evaporation, becoming droplet nuclei. If they are smaller than 5μm diameter by the time they are inhaled they will settle more easily in the smaller airways and alveoli where rehydration will increase their size again, preventing immediate exhalation. Exhaled, coughed or sneezed infective particles settle closer to their point of origin and expose a smaller group of people to infective risk. Smaller particles travel further and stay airborne for longer. Some people are more efficient sources than others, particularly for viral infections such as influenza and SARS. The most efficient transmitters are known as 'super spreaders'. Optimal conditions for transmission of infection via the airborne route occur when the air is still in confined spaces indoors. Forced air ventilation can be a source of respiratory infection, particularly if coupled with poorly maintained air conditioning. Other environmental conditions that can favour generation of infective articles include soil disturbed by windstorms, farming and construction, surface water disturbance, or poorly regulated industrial processes in abattoirs. Large quantities of smoke whether from cigarettes, cooking fires or poorly controlled industrial processes will significantly suppress respiratory defences that eliminate inhaled particles. Alcohol consumption and other external agents such as endotoxin and possibly HIV will also depress respiratory defences.

The fate of inhaled infective particles that remain in the smaller airways and alveoli differs with differing infective agents. *Streptococcus pneumoniae* causes a profuse inflammatory exudate assisting spread of invading bacteria via inter-alveolar pores until obstructed by the septa that separate the lobes of the lung. Influenza, by contrast, causes inflammation of the respiratory epithelium in the trachea and bronchi. This may result in desquamation and haemorrhagic pneumonia, or secondary bacterial infection, most commonly with *Staphylococcus aureus*.

The aetiology of the common pneumonias is given in Table 9.1.

Table 9.1   Aetiology of the common pneumonias*

Cause	Epidemiology	Features	Antibiotics
Streptococcus pneumoniae	commonest adult after prior viral infection	lobar, rusty sputum pleurisy	PEN, CHL
Mycobacterium tuberculosis	chonic/non-resolving In HIV+, family contacts	apical, miliary	DOTS
Legionella pneumoniae	poorly documented	atypical, confusion	Erythromycin
Haemophilus influenzae	some children	bronchopneumonia	
Burkholderia pseudomallei	SE Asia + N Australia Soil/water exposure	with septicaemia	Ceftazidime eradication
Leptospirosis	water exposure	jaundice, renal failure	AMX
Staphylococcus aureus	neonatal, aspiration	bloodstained sputum Cavitation	FCL
Escherichia coli	neonatal	bronchopneumonia	GM, Ceph
RSV	childhood	bronchiolitis	RIBA

*KEY: PEN, benzyl penicillin; CHL, chloramphenicol; DOTS, directly observed therapy; AMX, amoxycillin; FCL, flucloxacillin; GM, gentamicin; Ceph, cephalosporin; RIBA, ribavirin

Severe community-acquired pneumonia is most often due to *Streptococcus pneumoniae, Legionella pneumophila* or *Klebsiella* spp.. Though the aetiology cannot be determined in a high proportion of cases, it is likely that many of these are due to *S.pneumoniae*. Less severe pneumonia of slower onset in which cough and breathlessness occur without pronounced sputum production may be due to *Mycoplasma pneumoniae*, although the epidemiology of this atypical pneumonia pathogen is poorly understood in the tropics. The overlap of clinical presentation, epidemiological and demographic features makes prediction of the aetiology difficult in specific cases of pneumonia.

9.2.5   Clinical management

Diagnostic backup is limited and may be entirely absent in many parts of the tropics. Decisions on choice of therapy, mode of delivery, duration of treatment and even whether to admit to hospital must be made with less evidence of the specific aetiology. The history, epidemiology and clinical examination may provide helpful clues and should be relied upon much more. Bacterial culture of sputum is unlikely to help and results of poorly collected specimens, processed with limited laboratory facilities may be extremely difficult to interpret. Chest X-ray if available should be reserved for patients requiring hospital admission or whose infection has failed to resolve on initial therapy. The management will vary considerably in different specific and may resemble the syndromic approach adopted in advanced medical centres in developed countries. However, the actions taken and critical decision points will differ considerably from the tropics so that the diagnostic and treatment pathways intended for well-resourced medical centres cannot be applied directly in a tropical, developing country setting.

