INTRODUCTION

Geriatrics refers to the process of ageing or to the elderly. Though aging is not a disease, it may be defined as a progressive decline in tissue function that eventually results in death. Elderly patients with age-related co morbidities, cognitive problems, poor social support, atypical presentation, poor nutrition etc. require holistic approach. Ageing is accompanied by increased systemic inflammatory activity due to reduced capacity of inflammatory system to react to environmental insult called inflamm-aging. Based on the world census (as of 15 Dec 2008) the number of adults aged > 65 years has increased from approximately 380 million in 1996 to about 500 million in 2008 and is projected to increase to > 700 million by 2020 meaning 16 % of the total population would be geriatric population which is currently about 7 %.

LUNG FUNCTIONS

Lung functions decline throughout the adult life even in healthy individuals. This decline may accelerate after 70 years of age and if associated with smoking decline is even more rapid. Current smoking is associated with more rapid decline in forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) compared with never smokers. Healthy elderly man lose lung functions at a faster rate compared with healthy elderly women. Elderly with congestive heart failure, systolic hypertension and taking beta blockers has significantly lower mean FVC and FEV1.

DISEASE BURDEN

There is a huge burden of respiratory diseases in elderly be it chronic obstructive pulmonary disease (COPD), Community acquired pneumonia (CAP) or asthma. Also geriatric lung suffers from malignancies either directly or indirectly. Disorders like sleep apnoea or tuberculosis may have a different course in elderly. The risk factors for the respiratory diseases in elderly work either separately or in association to develop disease in an individual.

AIR POLLUTION

Smoking is most important risk factor. Even after development of disease and realization that smoking is responsible for that, quitting smoking is difficult particularly if smoking is accompanied by lack of social support. It is found that elderly are more resistant to smoking cessation. Adverse effects of smoking on lung functions are greater in women than in men. Outdoor and indoor pollution may be strong risk factors as well. Indoor pollution may be more responsible as elderly may refrain from moving out and may spend more time at home where tobacco, cooking and heating gases or biological allergens may be important ones. Those with underlying disease may be exposed to very high levels of indoor pollution also for over a prolonged period of time especially if their disease restricts their activity.

DIAGNOSIS

Ageing is accompanied by gradual decline in many aspects of immune functions leading to an increase in the risk of respiratory infections in older people. In elderly various forms of obstructive airway disease like asthma, chronic bronchitis and emphysema overlap. Also objective diagnosis of obstructive lung disease based on spirometry gets complicated as the reference data for lung functions in elderly is inadequate. Most of the diagnostic tests would be independent of patients efforts to obtain best quality results like 2D-echo whereas spirometry would require good co-operation from patient. Sub maximal patient effort or poor understanding on patient’s part would adversely affect the results in spirometry. Good test would require not only sensitive apparatus but also motivated technician with good interpersonal communication skills.

The approach to management requires multidisciplinary assessment including health status and related quality of life, lung functions and physical functioning, mood and nutritional status, cognitive function and quality of sleep, social factors and other systemic co morbidity assessment. The assessment is followed by multidisciplinary interventions by team of specialists with focus on pharmacotherapy, rehabilitation, diet & nutrition and psychotherapy.

BRONCHIAL ASTHMA IN ELDERLY

Asthma is highly prevalent in elderly population as well as in young and still continues to be highly under diagnosed and hence undertreated. The diagnosis is often missed because of our perceptual bias that the disease is a childhood or adolescent problem. It may
be the disease which manifests late or it may be the disease of childhood persisting to geriatric age. It may manifest itself after a long period of clinical remission.

Ageing leads to structural and functional changes in the lungs which influence the airways response to variety of allergens. The airway hyper-responsiveness plays an important role in development of asthma in elderly. Obesity and increased body mass index also are a risk factor for airway hyper-responsiveness. Obesity is associated with increased asthma incidence, severity and reduced response to drug therapy. Thoracic obesity reduces lung volumes leading to restriction of movements of the chest.

