BRONCHIECTASIS AND CYSTIC FIBROSIS

1 Bronchiectasis

1.1 Description

Bronchiectasis is a chronic disease characterised by irreversible dilatation of the bronchi due to bronchial wall damage from infection and inflammation. It is accompanied by chronic suppurative lung disease with productive cough and purulent sputum. The disease is caused by impairment of the mucociliary transport system, which normally protects the lungs from infection. This predisposes the lungs to bacterial infection, and hence an inflammatory response, increased mucus production and further impairment of mucociliary function. The walls of the bronchi become infiltrated by inflammatory tissue, losing their elastin content to become thin and dilated.

1.2 Aetiology

- Respiratory Infections cause the majority of cases.
    a) Infective and Aspiration Pneumonias (70% are bacterial and 30% are viral.)
    b) Tuberculosis (TB) (common in developing countries with increasing incidence in the UK.)
    c) Childhood Pertussis and Measles.

- ***Cystic Fibrosis – see Part 2.***

- Bronchial Obstruction.
    a) Inhaled Foreign Body e.g. peanut.
    b) Bronchial Carcinoma.
    c) Lymph Node Enlargement e.g. TB.

- Immune Deficiency.
    a) HIV infection and AIDS.[1]
    b) Haematological Malignancies.
    c) Hypogammaglobulinaemia.

- Smoking (Impairs lung function and accelerates the progression of bronchiectasis.) [1]

- Allergic Bronchopulmonary Aspergillosis.

- Other Rare Causes.
    a) Inherited Ciliary Dyskinesias e.g. Kartagener's Syndrome.
    b) Autoimmune Diseases e.g. ulcerative colitis, rheumatoid arthritis, vasculitis.

- Rarely, the cause of bronchiectasis cannot be determined.

1.3 Prevalence

During the 20th century, severe and chronic respiratory infections declined in frequency due to the introduction of childhood vaccinations, the development of antibiotics, and improvements in socio-economic conditions. For these reasons, despite a lack of formal research, it is believed that the prevalence of bronchiectasis is falling in the UK.[1]

1.4 Diagnosis

1.4.1 Common signs and symptoms

The cardinal features of bronchiectasis are a chronic cough and copious purulent sputum. The degree of breathlessness may vary from case to case.

The mildest cases have no symptoms or signs between exacerbations, and are often misdiagnosed as chronic bronchitis.

An exacerbation occurs when an acute respiratory infection makes the condition worse. The additional symptoms usually include fever and pleuritic chest pain. Sometimes there is haemoptysis.

Severe chronic bronchiectasis is associated with malaise, weight loss and halitosis.

1.4.2 Examination

Finger clubbing is associated with persistent purulent bronchiectasis.

Coarse crackles and/or wheeze may be audible on listening to the chest.

Very severe cases may show signs of cor pulmonale or respiratory failure.

Cachexia, weight loss, and muscle wasting are associated with chronic severe illness.

1.4.3 Investigations

Investigations are needed to confirm the diagnosis, establish the severity of the condition, and provide a baseline for monitoring the long-term progression of the disease.

Chest X-Ray (CXR) is the most important first-line investigation. In less severe cases the CXR is likely to be normal. In more advanced disease it may show peri-bronchial thickening (tramline shadowing) or cystic dilated bronchi. High resolution CT scanning is the best diagnostic tool for locating and identifying the extent of the disease.

Other investigations which may be required:

a) Sputum Microbiology.
b) Lung Function Tests.
c) Sweat Test (Cystic Fibrosis.)
d) Immunoglobulin Levels.
e) Aspergillis Precipitins.
f) Ciliary Function Tests.

1.4.4 Differential Diagnosis

a) Asthma &. COPD.
b) Lung Cancer.
c) Other Chronic Lung Diseases.

(These are described within the protocols: ***Interstitial Lung Disease, Asbestos Related Lung Disease, and COPD.***)

1.5 Treatment

Where possible, the underlying cause of bronchiectasis should be treated, for example:

a) Removal of Foreign Body.
b) Immunoglobulin Replacement.
c) Corticosteroids and Itraconazole for the treatment of Allergic Aspergillosis.