9.2.6   Pneumonia in childhood

The majority of severe, potentially fatal infections are bacterial and are usually due to *Streptococcus pneumoniae* or *Haemophilus influenzae*. The severity of infection can be guaged by a rapid respiratory rate and indrawing of the lower chest. A rate of >50/min in a 2-12 month child, or >40/min in a 12 month – 5 year old child, combined with indrawing, cough or difficulty breathing, stridor when calm or any general danger sign indicates severe disease requiring referral from the clinic for more detailed assessment. The WHO management pathway for acute respiratory infection in childhood aims to get children treated effectively earlier in the course of the infection, thereby reducing the risk of mortality and other major complications. Initial decisions on referral do not require diagnostic tests or specialist insight. Antibiotics recommended are few, inexpensive and easily available. Chloramphenicol is the preferred choice of pre-referral antibiotic due to its good oral uptake despite the small risk of haematological side effects. Amoxycillin is another suitable agent that is effective against the two most probable bacterial pathogens, but may exacerbate diarrhoea. Cotrimoxazole is a further alternative oral agent but faces increasing resistance in *S. pneumoniae* and *H. influenzae* strains. There enough overlap in the initial clinical presentation of pneumonia and malaria in Africa to make treatment of both conditions necessary in many children less than 5 years.

9.2.7   Pneumonia in adults

The majority of bacterial pneumonias in adults in the tropics are caused by *S. pneumoniae*. Atypical pneumonia caused by *Mycoplasma, Chlamydia* or *Legionella* spp. occur but little is known about how common they are in the tropics. A pneumonia severity index (PSI) has been developed to assist a decision on the urgency of hospital admission and the extent of respiratory support. The PSI was based on data from the USA and predicts the risk of death. Risk group 1 are those patients with pneumonia and no significant underlying illness (liver, kidney, malignant, cerebrovascular or congestive heart disease) or sign of severe pneumonia (respiratory rate >30/min, confusion, systolic pressure < 90mmHg, pulse >125/min, extremes of temperature – below 35 or above 40'C). Any of these features and results of laboratory tests help put patients into higher risk groups. The PSI is obviously less suited to tropical healthcare settings where laboratory tests and chest X-rays are often unavailable. The more recently published CURB-65 criteria (confusion, raised urea, raised respiratory rate, low blood pressure and age over 65 years) may be easier to use but have yet to be validated in a tropical setting or in the absence of X-ray facilities. Variations on these clinical grading criteria have been proposed but again these are intended for well-equipped non-tropical settings in which *S.pneumoniae* is the commonest aetiology for pneumonia.

Decisions on how best to use limited resources will therefore depend on history and clinical examination. Fever, productive cough, rusty sputum, shallow, rapid breathing, localised pain on coughing should be sought. The lobar distribution of *S. pneumoniae* pneumonia may be detected by auscultation. There is relatively little place for sputum culture. Microscopy of a sputum smear preparation can usefully indicate numerous Gram positive cocci, consistent with *S. pneumoniae* infection. Chest X-ray, where available, should be reserved for the more troublesome cases; those who fail to response to initial therapy, those with possible pulmonary complications such as pleural effusion, or those with more chronic disease. Atypical pneumonia, pulmonary tuberculosis and malignancy should all be considered in patients with a slow response to antibiotic therapy.