Atopic status of the elderly is also affected because of the immune system modification. Though, the prevalence of atopic status is lower in elderly, but the outcome may be worse compared with younger population. This may be, as various systems may have declining functions due to ageing and may not be able to compensate as well for allergic reaction. Smoking in elderly contributes to the erroneous diagnosis of COPD. Gastro oesophageal reflux disease (GERD) is responsible for asthma exacerbation especially in elderly. They are more prone to the GERD because of age-related changes in the mechanics of the lower oesophageal sphincter pressure, degenerative changes of the gastric mucosa and effects of multiple drugs that elderly patient may be taking because of associated co-morbidities. Asthmatics or COPD patients with increased work of breathing may increase the gradient between thorax and abdominal cavity promoting reflux. Asthmatics may be hypersensitive to air pollutants and levels of which may be higher in indoors. Elderly patients may spend most of their time indoors and hence, even a low concentration of these allergens may have a larger impact.

Though clinical presentations may not be much different in elderly as with younger asthmatics for it to be under diagnosed, greater attention on cough and wheezing in elderly even with history of smoking, could lead to diagnosis of asthma.

**Relationship with COPD:** Asthmatics may have 10 times higher risk of developing COPD irrespective of smoking. It may be because of chronic inflammation (particularly if it has been untreated with inhaled steroids) leads to airway remodeling and structural changes which leads to irreversible airways obstruction. COPD may occur in asthmatic elderly as a co-morbidity. It may be a consequence of smoking in elderly asthmatic and the FEV1 decline would be even more accelerated.

**COPD**

COPD is one of the most common causes of morbidity and mortality world wide. Currently it is the fourth leading cause of death in the world and is marching to become third commonest cause in next 10 years. The exact prevalence worldwide is largely unknown, but estimates have varied from 7-19%. The most recent study suggests a global prevalence of about 10%. In addition to generating very high health care costs, it also imposes significant burden on quality of life. In spite of this, the disease has failed to receive the attention it deserves.

COPD is highly under diagnosed and under treated. Also it is neglected by patients, doctors and pharmaceutical companies alike when compared with other major killer diseases. It is partly because of the perception that it is due to self-inflicted habit of smoking, partly because it affects elderly, who have a lot of other ‘important’ co-morbidities and partly as there was no effective treatment available so far. Patients get used to the dyspnoea as it is very slowly advancing and relates it to ageing. Because of age they may fail to perceive the symptom. Also, social environment may not allow patients to seek medical help. COPD may be missed at the physician levels due to failure of doing spirometry or misattribution of the symptoms to other etiology like cardiovascular causes.

**DEFINITION:**

The Global initiative for chronic obstructive lung diseases (GOLD) defines COPD as “A preventable and treatable disease with significant extra pulmonary effects that may contribute to its severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gases.”

The current definition conveys a significant change from our conventional understanding of the disease which always centered around airflow obstruction. The new definition puts the emphasis on its extra pulmonary effects & has positive implications towards better patient care.

**Etiology:** Smoking is the most important risk factors for COPD. In India & many other developing countries, more than 30% of COPD cases occur in non smokers. This is due to exposure to biomass fuels used in cooking or heating. This is becoming an important issue since clinicians may not consider a diagnosis of COPD if the patient does not smoke. Other potential risk factors for COPD include occupational hazards, respiratory tract infections at early age and even tuberculosis. Second hand smoking or passive-smoking are other risk factors for those who have never smoked.

Complex interplay of environmental factors, smoking, genetic susceptibility, and frequent lower respiratory tract infections leads to development of COPD. Though it is a disease of elderly, its development begins a long before patients gets symptomatic and partly it is due to age related decline of lung function, age related chest wall changes (Kyphosis), psychological factors and post-menopausal hormonal changes in female patients.

In clinical practice, history of chronic cough with expectoration, progressive wheeze and / or breathlessness with significant smoking history (20 pack years) with objective evidence of irreversible airflow obstruction on spirometry is sufficient to make the diagnosis of COPD, provided other causes like cystic fibrosis, bronchiectasis and bronchiolitis obliterans are rules out. It gets difficult to differentiate COPD from chronic asthma with...
persistent airway obstruction especially in elderly with history of smoking. Though it gets less important in clinical practice at that stage to differentiate these two conditions, as treatment may not change much, nevertheless heavy smoking, air trapping or emphysema on radio imaging with decreased diffusion capacity for carbon monoxide and hypoxia with carbon dioxide retention favors the diagnosis of COPD.

