# MICROBIOLOGICAL STUDY IN SOME PATIENTS WITH LOWER RESPIRATORY TRACT INFECTIONS

**THESIS**
Submitted for Partial Fulfillment of
*Master Degree in*
*Chest Diseases*



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M.B. Bch.



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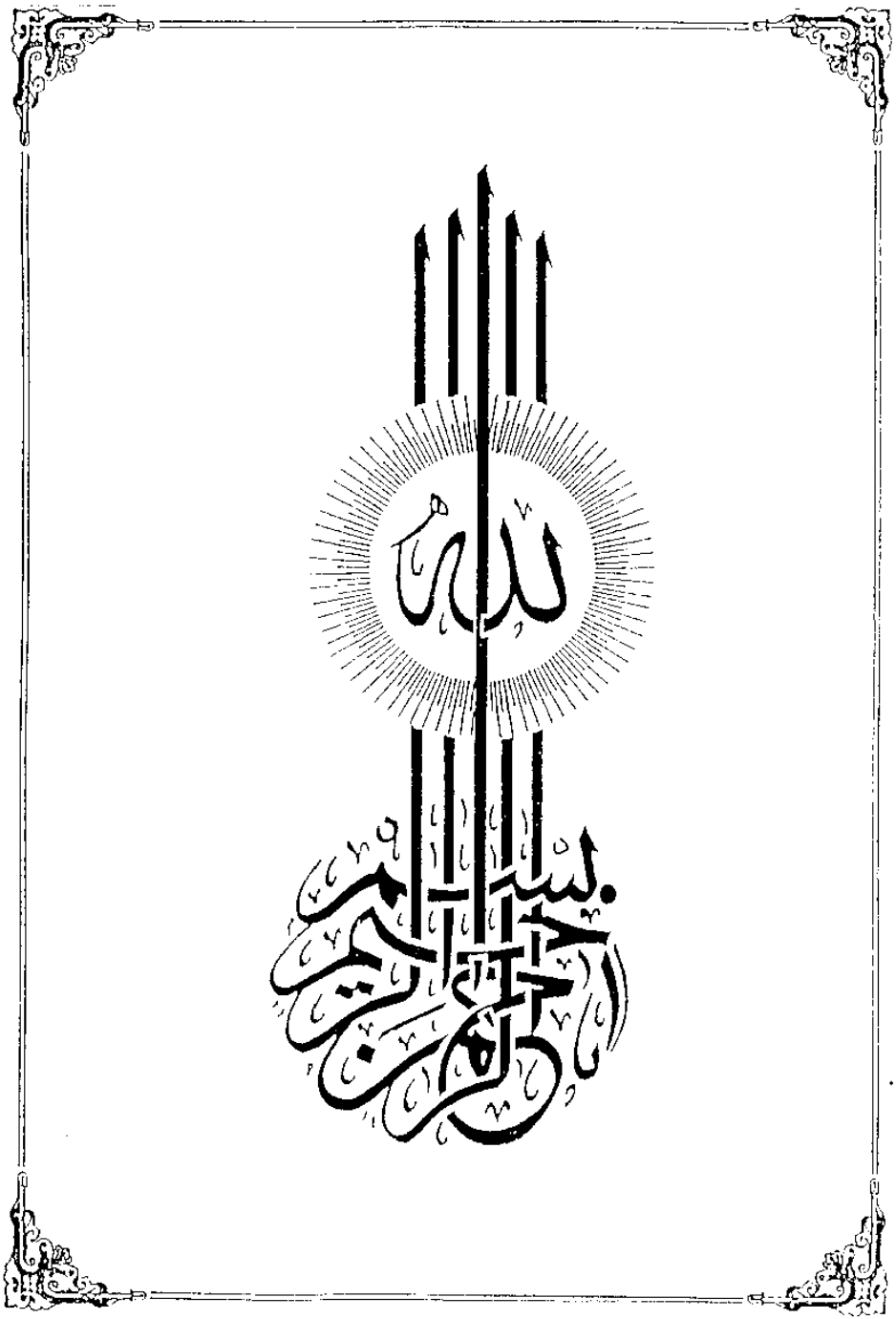

# Introduction

# INTRODUCTION

Respiratory tract infections are a major cause of morbidity and mortality in the community and the most important burden on the health service after mental illness (Woodhead and Macferlane, 1987).