9.2.8 Pulmonary tuberculosis

M. tuberculosis infection of the lung is so common worldwide that it must be considered in every instance of community-acquired pneumonia. Pulmonary tuberculosis can present with the symptoms and signs of bronchopneumonia, apical consolidation, miliary spread in the lungs or as an incidental finding of a hilar lymphadenopathy and focal pulmonary disease. The onset is usually slower and more insidious than *S. pneumoniae* infection. Other common features of pulmonary tuberculosis are haemoptysis, rigors, night sweats, weight loss and distant non-pulmonary disease. Patients with pulmonary tuberculosis and HIV are less likely to have acid fast bacilli in a sputum sample. Unusual presentations of pulmonary tuberculosis will be more difficult to diagnose where laboratory confirmation is restricted to an acid fast stain of a sputum smear preparation. It is also important to remember that not all smear positive sputa indicate pulmonary tuberculosis. *Mycobacteria* other than *M. tuberculosis* may cause pulmonary infection and will be very difficult to confirm in the absence of advanced laboratory support.

Directly observed therapy (DOTS) with antituberculous agents is widely used to ensure good compliance and reduce the risk of antibiotic resistance emerging. In the absence of resistance a range of possible treatment regimens can be used, the shortest courses (26 weeks) being those that include four agents: isoniazid, rifampicin, pyrazinamide and ethambutol. All of these agents have potentially serious side effects and adverse reactions, which can force the use of alternative regimens including second line agents such as capreomycin, kanamycin and ciprofloxacin. These treatment regimens can require up to 18 months to complete. Other reasons for prolonged anti-tuberculosis therapy include infection caused by an antibiotic resistant strain of *M. tuberculosis* or an immune compromised state, particularly related to HIV infection. Multi-drug resistant tuberculosis is defined as infection caused by a *M. tuberculosis* strain resistant to at least two major anti-tuberculosis agents. Respiratory isolation will be required in separate rooms while these patients are still acid fast smear positive. Following cohorts of patients with positive smears in the same room may be necessary in parts of the tropics but is less satisfactory. Patients with HIV co-infection or patients with multidrug resistant infection probably represent a higher infection risk, and one that is more difficult to gauge from the sputum smear.

9.3   CONTEXT-SPECIFIC PNEUMONIAS

9.3.1   Introduction

The differential diagnosis of bronchopneumonia in the tropics is very wide. However a number of pulmonary infections encountered in the tropics are specific to a particular epidemiological context, which may provide a useful clue to their aetiology.

9.3.2   Influenza

Influenza is a systemic viral illness characterised by fever, muscle ache, lymphadenopathy and a variable pulmonary involvement. A primary pneumonia can occur and may be severe enough to need mechanical ventilator support. Pneumonia is more commonly caused by a secondary bacterial infection, particularly by *Staphylococcus aureus*. Though normally considered an epidemic infection of cooler climates and seasons, influenza spreads worldwide due to international travel. Recent outbreaks of severe influenza A H5N1 among

poultry handlers have raised concerns that avian influenza may eventually undergo further mutation to cause a new influenza epidemic with greater public health impact than the 1919-20 pandemic. Diagnosis is confirmed by serological tests or PCR methods. Most cases are self-limiting but new and expensive antiviral agents such as oseltamivir can be effective in vulnerable patients if given early in the disease.

9.3.3   SARS

SARS, the severe acute respiratory syndrome was first encountered in southern China in early 2003, but was not recognised as an emerging infectious disease until it had spread to Vietnam, Hong Kong and Singapore. The infection is caused by a coronavirus, is spread by infected droplets of respiratory secretions, particularly in healthcare settings. Diagnosis is by serological or PCR-based tests and there is no effective treatment. Prevention is by wearing face masks that filter respirable particles and high standards of hand hygiene. Family, occupational and social contacts of patients are at higher risk of infection and may have to be quarantined to halt the spread of epidemic SARS. Several laboratory-acquired infections have occurred.

9.3.4   Pulmonary plague

Pulmonary plague due to *Yersinia pestis* is very unlikely to occur outside a few small endemic localities in Asia and Africa where the disease is maintained in an animal reservoir. The sputum is thin, watery and bloodstained and buboes are absent. The infection is rapidly fatal without appropriate antibiotic treatment: gentamicin, doxycycline or ciprofloxacin.