**Respiratory manifestations:** A patient complains of cough with mucoid expectoration which frequently turns yellow or green in presence of infection. Cough generally precedes dyspnoea in many patients by a number of years and is not noticed or ignored by patients as ‘smokers cough’ or age-related cough. In the beginning of the disease dyspnoea is present only on exertion but as disease worsens it is present even at rest. Orthopnoea usually represents pulmonary oedema or acute exacerbation.

Dyspnoea may not correlate well with more objective parameter like blood gases. There are variable clinical presentation with two distinct subsets “Pink puffers” and “Blue blotters.” A typical pink puffer or Type A patient has severe dyspnoea but maintains blood oxygen levels and does not get hypercapnia. They do not have cor pulmonale or right sided failures. While a blue blower or type B has cor pulmonale and gets frequent right sided failure with peripheral oedema, severe hypoxia and hypercapnia but typically is less dyspnoic. This is due to differences in the responsiveness of respiratory center to hypoxia and hypercapnia. Gases are generally well maintained in pink puffers at the cost of the effort of respiration while blue blotters hypventilate allowing carbon dioxide to rise and oxygen levels to fall.

With advancement in disease there is more and more air trapping. Lung volumes markedly increase leading to severe hyperinflation. Kyphosis increases and chest becomes barrel shaped. Low flat diaphragm in this situation can not move much and can not facilitate air exchange.

The mortality of COPD patients admitted to the hospital ranges from 5 to 15% but those requiring ICU admission, it may be as high as 24%. Severity of disease and increasing age are the risk factors for frequent exacerbations and presence of co-morbidities, nutritional status, social status, general care (pharmacotherapy and vaccination) & pulmonary rehabilitation are the factors responsible for relapses of exacerbations & need for hospitalization. The common causes for non-infectious exacerbations are heart failure, pulmonary embolism, pneumothorax etc and amongst the infection H. Influenzae, S. pneumoniae and Morexella are responsible. Patients with more severe disease, with frequent use of steroids and with other co morbidities, with frequent infections tend to have pseudomonas and enterobacteria infections.

Rhinovirus, the organism most often responsible for causing the common cold, is also the most common infectious cause of chronic obstructive pulmonary disease exacerbations. Corona virus, influenza, respiratory syncytial virus, Para influenza, adenovirus, and metapneumovirus are other important viral causes of chronic obstructive pulmonary disease exacerbations. These exacerbations can be severe with prolonged recovery times. Although PCR technology has dramatically increased the detection rate of viruses in patients with chronic obstructive pulmonary disease, it does not differentiate infection from colonization. The use of biomarkers represents an exciting new potential diagnostic tool that may lend new insights into the pathogenesis of viral infections in patients with chronic obstructive pulmonary disease.

Choice of antibiotics for the infection in COPD depends on probability of infection being bacterial, severity of underlying disease, present status of the patient, co morbidity patient has and patterns of resistance.

**Co morbidities:**

COPD is associated with various co morbidities such as heart disease, osteoporosis, depression and skeletal muscle dysfunction. These co-morbidities found in COPD are either the consequences of the disease process or are the result of common etiological factors. Age, smoking, sedentary life style (age related), decreased testosterone, poor nutrition may be responsible. COPD itself may also play a significant contribution in the development of these co-morbidities as a result of spilling over of inflammation from the lungs particularly in susceptible individuals.

Multiple interrelated multi-factorial stimuli play a vital role in development of variety of co morbidity like:

1. **Sedentarism:** Dyspnoea leads to inactivity which in turn causes further loss of muscle mass & reduces the force of contraction & makes it prone to fatigue.
2. **Systemic inflammation:** Systemic inflammation leads to degradation of myosin heavy chains leading to premature cell death.
3. **Oxidative Stress:** Glutathione (Intracellular anti oxidant) abnormality in skeletal muscle of COPD brings about muscle fatigue & also facilitates proteolysis.
4. **Tissue Hypoxia:** It suppresses protein synthesis in muscle cells. Associated depression may lead to sedentary life style which further may lead to SMD.
5. **Use of corticosteroids:** May lead to muscle weakness.
6. **Nutritional imbalance and others:** It includes hypoxemia and cardiac failure.