In managing the patient the primary goal of the physician is to identify the responsible microorganism(s) and appropriately treat it with suitable antibiotic when indicated. Considerable investigation of community and hospital - acquired respiratory infections is currently being undertaken, with the result being a better understanding of the epidemiology and pathogenesis of these illness (Roger et al., 1992).

The mortality rate for pneumonia among the elderly has not decreased substantially over the past 30 years despite the introduction of many new and potent antimicrobial agents. Regarding the microbial etiology, some diagnostic methods are flawed, others are expensive and technically difficult. Many well known pulmonary pathogens, such as Mycoplasma pneumoniae, and respiratory viruses such as influenza virus and adenovirus, are difficult to isolate or are not routinely cultured. New pulmonary pathogens, such as the various species and serotypes of Legionella, have been described in the past decade, and microbes that may have importance as pulmonary pathogens in adults, such as chlamydia trachomatis and chlamydio pneumoniae, have been investigated in recent years (Joseph et al., 1992).

Epidemiologic studies have shown a pronounced difference in the aetiology of community acquired and hospital acquired respiratory tract infections.

In community acquired pneumonias, pneumococci (strept pneumoniae), Haemophilus influenza, Legionella pneumophila, Mycoplasma pneumoniae and viruses predominate, whereas in nosocomially acquired pneumonias, klebsiella pneumoniae, pneumoniae, proteus, pseudomonas aeruginosa, and staphylococci comprise the most important frequent isolates (Hoffken, 1993).

Among the most useful procedures to define the etiology of respiratory tract infections is the microscopic examination of Gram-Stained sputum specimens. Although precise speciation of bacteria is impossible by Gram's stain alone, the appearance of organism allows reasonable inferances about their identity.

Microscopic evaluation of a well prepared Gram stain of sputum will often provide clues to the presence of infection and guide in the initial treatment (Harrison's, 1987).

Although a large number of patient with community-acquired pneumonia can safely be treated on an outpatient basis, this infection is still a common cause of hospital admission. In Spain, the annual rate of community-acquired pneumonia hospital admissions is 77 of 100,000

inhabitants. Despite the improvement in both antibiotic chemotherapy and a better knowledge of the etiologies that can cause community-acquired pneumonia (e.g. Legionella Pneumophila and Branhamella Catarrhalis), the mortality rate of community-acquired pneumonia is still averages between 10 and 20%. Different studies have shown that mortality is higher in those patients who develop severe acute respiratory failure and require mechanical ventilatory support because of their critical condition (Torres et al., 1991).

**Quantification of Nasopharyngeal Bacteria for Diagnosis of Respiratory Tract Infection:**

Agreement between clinical signs of bacterial respiratory tract infections and quantities of respiratory tract pathogens in nasopharynx was studied in 77 children, aged 6 - 13 years. Specimens were obtained from 27 clinically bacterial and 51 clinically non-bacterial respiratory tract infections, and in 124 instances from healthy children.

Viable counts of streptococcus pneumoniae, haemophilus influenza, branhamella catarrhalis, and beta haemolytic streptococci were made from swab specimens suspended in saline before being plated on agar media. The frequency of these species in children with clinically bacterial, non-bacterial and no signs of respiratory tract infections were 85%, 47% and 26% respectively. Bacterial counts $>10^4$ colony forming units (CFU)/ml of the pathogens occurred in 59% of

clinically bacterial infections compared with 18% in clinically non bacterial infections, the corresponding figures for counts $>10^3$ CFU/ml being 85% and 41% respectively. At neither level of bacterial count, was there a significant difference between the healthy and those with a clinically non-bacterial infection. The quantification of bacteria in nasopharyngeal samples may thus be of clinical diagnostic value (Soderstrom et al., 1990).

# Aim of The Work

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The aim of our work is to study group of patients admitted to Ain Shams University hospitals with lower respiratory tract infections as regard the causative organism, the response to treatment and to detect the sensitivity of isolated microorganisms to different antibiotics, by using sputum samples.

# Review of Literature

increase in acute respiratory infection morbidity. The importance of vitamin A in maintaining the integrity of mucosal surfaces, as well as in ensuring competent cell-mediated immune responses. (Chandra, 1980) has led to critical evaluation of its potential protective effect against acute respiratory infection.