9.3.5   Leptospirosis

Leptospirosis is common in many parts of the tropics where poor sanitation prevails and there is frequent contact with surface water. The cause is a spiral bacterium; *Leptospira icterohaemorrhagiae*. A high proportion of cases have pulmonary complications including cough, bloody sputum and X-ray changes. In parts of northern Australia and Southeast Asia a leptospirosis pulmonary syndrome has been described in which pulmonary features dominate the clinical presentation of the disease. The other common features of leptospirosis; jaundice and impaired renal function will usually be present. Diagnosis is by serological tests more than one week into the acute illness, or by PCR-based tests on urine or blood. Antibiotic treatment is with amoxycillin.

9.3.6   Melioidosis

Melioidosis is a multisystem bacterial infection present in many parts of the tropics and particularly prevalent in northern Australia and Southeast Asia. In northern Australia melioidosis is the commonest cause of pneumonia with septicaemia and is fatal in around 20% cases, occurring mainly within two weeks of the onset of heavy rains. The infection is caused by contact with soil or water contaminated with *Burkholderia pseudomallei* which is universally resistant to gentamicin and amoxycillin. Diagnosis is by culture or serological tests. Effective treatment requires Ceftazidime or Meropenem intravenously followed by eradication therapy with a combination of oral antibiotics such as co-trimoxazole and doxycycline to prevent relapse.

9.3.7 Histoplasmosis

Histoplasmosis is an invasive fungal infection that affects the lungs. It can be mistaken for pulmonary tuberculosis due to the formation of nodular pulmonary lesions and does not response to anti-tuberculous therapy. Patients are often immune compromised and may have had recent exposure to bat or bird guano dust. A specific diagnosis is difficult to make without biopsy material or specialised serology tests. Treatment is with itraconazole or amphotericin.

9.3.8 Cryptococcosis

Cryptococcosis is another fungal infection that can cause invasive infection in the lungs (including cryptococcoma), amongst other body sites. Focal or more widespread infection may occur, particularly in immune compromised patients. Diagnosis is by serological test or culture of the yeast. Treatment is with fluconazole or amphotericin B.

Filamentous fungi which invade the lungs include Aspergillus and *Penicillium marneffei* , the latter causing invasive pulmonary infection in HIV positive people from Southeast Asia. Multiple lumpy skin infiltrates may also be present. Diagnosis is mainly clinical but can be confirmed by tissue biopsy if laboratory support is available. Treatment is with amphotericin B and itraconazole. Prophylactic itraconazole has been recommended for HIV positive subjects with a CD4 count less than 100.

9.3.9 Thoracic actinomycosis

Infection with the complex bacteria *Actinomyces israeli* or other actinomycetes can cause invasive infection in the abdomen, thorax or cervico-facial region. Thoracic infection is usually invasive, resulting in local spread cross tissue planes resembling a malignant tumour or focal tuberculosis. Diagnosis is by recognition of the characteristic Gram positive branching filaments. Nocardia can be demonstrated, using a Ziehl-Neelsen stain, as branching acid fast filaments. Treatment is with a penicillin antibiotic, e.g. intravenous benzyl penicillin or ampicillin to begin with for four to six weeks. Prolonged courses of oral therapy (e.g. amoxycillin), from 6-12 months, have been recommended. Close supervision in well-equipped centres can produce successful treatment in less than six months. Doxycycline has been used as a successful alternative therapy.

9.3.10 Pulmonary anthrax

Pulmonary anthrax is an unusual but potentially fatal form of infection with *Bacillus anthracis* resulting from direct inhalation of the bacterial spores. Deterioration of the patient who has fever, bloodstained sputum and shallow, rapid breathing is usually very fast. This infection normally occurs in places where there is also anthrax in livestock. Diagnosis is by recognition of the Gram positive bacilli in a stain of sputum. Treatment is with very high doses of intravenous penicillin and ciprofloxacin. There is a potential infection hazard, not present in patients with conventional septicaemic anthrax. Additional infection control precautions (respiratory) will be needed.