The following sections describe well-established treatments for bronchiectasis and CF, but a review of the literature shows that many of them lack firm evidence of their long-term effectiveness.[2]

1.5.1 Clearing Secretions

Chest physiotherapy aims to prevent the accumulation of secretions. Postural drainage, percussion and forced expiratory techniques should be performed twice daily.

Inhaled anticholinergic drugs appear to dry up secretions and reduce bronchoconstriction.

1.5.2 Controlling Infections

High doses of antibiotics are required to penetrate the scarred bronchial mucosa and purulent secretions. If several exacerbations occur per year or there is persistent infection with declining lung function, then prophylactic antibiotics are considered, particularly over the winter months. As a result, the frequency of attacks may be reduced. Antibiotic resistance often develops, and treatment with combinations of antibiotics or a rotating antibiotic regime may be needed.

Pneumococcal and influenza vaccinations are recommended.

1.5.3 Reducing Airflow Obstruction

Reversible airflow obstruction should be treated with inhaled $ß_2$ agonists, corticosteroids and anticholinergics.

1.5.4 Surgical Options

Surgical excision of the damaged lung can be helpful following inhalation of a foreign body or in severe localised disease with troublesome symptoms.[1] It also remains the best treatment for persistent extensive haemoptysis. Lung transplantation may be an option for those who have progressed to respiratory failure.

1.5.5 Palliation and Rehabilitation

Patients suffering from respiratory failure may benefit from long-term use of controlled oxygen therapy.

Rehabilitation rarely restores normal health nor prolongs life, but much can be done to improve respiratory function, exercise capacity and quality of life.

Pulmonary rehabilitation programmes are already widely used in the US, and are becoming more common in the UK.[3] It has been shown that their benefits continue for 6-12 months after completing the programme.[4]

Programmes typically include:

a) General Exercise Training.
b) Specific Respiratory Muscle Training.
c) Nutritional Supplements.
d) Patient Education and Support.
e) Long-term Oxygen Therapy.

The British Lung Foundation funds research into respiratory diseases and is a source of information and support to sufferers and their families.

1.6 Prognosis

The normal course of bronchiectasis is a gradual deterioration of lung function, complicated by intermittent acute infective exacerbations. A small proportion of those with bronchiectasis are resistant to conventional treatment and deteriorate rapidly.

Treatment is aimed at reducing the frequency of exacerbations and hence the rate of decline in respiratory function. Complications such as abscess formation and amyloidosis are now rare. Similarly, because of improved management, respiratory

failure and cor pulmonale are becoming less common.[1]

1.7 Main Disabling Effects

Bronchiectasis is a chronic illness associated with deteriorating lung function.

As well as bronchiectasis, there may be concomitant conditions such as COPD and emphysema, and these may add to the respiratory impairment.

1.7.1 Assessing the Claimant

The assessment should be made using all the information available. This includes information from the claimant's file, informal observations, medical history, 'Typical Day' and examination.

There is a wide range of severity amongst claimants with bronchiectasis:

1.7.1.1 Mild Bronchiectasis

In many cases despite the degree of inflammation, tissue damage and fibrosis, lung function remains well preserved and has little effect on functional ability. In this instance, the 'activities of daily living' are unlikely to be significantly restricted. The person should be able to live independently and continue with their usual interests and hobbies. Cases of bronchiectasis under the supervision of the Primary Care Team are likely to be mild, with fewer infective exacerbations.

1.7.1.2 Severe Bronchiectasis

Severe cases are likely to require frequent courses of antibiotics, and may experience several hospital admissions each year. They are likely to be under the supervision of a multi-disciplinary team including a Consultant Respiratory Physician and Specialist Physiotherapists.

The burden of chronic infection often leads to weight loss, cachexia and muscle wasting. Together, respiratory failure and weakness may progressively reduce exercise tolerance. In end stage disease, even 'washing and dressing' may become difficult.

In the IB-PCA, reduced exercise tolerance is particularly likely to affect the activities walking and climbing stairs. Exemption from the assessment should be considered if effort tolerance is severely limited, the claimant is using oxygen therapy, or they have had to adapt their home, for example by installing a stair lift or converting a room downstairs for their bedroom.

