2. Literature Survey

Overview

This chapter provides the review of the literature survey of the respiration related diseases. Commonly occurred diseases are different types of asthma, tuberculosis, HIV, COPD (chronic obstructive pulmonary disease) etc. Several epidemiologic studies to correct the prevailing air pollution level in Mumbai to health morbidity have been done. India has more TB cases annually than any other country. Following the sharp growth in spending on TB control and rapid implementation of DOT (Directly Observed Treatment), India reached 57% case detection countrywide in 2004, and 70% within DOTS area [31]. It has been shown that in three urban communities with moderately raised pollution level (SO$_2$, NO$_2$, and SPM), there was a greater morbidity for symptoms of dyspnea, chronic and intermittent cough, frequent cold, chronic bronchitis and cardiac disease and due to non-tuberculosis respiratory and ischemic heart disease, there was an associated rise in respiratory death in the eastern suburbs along with increase level in pollution [32].
2.1 Introduction

Impedance measurements using frequencies up to 500 MHz were used along time domain reflectometry techniques to investigate respiration sensing using standard unipolar pacemaker leads. The waveforms were very similar to the waveform obtained from a standard unipolar pacing lead which has a non-insulted tip [33]. N. D. Khambete et al [34] explained the movement artifact rejection in impedance pneumograph using six strategically placed electrodes at appropriate locations and suitably combining the measurements obtained.

To assess clinical significance of breath to breath variation of tidal volume and its distribution pattern displayed as a histogram, continuous measurement of the tidal volume was made with electrical impedance pneumography for about 60 minutes. To evaluate variation of tidal volume quantitatively, coefficient of variance (CV) and SD (Standard Deviation) was used. In comparison to normal pattern of distribution (CV=26.0 ±7.5%, mean ± SD), patients with restrictive lung disease showed extremely narrow patterns of distribution and significantly smaller CV (1.75V 4.6% in old pulmonary Tuberculosis). Where as patients with obstructive lung disease showed widespread patterns of distribution and significantly greater CV (43.2 ± 13.5) in pulmonary emphysema with hypercapnia [35].

Jan H. Houtveen et al [36] studied the validate change in thoracic impedance derived from respiratory signal obtained from four spot electrodes against incidental spirometry. Additionally, they performed for a dual respiratory belts signal to compare the relative merit of both methods. Multilevel regression was used to examine the within- and between-subjects structure of the relationship between the spirometric volume and the respiratory amplitude signals obtained from either dZ or respiratory belts.

The diagnostic performance of heart rate variability analysis from exercise ECG in the detection of coronary artery disease (CAD) is shown [37].

Previous studies have found that respiratory variations of ventricular response in atrial fibrillation are infrequent and inconsistent. This asynchrony between heart rate and respiratory may characterize the physiological mechanism coupling heart
rate and blood pressure oscillations in the respiratory band. Maria Vittoria Pitzalis et al. [38] evaluate whether synchronous variation in systolic blood pressure and respiration depend on a simultaneous change in heart rate. Univariate and bivariate spectral analyses were made of the R-R interval, systolic blood pressure, and respiratory signals during controlled respiration. With atrial fibrillations before and after efficacious electrical cardioversion and age and sex matched control subject. During atrial fibrillation, the spectral coherence between respiration and heart rate was low, but there was a high level of coherence between respiration and systolic blood pressure. Their results confirm the inconsistent effect of respiration on heart rate response during atrial fibrillation and demonstrate that respiratory sinus arrhythmia is not a prerequisite for systolic blood pressure oscillations but may play an anti-oscillatory role in respiratory systolic blood pressure variability, which is probably mediated by arterial baroreflex mechanisms.

2.2 Bronchial Asthma

Bronchial asthma is a chronic inflammatory condition of the airways. It is regarded as a complex inflammatory condition of the airways involving many inflammatory cells and wide variety of mediators. These mediators act on the cell of the airways leading to smooth muscle contraction, mucus hyper secretion, plasma leakage, oedema, activation of cholinergic reflexes and activation of sensory nerves. Prevalence of asthma is rising. It is supposed that 5-10% of general population in our country is suffering from bronchial asthma [39]. The sleeping patient is a still patient. His disease not only goes on while he sleeps, but indeed may progress in an entirely different fashion from its progression during the waking state.

Though the area of medicine is still in infancy regarding various changes during the sleep, there has been a tremendous growth in knowledge in various fields in the last few decades in this regard i.e. peak period of certain diseases like surgical death at 1.00 am, myocardial infraction and diabetic – ketoacidosis at 4.00 am and menses onset at 5.00 am [11]. Patient with asthma are particularly at risk for change in the pulmonary function during sleep. Nocturnal has been recognized as a distinct clinical entity for many years. In the 17th century, John Flyer described his
asthmatic fit and recognized its association with sleep. It is typically occurred between 10.00 pm and 7.00 am with peak at 4.00 am.

2.3 Tuberculosis and HIV

Tuberculosis usually affects the lung, although the other organs may also get involved. The disease affects the lung in 90% and other systems of the body are 10%. Tuberculosis is caused by the bacteria belonging to the mycobacterium tuberculosis complex [40].