9.3.11 Tularaemia

Tularaemia is another bacterial zoonotic infection that occurs following inhalation of an aerosol of *Francisella tularensis* from wild animals. Most infections occur outside the tropics but the distribution of the disease is not fully known. Diagnosis is by serological tests or culture of the causal bacterium. Treatment is with gentamicin.

9.3.12 Pulmonary typhoid

Pulmonary typhoid is an unusual complication of enteric fever in which a bronchopneumonia is a pronounced feature of infection with *Salmonella typhi*. The infection normally occurs after ingestion of *S. typhi* in food or drink contaminated by a human carrier, and will therefore occur in places with a combination of poor sanitation, poor food hygiene and other cases of typhoid. Diagnosis is difficult to make without blood and stool culture facilities. Treatment is with amoxycillin, chloramphenicol or ciprofloxacin but resistance to these antibiotics is common.

9.3.13 *Pneumocystis carinii* pneumonia (PCP)

PCP is an important opportunist fungal infection of immune compromised patients that may be a herald event for HIV disease. Patients become increasingly breathless but do not necessarily have a productive cough or high fever. Recognition of the condition may only happen after they have failed treatment or HIV-related disease has been considered. Diagnosis is by specialised stain of induced sputum with calcofluor white or alternative. Treatment is with high dose co-trimoxazole, nebulised pentamidine or atovoquone.

9.4   PNEUMONIA AND HIV

The AIDS pandemic has had a huge impact on the type, severity and prevalence of pneumonia. In tropical communities with a heavy AIDS burden there is usually a high incidence of tuberculosis. Tuberculosis is more common in HIV+ persons and is more often fatal but not all the additional tuberculosis is in HIV+ people. The two diseases therefore have an overlapping and synergistic but distinct epidemiology. There are several other points of note regarding tuberculosis in AIDS and HIV+ people. Tuberculosis is more often extra pulmonary, and when pulmonary is more commonly smear negative. These features make tuberculosis more difficult to diagnose without sophisticated laboratory support. However the condition is treatable. Multidrug anti-tuberculous regimes should be used whenever possible to give the patient their best chance of survival and to reduce the likelihood of resistance emerging to anti-tuberculous agents. The variety of pathogens that cause pneumonia in HIV+ people is wide and includes agents not normally seen in immunocompetent patients such as *Pneumocystis carinii,* and *Penicillium marneffei* mentioned above. Conventional respiratory pathogens like *S.pneumoniae* are more likely to cause severe infection in the presence of HIV.

9.5   VIRAL INFECTIONS OF THE LUNG IN THE TROPICS

The need for advanced laboratory technology to investigate the aetiology of viral infections is probably the main reason for the patchy data on viral pulmonary infection in the tropics. In the paediatric population respiratory syncytical virus is probably the commonest cause of

infection. This important cause of bronchiolitis can be treated with specific antiviral agents but the cost is prohibitive for the marginal benefits obtained. A vaccine is under development. Influenza, parainfluenza and adeno-viruses account for most of the remaining viral lung infections in children where studies have been completed. A small proportion of severe lung infections are either due to measles virus or bacterial secondary infection subsequent to an initial measles infection. The recommended approach to these infections which together account for around one quarter of all childhood deaths is mainly preventive: a combination of vaccination, good nutrition, family planning and early help-seeking. Information on adult viral lung infections is even more incomplete and focuses on epidemic influenza and more recently SARS. Another viral pathogen that causes serious pneumonia in adults in varicella-zoster virus. Little is known about VZV pneumonia in the tropics, but it has recently been noted that HIV+/AIDS patients with chickenpox are at high risk of potentially fatal varicella pneumonia. Treatment with antiviral agents and glucocorticosteroids may be life-saving.

9.6   PARASITES AND THE LUNG

9.6.1   Introduction

Several parasitic diseases can affect the lungs. These include invasive amoebiasis, paragonomiasis, hydatid disease, ascariasis, hookworm infection and filariasis.