In respiratory medicine, percentage of predicted FEV_1 is regarded as a useful measure of lung function. It is important to remember that there is considerable variability between individuals, and measures of lung function do not always correlate with functional ability. The following table describes the broad categories of functional impairment that might be expected from progressively deteriorating lung function:[4] **NB. The table is for guidance only.**

% Normal FEV_1	Description of Severity	Range of Functional Effects	
>80%	Normal	Nil	
60-80%	Mild	**From**	Breathlessness on heavy exertion.
		To	Breathlessness walking at normal pace on the flat.
40-59%	Moderate	**From**	Breathlessness on walking 100m.
		To	Breathlessness on climbing one flight of stairs without stopping.
<40%	Severe	**From**	Cannot climb one flight of stairs without stopping.
		To	Bed-bound or chair-bound.

After Dr David Fishwick, Senior Lecturer in Respiratory Medicine, Royal Hallamshire Hospital and Health and Safety Laboratory, Sheffield.

1.7.2 Psychological Effects

Depression is positively correlated with the severity of breathlessness.[5] Thus successful recognition and treatment of depression may improve quality of life and reduce disability.

2 Cystic Fibrosis

2.1 Description

Cystic fibrosis (CF) is an inherited disease characterised by pancreatic insufficiency and recurrent respiratory tract infections.

The disease is highly disabling: progressive lung damage eventually results in respiratory failure.

2.1.1 Effects on the Pancreas and Liver

Damage to the pancreas occurs in 85% of cases. It begins in-utero and continues in the neonatal period. The failure of digestive enzyme secretion leads to malabsorption and hence steatorrhoea, meconium ileus (in 10%), and often failure to thrive (in 50% at 6 months of age.)

The fat-soluble vitamins A and D are poorly absorbed, and thus visual disturbance and rickets can occur in untreated cases.

Damage to the pancreas causes diabetes mellitus in 10% of cases.

Abnormal secretion of bile leads to a high incidence of gallstones, and (in 5% of cases), is associated with biliary cirrhosis of the liver.

2.1.2 Effects on Reproduction

90% of males with cystic fibrosis are infertile. They are born with an abnormal reproductive tract because of damage sustained in-utero. Females have near-normal fertility.

2.1.3 Effects on the Lungs

Pulmonary disease is the major cause of morbidity and mortality in CF.

Neonates have histologically normal lungs, but mucous plugging and inflammation of the airways soon develops. Eventually destruction of lung tissue results in bronchiectasis.

2.2 Aetiology

CF is caused by an autosomal recessive inherited disorder.

There is a defect in the gene which codes for the Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) protein.

The CTFR protein transports chloride ions across cell membranes, and hence controls the movement of sodium and water.

Lack of the CFTR protein causes thick viscid secretions. These clog the ducts of the pancreas and liver, and impair the mucociliary transport mechanism which protects the lungs from infection.

This abnormal environment plus the breakdown of lung defences allows colonisation and infection with bacteria. At first Haemophilus Influenzae and Strep. Pneumoniae are the commonest pathogens. Later, Pseudomonas and Staph. Aureus become common, and are associated with a more rapid decline in health.

In advanced disease, the complications of haemoptysis, pneumothorax, and aspergillosis may occur.

Finally lung destruction and airways obstruction lead to respiratory failure and cor pulmonale.

2.3 Prevalence

Cystic fibrosis affects about 1:2000 live births.

The gene mutation is common: carried by 1:25 of the UK population.

Currently, there are thought to be about 6250 sufferers in the UK.[6][7]

2.4 Diagnosis

2.4.1 Common signs and symptoms

The diagnosis is usually made in childhood following the appearance of suspicious clinical features:

a) Meconium Ileus
b) Steatorrhoea
c) Failure to Thrive
d) Recurrent Severe Respiratory Infections.

2.4.2 Examination

This is described in ***Part 1 – Bronchiectasis.***

2.4.3 Investigations

The Sweat Test remains a key diagnostic tool. It relies on the high levels of sodium present in the sweat of those with CF.

Genotyping is a very useful way of detecting the commonest CF mutations. However, there are many varieties of the mutation, and currently not all of them can be identified by this test.