Robert Koch in 1882 stunned the world with his discovery of the tubercle bacilli. The knowledge of the tuberculosis is as old as civilization. It has been mentioned in the Hebrew literature, Chinese and Egyptians literature [41] during the industrial revolution and the period of related urbanization in the 17th and 18th centuries, tuberculosis become a problem of epidemic proportion. Improvement of socioeconomic conditions and isolation of infectious patient in sanatoria has a favorable impact on the epidemiology of tuberculosis. In 1982, the world was celebrating centenary of Robert Koch’s discovery of tubercle bacilli but was not aware that HIV infection had already arrived.

The importance of dealing with tuberculosis lies in the fact that it is an infective and airborne disease transmitted via the respiratory track, completely treatable by early diagnosis and adequate chemotherapy. The other significant aspect in that it is a HIV associated disease (transmissible to the segment of the population not infected with HIV).

In case of TB two different forms occur in the western world and Asian region.

1. TB infection acquired before HIV infection: Common developing countries. Present in the form of primary infection, sputum test positive, and tuberculosis test positive.

2. TB infection following HIV seen in developed countries among HIV positive patients and in parentally HIV infected children. Patients usually present with sputum negative and TB skin test negative.
The life time risk of TB among HIV positive is about the five times that of HIV negative. In relation to tuberculosis status the risk of accuracy of TB in HIV positive TB reactors is estimated to be 30 times that of tuberculin negative HIV positive.

Selvyn et al [42] estimate that about 95% of HIV infected tuberculosis cases are attributable to HIV infection and remaining 5% could have developed tuberculosis regardless of HIV status. Table 2.1 estimates total/HIV related incidence of tuberculosis. The detail about the history is explained by Rao N. K. in his text book on "History of tuberculosis" [43].

Table 2.1: Table shows the estimate of TB and HIV materials.

<table>
<thead>
<tr>
<th>Year</th>
<th>TB Morbidity</th>
<th>HIV related TB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Per 1 Lakh population</td>
</tr>
<tr>
<td>1990</td>
<td>75,37,000</td>
<td>143</td>
</tr>
<tr>
<td>1995</td>
<td>87,68,000</td>
<td>152</td>
</tr>
<tr>
<td>2000</td>
<td>10,222,000</td>
<td>163</td>
</tr>
</tbody>
</table>

2.3.1 Diagnosis Test with Hospital Background:

I. Tuberculosis;

II. Sputum; and

III. Chest X-ray.

Recent advantages in tuberculosis diagnosis techniques are

1. Sero-immunological investigation (ELSA, RIA)

2. Identification of isolates (spectroscopy, gas chromatography)

3. Rapid mycobacterium detection by culture technique

4. Molecular Biology Technique (DNA)
Smear negative pulmonary tuberculosis in industrialized countries much attention has recently been paid to the problem of smear negative pulmonary tuberculosis. Clinician need to decide whether to begin empiric therapy for patients who are suspected of having tuberculosis but show negative sputum smear results [44]. Culture results may take two weeks and delaying treatment may allow further transmission of disease.

Pulmonary disease in the elderly [10, 45] in Africa as the nomadic tribes of Hottentots crossed the plains, unable to care; they left behind their elders who could not keep up, in specially constructed huts, where they could eventually be devoured by a hungry jackal or lion. Sadly in the world, old age begins when you cannot keep up with the able bodies of youth. In India, elderly account for 6% of the population.

Among the pulmonary disease in the elderly community acquired pneumonias can present deceptively only to progress rapidly with a tragic outcome. The clinical profile is made more confusing by the fact that very scanty sputum is produced and the total WBC’s counts are not very high. Many times the only initial presenting symptom is an altered sensorium or confusion.

Brook, Cooper and Houghton el at [46] studied and did the comparison of plethysmography, spirometry and oscillometry for assessing the pulmonary effects of inhaled bromide in healthy and patients with asthma. They conclude that the spirometry is more sensitive for healthy subjects.

2.4 COPD (Chronic Obstructive Pulmonary Disease)

In our own urban specially referral practice out of 100 consecutive out patients, 25% are aged 50 years or above. Again out of 100 consecutive patients aged 50 years and above, asthma (62%), chronic obstructive pulmonary disease (COPD) 34% and tuberculosis 18% are more common disorders. The other diseases are hypertension 4% and diabetic 25%. Most complications of COPD occur as the person enters his sixth decade of life when he is most vulnerable socially, financially and emotionally. Decision like hospital admission for acute exacerbation of COPD, use of nebulizations at home, home oxygen etc. would become more
difficult. There is an urgent need to pay attention to the issues involving the elderly and provide for their case in hospital in systematic and specialized manner [30]. It is estimated that COPD affects 16 million persons in the US and is the fourth leading cause of death.

The pulmonary function tests and bronchial provocation test are explained by M. C. F. Pain [47] explained as follows:

Pulmonary function tests have many limitations.

1. They do not establish a clinical diagnosis but quantitative level of disordered physiology and hence requires interpretation within the clinical cortex.
2. They mostly require the subject cooperation.
3. They demand an enthusiastic relationship between the subject and the operator.

For bronchial provocation

1. Cut off between normal and abnormal is not defined.
2. Differing laboratory techniques make comparison between reported studies difficult.
3. There is subject variability to provoking (cold air, exercise)
4. There are probably different mechanisms producing episodic airflow obstruction.

The main study was on forced oscillation superimposed onto airway pressure by means of the PAV (proportional assist ventilation is a new modeling of artificial respiratory support designed to improve the interaction between the ventilator and patient) to noninvasive and automatic arrangement of respiratory resistance [48].