9.6.2   Amoebic lung abscess

Amoebic lung abscess is a well recognised complication of invasive amoebiasis due to *Entamoeba histolytica*. Such abscesses involving the lungs are less common than amoebic liver abscesses and may develop where liver abscesses progress unchecked and penetrate the diaphragm to involve the right lung. Production of a paste-like foul red sputum in a patient with a history of right upper quadrant pain may indicate this course of events. Microscopic examination of sputum may rarely reveal haematophagous trophozoites of *E. histolytica* but antibody serology, if available, is more useful. Treatment is with metronidazole.

9.6.3   Paragonimiasis

Paragonimiasis occurs in East Asia and Africa due the human lung fluke, *Paragonimus westermanni* and a few other species. It follows ingestion of the fluke metacercariae after consumption of fresh water crabs. These ingested infective stages penetrate the gut wall and migrate via the diaphragm to the lungs where they develop into adult flukes. Small lesions, some with a central cavity, can be seen on x-ray. The eggs of the flukes can be seen on low power microscopy of sputum. Treatment is with a short course of praziquantel.

9.6.4   Schistosomiasis

Schistosomiasis can sometimes involve the lungs in infection with any of the human schistosome species. Here eggs or ectopic adult worms in the lungs result in fibrosis which may lead to bilharzial cor pulmonale.

9.6.5 Hydatid disease

Hydatid disease of the lungs is caused when one or more cysts of *Echinococcus granulosus* develop in the lung parenchyma, although other locations in the body are more commonly involved, particularly the liver. Discovery of a pulmonary hydatid cyst should prompt a search for other lesions outside the lungs. Hydatid cysts contain fluid and a germinal membrane with daughter cysts and protoscolices. Rupture of the capsule can cause a severe anaphylactic reaction and metastatic spread. The anaphylactic reaction can have fatal consequences. Drainage should be avoided unless the capsule can be removed intact. Treatment involves the use of albendazole either alone if the cyst is inoperable, or together with surgical removal. Diagnosis of hydatid disease involves x-ray or other imaging technique with confirmation using antibody serology if available, Prevention is by routine deworming of dogs and avoidance of feeding them with sheep (or sometimes cattle) offal.

9.6.6 Loeffler¹s syndrome

Loeffler's syndrome can result when the migratory stages of intestinal nematodes such as Ascaris, Strongyloides or the human hookworm species migrate through the lungs. This lung migration can cause coughing, bloody sputum, fever, mottling of the lungs on x-ray and a marked eosinophilia. Larvae may at times be demonstrated in a sputum smear.

9.6.7 Tropical pulmonary eosinophilia

Tropical pulmonary eosinophilia can develop in cryptic infections with *Wuchereria bancrofti* or *Brugia malayi*. Here the infection is afilaraemic (ie no microfilaria can be demonstrated in midnight blood smears). Patients present with fever, cough, lung consolidation on x-ray and a very marked eosinophilia. Diagnosis in the past has depended on response to treatments such as diethylcarbamazine, but antibody serology against both *W. bancrofti* and *B. malayi* is now available. Treatment is diethylcarbamazine or ivermectin. *Dirofilaria immitis* infection due to the dog heartworm and spread by mosquitoes, may also present as a filarial infection of the lungs. Here the infection usually remains non-patent (ie the worms never develop to adults producing microfilariae) and ,may present with a "coin-lesion" in the lung suggestive of tuberculosis. Diagnosis is serological and treatment with antifilarial drugs as for Wuchereria or Brugia.

9.7 SUPPURATIVE INFECTIONS

9.7.1 Empyema

Empyema is the collection of purulent exudate or pus in the pleural cavity, usually resulting from extension of suppurative infection in the lung. The condition often follows surgery to the oesophagus or mediastinum. In the tropics, it may be a complication of bronchopleural fistula caused by tuberculosis, actinomycosis or nocardiosis. Subdiaphragmatic infections with salmonella, clostridia or *Entamoeba histolytica* can also cause empyema. In some series the commonest single bacterial species recovered from empyema fluid is *S.aureus*, but oral streptococci and anaerobic bacteria are often found. The bacteria in empyema fluid can be slow growing, even in the absence of antibiotics. The Gram stain results are a useful guide to the type and diversity of bacteria present. If no bacteria are seen, a thorough search should be performed for amoebae, fungi and *Mycobacteria*. Treatment is with a combination of