**Cardiovascular manifestations:** Pulmonary arterial hypertension with right ventricular hypertrophy leads to right heart failure. Though left ventricular functions are well preserved but with progressive disease right ventricular dilatation leads to septal shift and decreased left ventricular compliance. There may be higher risk of cardiac arrhythmias especially supra ventricular type. Reduced FEV1 is the marker of cardiovascular morbidity and mortality independent of cigarette smoking and hypertension. COPD may increase the risk of cardiovascular mortality by 2 to 3 fold. In fact, poor lung function is a better predictor of all cause and cardiac specific mortality than established risk factors.
like dyslipedemia or hypertension. Systemic inflammation and endothelial dysfunction are responsible for atherosclerosis in COPD. Leukocytes, platelets, fibrinogen and C-reactive protein (CRP) levels are increased in COPD patients and have direct effect on plaque formation. Neutrophilic inflammation can destabilize the plaque and lead to its rupture. Polycythemia may also act as a predisposing factor to vascular events.

**Skeletal muscle dysfunction**: Shortness of breath is the commonest compliant of COPD and that is thought to be due to increased work of breathing and airflow obstruction. There is a growing opinion that skeletal muscle dysfunction (SMD) contributes to reduced exercise tolerance and the quality of life. There is loss of muscle mass and also dysfunction of remaining muscle mass having dual impact. Increasing severity of COPD is associated with decreasing fat free mass and bone mineral density. There anatomical changes in fiber type with shift from type I to type II muscle fibers where fiber strength and enzyme activity is reduced. Hence skeletal muscles are underused and diaphragm is overworked to take the load.

**Nutrition and weight**: More than 50% of severe COPD patients have unexplained weight loss. 10 to 15% of the patients of mild-to-moderate COPD also suffer from weight loss and that is mainly due to loss of skeletal muscle mass. Increased metabolic demands due to systemic inflammation, tissue hypoxia and pharmacotherapy for COPD when not matched with increased caloric intake results in weight loss. Unexplained weight loss is a marker of poor prognosis of COPD patients and is independent of the other indicators, such as FEV1 or PaO2. The BODE index which includes body mass index, degree of air flow obstruction, degree of dyspnoea and exercise capacity of the patient predicts mortality better in COPD patients than FEV1 alone.

**Psychological issues**: Depression and anxiety are common in patients with chronic diseases state, more so with COPD. It is linked to major physical impairment and embarrassing symptoms such as productive cough and dyspnoea. Psychological disturbances lead to further compromised quality of life. Also it leads to poor perception of disease and with poor understanding leads to poor compliance to treatment hence an overall poor control of disease.

**Osteoporosis and bone fractures**: Since the risk factors for COPD and osteoporosis are common like smoking, systemic inflammation, low body mass index, decreased activity, steroids use, hypogonadism, sedentary life style and less sunlight exposure, osteoporosis is found in almost all patients of COPD irrespective of the severity of their diseases.

Osteoporosis leads to vertebral fractures. Thoracic vertebral fractures compromise the lung functions further. A single thoracic vertebral fracture could lead to 10% fall in VC. Also it adds to inactivity and affects the quality of life negatively.

**Anemia**: During earlier stages of type I respiratory failure there is polycythemia and Hemoglobin levels are increased in blood as hypoxia is a strong stimulus for erythropoisis. But as the disease advances most of the patients exhibit various levels of anemia depending on their nutritional status. Anemia also adds to inactivity.

In advanced stages of COPD with polycythemia, when this patients are put on oxygen therapy again anemia manifests. With oxygen therapy, hypoxia the strong stimulus for erythropoisis is no longer there, manifesting anemia.

There are other co morbidities like Sleep disturbances including sleep apnoea and Diabetes and glucose intolerance etc.

**Impact on management**: It remains to be seen whether therapeutic interventions to treat COPD like inhaled steroids or the new Phosphodiesterase inhibitor group of molecules have the potential to influence systemic inflammation. Further it is not known if treatment of the treatment of underlying inflammation brings about significant improvement in COPD or for that matter the associated co morbidities. Drugs such as statins and ACE inhibitors which improve endothelial dysfunction may have benefits in COPD. Oral drugs currently under investigation may have the advantage of controlling both local pulmonary as well as systemic inflammation as compared to inhaled medicines.