2.4.4 Differential Diagnosis

a) Asthma
b) Immune Deficiency Syndromes
c) Malabsorption Syndromes.

2.5 Treatment[8]

CF is best treated by multi-disciplinary teams based in specialist regional centres. Much of the treatment is similar to that of bronchiectasis and was described in ***Part 1.*** Information specific to cystic fibrosis is presented here:

2.5.1 Malabsorption

Malabsorption due to pancreatic insufficiency can be successfully treated by taking oral enzyme supplements with meals. Patients with CF need a high calorie diet, up to 50% higher than the normal requirement. When oral feeding is insufficient to maintain weight, enteral tube feeding can be used. Supplements of vitamins A and D are also necessary.

2.5.2 Clearing Secretions

Inhalations of hypertonic saline, acetylcysteine and recombinant deoxyribonuclease break down the viscid secretions so they become easier to clear.[9][10]

2.5.3 Controlling Infections

An infective exacerbation of CF will usually lead to hospital admission for a course of intravenous antibiotics. Once the infection is controlled, it is common practice to complete the course at home.

Nebulised tobramycin is useful for controlling the damaging effects of Pseudomonas infection. The number of infections is reduced, and lung function is maintained longer.[11]

2.5.4 Reducing Inflammation

Inhaled corticosteroids are thought to have a useful anti-inflammatory effect, but there is little trial evidence. Oral corticosteroids have been shown to slow the deterioration of lung function. Unfortunately this is associated with adverse effects: cataract and growth retardation.[12]

10% of CF sufferers develop Allergic Bronchopulmonary Aspergillosis and require

treatment with high dose corticosteroids and the anti-fungal drug itraconazole.

2.5.5 Preventing Osteoporosis

Osteoporosis is known to affect one third of adults with CF. As their typical lifespan improves, there is an increasing likelihood of osteoporotic fractures. As well as vitamin supplementation, bisphosphonate drugs may become a routine treatment in CF.

2.5.6 Transplant

Heart-lung transplant provides a potentially effective treatment for failing lung function, and achieves a five-year survival of about 50%. However the supply of donor organs is very restricted, and this makes the treatment unavailable to most CF patients.[1]

2.5.7 Genetics and Gene Therapy

Experimental work is underway to identify a method for introducing an intact version of the CF gene to the lungs. This has been achieved in animal models, but is not yet possible in humans.[13]

Now that the genetic basis for CF has been understood, it is possible to offer genetic counselling and pre-natal diagnosis to prospective parents.

The Cystic Fibrosis Trust is a source of support and information to CF sufferers and their families.

2.6 Prognosis

Treatment of CF is now able to achieve a life expectancy of 30-40 years.[7]

This means that there are an increasing number of adults with CF in the UK.

CF causes considerable medical and social morbidity during the course of the illness. As well as the physical burden of the disease, the sufferer's family have to cope with the strain of caring for someone with a chronic condition. Someone with CF may find it impossible to secure life assurance, their choice of career may be severely restricted, and their genetic status or infertility can affect their ability to find a partner and have a family.

2.7 Main Disabling Effects

CF is a chronic illness associated with deteriorating lung function.

Many of the disabling effects are similar to those described for bronchiectasis. (***See Section 1.7***) Information specific to CF will be described here.

A young adult is likely to enjoy relatively good health, but will experience intermittent episodes of illness due to recurrent respiratory infections.[14][15][16] Clues about the relative severity of the disease can be gathered from the social and occupational history. For example, mainstream schooling and the ability to live independently both suggest less severe disease.

A survey of adults with CF showed that the disease had caused complete cessation of work in only 35%. Other studies found that 56% of adults with CF were employed, and that young adults with CF were able to function on a par with their healthy counterparts.[15]

Once sufficient lung damage has occurred, a vicious cycle of more frequent and severe infections accelerates the deterioration in lung function, and thus severe respiratory impairment can develop relatively rapidly. This may be illustrated by increasing dependence on family and carers, or having to give up hobbies and interests previously enjoyed.

The burden of chronic infection often leads to weight loss, cachexia and weakness.

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