drainage and antibiotics. Residual empyema fluid can be difficult to remove via a chest drain, particularly if the empyema has begun to organise and form loculated compartments. There is a risk of pneumothorax during placement of the drainage catheter. This can be reduced by using ultrasound to correctly place the catheter, if available. If the fluid collection does not respond to tube drainage in 24 hours, a urokinase infusion should be considered.

9.7.2   Lung abscess

Lung abscess is a focal collection of inflammatory exudate within the lung parenchyma and has a range of causes. The patient will have foul smelling breath, and may have amphoric breath sounds over the affected lung, which is more commonly on the right. The commonest cause is aspiration of oral contents and therefore oral bacteria including anaerobes are present. Other causes of lung abscess include necrotising pneumonia (*S. aureus*, *Klebsiella*, *Legionella* and *Nocardia*), or infection of an emphysematous bulla. Amoebic lung abscess due to invasive *E. histolytica* is encountered in tropical regions. If chest X-ray is available, a cavity with an air fluid level may be seen. Anaerobic lung abscess can be treated with clindamycin and will take on average two months to reduce without surgery. Surgery should be reserved for cases where spillage of abscess contents may cause asphyxiation, or extension threatens the continued function of adjacent organs.

PART B.   INFECTIONS OF THE UPPER RESPIRATORY TRACT

9.8   INTRODUCTION

Upper respiratory infections are common in all parts of the tropics, are usually caused by viruses and are mostly self-limiting. The combination of poverty, poor sanitation and overcrowding means that in many urban tropical settings upper respiratory infections spread quickly. Exposure to many upper respiratory pathogens occurs at a younger age on average than in most developed countries. While these infections may not cause significant direct morbidity, they contribute to a higher prevalence of otitis media with consequent hearing impairment. It is possible that a higher incidence of acute upper respiratory infection may be part of the reason for the higher prevalence and severity of bacterial pneumonia in urban tropical settings.

9.9   PHARYNGITIS

Pharyngitis involves inflammation of the oro- or nasopharynx. The main symptom is sore throat whose severity can be judged by the difficulty a patient has during swallowing. Infection is caused by a range of viruses and bacteria. Viral pharyngitis is generally more common than bacterial pharyngitis and less likely to cause complications, but examination of the mouth is not a reliable method of distinguishing the two. Most pharyngitis does not come to medical attention, unless there are significant complications such as a streptococcal peritonsillar abscess or quinsy that requires drainage and antibiotic treatment. This is unfortunate because of the non-infective sequelae of pharyngitis caused by *Streptococcus pyogenes*; rheumatic fever and subsequent rheumatic heart disease, post streptococcal glomerulonephritis and Sydenham's chorea. The high incidence of rheumatic heart disease in many tropical settings is potentially preventable, but the preventive return is low on mass treatment for a precipitating condition that many consider trivial compared to other health

issues in the tropics. There is no immediate prospect of a vaccine or other effective population health measure. Other bacterial causes of pharyngitis include *Neisseria gonorrhoeae, Mycoplasma pneumoniae* and *Arcanobacterium haemolyticum*, all of which will remain undiagnosed without laboratory facilities. Diphtheria remains an important cause of severe pharyngitis in the tropics. Infection with *Corynebacterium diphtheriae* causes a membranous exudate to form at the rear of the throat. The exudate is a pseudomembrane that does not detach easily from the underlying mucosal surface. Attempts to do so cause bleeding. In severe cases the pseudomembrane extends to involve the epiglottis and larynx at which point, swelling compromises the patient's airway. Other clinical features that help in recognition of diphtheria include swelling of the neck (bull neck) and toxic complications that cause neurological and cardiac signs. Treatment is with antitoxin and doxycycline.