**Prevention of COPD exacerbation**: COPD exacerbations can be prevented with the optimal use of available pharmacotherapy with long acting beta agonists, anticholinergic drugs, and inhaled steroids. Preliminary data with oral PDE inhibitors suggests an additional effect. Non pharmacological interventions include rehabilitation & self management plans & maintaining good physical activity are good strategies for maintaining stable state. Lung Volume Reduction surgeries must be considered for selected patients. Antioxidants such as N acetyl cysteine may not have much of role to play but may be beneficial in patients not taking inhaled steroids.. Immnomodulators are of doubtful value. Prophylactic antibiotics are not much used. All COPD patients may be vaccinated to prevent future exacerbation.

**Pneumococcal vaccination**: It contains purified capsular polysaccharide from 23 serotypes that is responsible for the most of the invasive form of pneumococcal disease. It is recommended for all immuno compromised patients or elderly patients with multiple co morbidities. Though it is not shown to reduce the infective exacerbations of chronic bronchitis in COPD but it may be effective in preventing invasive illness.

**Influenza vaccination**: It is a purified, inactivated, split virion vaccine prepared with A & B strains of influenza virus corresponding to the epidemiological evidence for the year. The efficacy of the vaccine depends on the match between strains in the vaccine & the circulating influenza strains in community. A Meta analysis pneumonia in elderly showed that vaccine reduced the occurrence of pneumonia by 53%, hospitalization rate by 50% & mortality rate by 68%.%

**PNEUMONIA IN ELDERLY**
In comparison with younger patients with pneumonia, elderly patients have greater incidence, more severe disease, often require
hospitalization, may need longer duration of stay & also have higher mortality.

Community acquired pneumonia is an acute infection acquired outside the health care facility like hospital, ICU or even diagnostic centers and Paramedical clinics like rehabilitation centers in an immunocompetent patient.

Increased age with weaker immune system & and poor nutrition itself could predispose to the condition. Social factors like dependence and inadequate family support could lead to smoking and alcohol consumption which may again put them at a higher risk of getting pneumonia. Associated co morbidities like diabetes and kidney or liver disease or cerebrovascular disease related altered sensorium or other chronic respiratory disease like bronchiectasis could make the patient susceptible to pneumonia.

Pneumonia in elderly may not present with conventional combination of cough, with purulent expectoration, breathlessness and fever. It may present as worsening on pre existing stable co morbidity, like a stable chronic renal failure (CRF) in dialysis may have acute renal failure with pneumonia or stable COPD may get acute exacerbation of bronchitis. It may also present as altered sensorium or as loose motion & weakness. The non specific presentations like deterioration of general condition, confusion, incontinence of urine may be the presentation of pneumonia.

Even after extensive diagnostic work up studies evaluating causes of pneumonia have failed to identify specific etiology in 40 to 60 % of the patients. Amongst the bacterial infections Strepoccus pneumoniae remains the commonest infection, followed by Haemophilus influenzae and Moraxella catarrhalis. Infection with Pseudomonas or Enterobacteriaecae or other gram negative bacteria occurs with underlying unhealthy lung or in patients with associated co morbidity or patients exposed to antibiotics frequently.

Influenza infections or respiratory syncytial virus infection are common viral infections of elderly. The choice of antibiotic depends on the suspected etiological bug, associated co morbidity, general status of the patient & decision whether to offer him OPD or in patient treatment. Elderly with dysphagia and gastroesophageal reflux caused by associated neurological or metabolic insult have the increased risk of aspiration of oropharyngeal or gastric content.

The type of antibiotic for aspiration pneumonia also would depend on if the aspiration occurs in hospital or in community. Also, if patient has poor oral hygiene or foul-smelling sputum, anaerobic organisms would be a possibility.