**The Mucociliary Blanket:**

This is the major mechanism for clearing particles from the airways, but is also found in the nose, paranasal sinuses, middle ear and eustachian tubes. It consists of:

1. A viscid or gel mucous layer containing large glycoprotein molecules which are secreted by the goblet cells and submucosal bronchial glands.
2. A watery or sol periciliary layer in which the cilia beat, only their tips projecting into the mucous layer, relaxation occurring in the periciliary layer. The epithelial cells bearing microvilli are involved in production and absorption of this watery layer. The airway mucosal cells transport chloride ions (ct) towards the airway lumen, so generating an osmotic gradient which attracts water into the periciliary layer. These active ion transport processes are also altered by inflammatory mediators or drug therapy.
3. The respiratory cilia, some 200 per cell which beat towards the mouth at 12 - 17 beats/second. Each cilium is 50 - 500 μm long, with a complex internal structure of sliding tubules. In primary

ciliary dyskinesia the cilia are persistently abnormal, as shown by electron microscopy, but they also show similar electron microscopic changes during respiratory viral infection, but then return to a normal structure within 6 weeks. In health, the mucous layer in man moves at about 5 - 20 mm/min, but this can be reduced ten fold in patients with chronic bronchitis and emphysema.

Particles are deposited on the mucociliary blanket by impaction, occurring particularly a branches in the airways, gravitational sedimentation and Brownian movement. Particles in the coarse mode of the atmospheric aerosol (2 - 50 μm) diameter tend to be deposited in the nasopharynx, only fine mode (0.1 - 1.0 μm in diameter) particles being deposited in the alveoli. However, particles in this size range may undergo hygroscopic growth, with an increase in size from absorption of water within the airways, the increase in diameter then also increases their chance of being deposited in the alveoli or small airways.

The rate of mucociliary clearance varies in health, being reduced during sleep and in chronic cigarette smokers, but increased in exercise, and following acute exposure to bronchial irritants (tobacco smoke, sulphur dioxide, ... etc.). Patients with bronchial asthma or chronic bronchitis and emphysema have impaired mucociliary clearance, and this can be improved by $B_2$ sympathomimetics but is not impeded by ipratropium bromide aerosol, despite its other

anticholinergic actions (Flenly, 1990).

**Cough:**

It starts with a brief inspiration, followed by sudden closure of the glottis for about 0.1 - 0.2 second, during which expiratory muscle contraction raises the intrathoracic and abdominal pressures to 50 - 100 mmHg or more. The glottis then opens suddenly, so that there is a rapid expulsion of the gas compressed within the thorax. Peak expiratory flow rising to about 12 litres/second or more in health. The sound of cough results from rapid oscillations of gas and tissues of the upper airways. Central airways narrow during a cough, so increasing the linear velocity of the air flow, thus clearing excess secretions from the trachea and bronchi. Glottic closure is not essential for this clearing, however, and some patients with long standing laryngeal palsy can learn to cough effectively enough to clear their secretions.

Cough is initiated either voluntarily or by reflexes arising from irritant receptors in the larynx, trachea and bronchi. Persistent failure of an effective cough can be life threatening, from aspiration of food, foreign bodies, or secretions into the lungs.

**Cough Failure can Result from:**

1. Local airway anaesthesia, or by passing of the glottis by an endotracheal tube.

2. Central depressant drugs (e.g. Heroin, Codeine, Methadone .. etc.).
3. Neurological disorders which affect either afferents from the irritant cough receptors as in trauma of the base of the skull (IX and $X^{th}$ cranial nerves) or motor fibres (vagal for laryngeal muscles, phrenic for intercostals), or to the expiratory muscles as in poliomyelitis, syringomyelia motor neurone disease, ... etc.
4. Weakness of expiratory muscles, as in myopathies, spinal cord lesions, following muscle relaxant drugs or in myosthenia gravis.
5. Lung disease, by reduction of the maximal expiratory flow rates from loss of elastic recoil and airway obstruction, as in chronic bronchitis and emphysema.

Cough syncope, in which a paroxysm of coughing terminates in an abrupt but transient loss of consciousness, without a fit, is a recognized complication of chronic bronchitis and emphysema. Most of patients are men who are otherwise vigorous. Loss of consciousness results from a fall in cerebral blood flow following the marked reduction in venous return during the periods of high intraabdominal and intrathoracic pressures which precede the expulsive phase of the cough (Flenly, 1990).

**Intrinsic Defects in Cilia:**

Defects in the ultrastructure of respiratory cilia that alter or prevent motility represent a fascinating link between altered airway host defence and a propensity for recurrent or chronic infection at