9.10   EPIGLOTTITIS

Epiglottitis is a potentially life-threatening bacterial infection that usually occurs in young children less than five years of age. It must always be considered a medical emergency. As the majority of cases are caused by *Haemophilus influenzae* capsular type B, this infection has become very uncommon in countries with an established HiB vaccination programme. However, in many parts of the tropics, where there is no HiB vaccination, epiglottitis continues to occur. The child usually presents with rapid onset of fever, difficulty breathing and drooling from the mouth. Nothing should be placed in the mouth (e.g. tongue depressor) to assist examination unless preparations have already been made for emergency intubation in case of respiratory obstruction. Amoxycillin or chloramphenicol are suitable antibiotics and should be given intravenously. The patient's airway should be protected by expert insertion of a nasopharyngeal tube.

9.11   CANDIDIASIS

Candidasis of the mouth may extend into the oesophagus in HIV+ people, in which it may feature as a herald infection. Milder oral thrush with easily displaced white mucosal crusts and little, if any mucosal bleeding are commoner and can result from prolonged courses of antibiotics or co-morbidities such as diabetes. Infection is caused by the yeast *Candida albicans* and may respond to removal of the precipitating factor (e.g. antibiotics) if this is possible. More severe disease including lung involvement, particularly in immune compromised patients, will need treatment with antifungal agents such as nystatin, miconazole or fluconazole.

9.12   CONCLUSION

Respiratory infections are a leading cause of morbidity and mortality in the tropics. Urbanisation, tobacco consumption, climate change and specific diseases such as HIV/AIDS have contributed to a rising prevalence of tropical respiratory infections. Improved knowledge of the leading causes, their presentation and management will help improve outcomes for patients with respiratory infections in the tropics. Regional variations in respiratory disease prevalence have important implications for diagnosis, treatment and prevention particularly where medical facilities are limited. Advances in health technology such as improved vaccines and antibiotics have yet to make any lasting impact on the

commonest tropical respiratory infections. The immediate prospects for significant further advances are not good.

Antimicrobial agents used in the treatment of respiratory infections is given in the appendix.

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9.14

Appendix. Antimicrobial agents used in the treatment of respiratory infections

Agent	Route	Adult dose	daily frequency	comment
Amoxycillin	p.o.	1.0g	3	
	i.v.	1.0g	4	
Benzyl penicillin	i.v.	1.2g	4	
Ceftazidime	i.v.	2.0g	2	
Ciprofloxacin	p.o.	500mg	2	
Cotrimoxazole	p.o. or i.v.	5+25mg/kg	3-4	
(trimethoprim+sulphamethoxazole)				
Doxycycline	p.o.	100mg	1	plus loading dose of 100mg
Erythromycin	i.v.	500mg	4	
Flucloxacillin	i.v.	1.0g	4	
Gentamicin	i.v.	3-5 mg/kg	1	caution when renal function impaired avoid if blood levels cannot be measured
Metronidazole	p.o.	500mg	2	
DOT short course				
Ethambutol	p.o.	15mg/kg	1	for 2 months
Isoniazid	p.o.	300mg	1	for 6 months
Rifampicin	p.o.	600mg	1	for 6 months
Pyrazinamide	p.o.	2.0g	1	for 2 months
Melioidosis eradication therapy				
Trimethoprim/sulphamethoxazole	po	320/1600	2	for 3 months
Doxycycline	p.o.	100mg	2	for 3 months
Amphotericin B	i.v.	1mg/kg	1	infusion, Caution if renal function impaired
Fluconazole	p.o.	400mg	1	initial loading dose of 800mg
Itraconazole	p.o.	300mg	2	
Pentamidine	i.v.	4mg/kg	1	
Albendazole	p.o.	400mg	2	
Atovaquone	p.o.	750mg	2	
Ivermectin	p.o.	200ug/kg	single dose	
Praziquantel	p.o.	20mg/kg	1	
Aciclovir	i.v.	10mg/kg	3	
Ribavirin	aerosol	1.1g/day	1	pregnant staff should avoid