**INTERSTITIAL LUNG DISEASE**

Interstitial lung disease comprises of a big group of diseases resulting from various etiological factors having similar clinical, physiological, pathological and radiological presentation. Progressive cough and dyspnoea, with abnormal X-ray having reticulo-nodular bilateral lesion with soft crepitus at the bases and restriction on spirometry are the hall marks. Occupational exposure, environmental factors like contact with birds, drugs or presence of systemic disease that is known to involve lung would raise the suspicion. Presentation could be very insidious onset of dyspnoea and cough. Cough is generally dry and rarely present at night. Patients may have associated myalgia or arthralgia or skin disease or renal involvement. Amongst the various ILDs disease like IPF, Bronchiolitis obliterans organizing pneumonia, connective tissue disorders like rheumatoid arthritis and systemic sclerosis and Vasculitis like Wegner's and Churg – Strauss syndrome are seen commonly in elderly. Also drug-related interstitial lung diseases could be more common in elderly as diseases for which these drugs are used is prevalent in elderly like cardorone & methotrexate.

Radiation used for thoracic malignancies could lead to asymptomatic radiological findings in as high as 50 % of the patients and radiation pneumonitis may be clinically evident in 15 % of them depending on radiation dose, volume of lung irradiated & associated chemo therapy. Amongst the bacterial infections Strepoccus pneumoniae remains the commonest infection, followed by Haemophilus influenzae and Moraxella catarrhalis. Infection with Pseudomonas or Enterobacteriaecae or other gram negative bacteria occurs with underlying unhealthy lung or in patients with associated co morbidity or patients exposed to antibiotics frequently.

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**LUNG IN SYSTEMIC DISEASES:**

Pulmonary involvement in systemic disease could be due to direct involvement of the lung in the systemic diseases like Vasculitis or rheumatoid arthritis or it could be because of indirect effect of the disease on lung like kyphoscoliosis leading to chest wall abnormality and restrictive lung disease or obesity or endocrinal disorders like hypo thyroidism leading to poor respiratory drive. Lung may get involved due to treatment of associated co morbidity. Drugs like cardorone or steroids or ACE inhibitors used for various systemic diseases are known to have specific effects on respiratory system. Variety of systemic diseases like Obesity, Diabetes, metabolic syndrome, hypertension, CHF and COPD are known to have restrictive pattern on spirometry. Lung function loss in elderly could be due to decline in cognitive function, poor nutrition, decreased muscle strength, osteoporosis, age related Kyphosis other co morbidities.

Diseases like pulmonary embolism are seen at an increased frequency in elderly. Between 60 – 74 years the annual incidence of venous thromboembolism is approximately 3.5 per thousand populations. These rates increase approximately to 9 per thousand amongst patients aged > 75 years. Sleep in elderly could be disturbed due to various reasons. It may...
be age-related physiological changes in duration and composition of sleep or effect of various co morbidities. Due to altered morphology of upper airway due to sagging muscle, poor muscle tone, loss of elasticity of skin, poor denture they may be at a higher risk of sleep disordered breathing. Snoring in obese or overweight patient, hyper somnolence, nocturnal choking, multiple arousals, witnessed apneas, accidents and falls should raise the possibility of obstructive sleep apnoea syndrome (OSAS). Elderly patients may have special issue with compliance to therapy including the use of CPAP or oxygen therapy.

Elderly patients with respiratory disease may have a lot of co morbidities such as COPD, Diabetes, HIV and other immuno-deficiencies. These conditions may be found in cases of frequent respiratory tract infections. Obesity, hypertension, diabetes mellitus, chronic renal failure may be found in sleep disordered breathing. Patients with lung cancers are found to have associated COPD, cardio vascular diseases and other systemic cancers due to effects of smoking. Sinusitis, gastro-oesophageal reflux, psychological illnesses are frequently found to co-exist in asthmatics.

**LUNG CANCERS**

Lung cancers in elderly, presents with unique issues that makes selection of the best treatment approach difficult and as a result, a lot of them are under-treated. Poor physiological reserves, nutritional status and co-morbidity may limit surgical option. We also may not know much about their response to various therapeutic options as they may be excluded from most of the clinical trials. Clinical data from younger individuals may not be automatically extrapolated to elderly with lung cancers. Elderly tend to tolerate aggressive chemotherapy & radiotherapy poorly in comparison to younger.

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