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Respiratory Disorders in Oman

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Respiratory diseases are very common, accounting for significant morbidity and mortality worldwide. They comprise a wide range of conditions affecting both the upper and lower respiratory tracts in both adults and children. These diseases can be categorised as acute or chronic, although they often overlap between categories. Significant advances have been made in the control of many respiratory disorders and essential facilities are now accessible country-wide within Oman. However, the available respiratory services are often perceived to be inadequate and lacking sufficient coordination. In addition, there is limited data on the burden of common respiratory diseases in Oman. As an example, our studies showed that the prevalence rate of self-reported asthma diagnoses was 10.5% in children and 20.7% in adolescents, with a relatively high prevalence of severe asthma symptoms. There are no data on the rates of chronic pulmonary disease or asthma in adults. Studies on asthma management among adults suggest that this condition is underdiagnosed and sub-optimally managed, despite the availability of the National Asthma Management Guidelines. This presentation highlights the paucity of information on respiratory disorders in Oman. Data from the limited number of national studies on the management and control of respiratory disease have identified important deficiencies and areas for improvement, as well as the need for further coordinated research on respiratory disorders in Oman.

Management of Chronic Obstructive Pulmonary Disease

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Chronic obstructive pulmonary disease (COPD) is a common respiratory illness that affects a large population of patients, the majority of whom are smokers. This condition remains underdiagnosed and undertreated within Oman. Traditionally, identifying the stage of the disease's severity was mainly achieved by using the post-bronchodilator forced expiratory volume in one second (FEV1) percentage as the marker of disease severity. Recently this has been challenged and a new staging algorithm was designed by the Global Initiative for Chronic Obstructive Lung Disease (GOLD). This includes the patient's symptoms, risk of exacerbation, as well as the degree of airflow obstruction measured by FEV1. Cessation of smoking remains a key issue in the management of all COPD patients who are current smokers. Medical therapy mainly aims to reduce symptoms and the frequency and severity of the exacerbations, as well as improving the patient's exercise tolerance. So far, no intervention has been proven to prevent lung function decline or reduce mortality. Treatment is initiated according to the overall assessment of disease severity, with bronchodilators being the first line of therapy. Long-acting anticholinergics (e.g. tiotropium) are the preferred starting agents. Long-acting beta 2 agonists (LABAs) can then be added if the patient remains symptomatic. Combined therapy with LABAs and inhaled corticosteroids is recommended for patients with a severe or very severe form of the disease. The phosphodiesterase-4 inhibitor, roflumilast, may also be used for such patients. The treatment of existing medical comorbidities is of paramount importance. Long-term oxygen therapy remains the only intervention that prolongs survival in patients with severe COPD and resting hypoxaemia. Bronchoscopic lung volume reduction is a relatively new technique which has been tried in patients with severe emphysema. These patients were found to show some improvement in their lung function and exercise tolerance.

Management of Severe Allergic Asthma: *An update*

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Asthma is a chronic lung inflammatory disease affecting 5 to 10% of the population. Although patients do have symptom-free periods, inflammation is always present in their airways. Asthma manifests with paroxysmal bronchospasms, wheezing, dyspnoea and respiratory distress. Allergic asthma is the most common form of asthma, affecting over 50% of asthma sufferers. Symptoms are triggered by allergens, such as dust mites, skin flakes or materials shed by pets, pollens, moulds, etc. Studies have shown an increase in the serum levels of circulating immunoglobulin E (IgE). Most patients have mild or moderate asthma, which can be well controlled with β-agonists and inhaled corticosteroids. A subgroup of patients have a more troublesome form of the disease, reflected by high medication requirements, persistent symptoms, asthma exacerbations and persistent airflow obstructions. Omalizumab, an anti-IgE monoclonal antibody that binds the Cε3 domain of IgE, is currently a favoured add-on therapy to improve asthma control in adult and adolescent patients who are suffering from severe persistent allergic asthma. Omalizumab induces a conformational change of the immunoglobulin and a concealment of the FcεRI and FcεRII receptors' binding sites, preventing the binding of IgE. As a result, the

release of inflammatory mediators is prevented. Omalizumab has been used in the control of moderate to severe allergic asthma that does not respond to a combination of high-dose inhaled corticosteroids and long-acting beta agonists, with or without leukotriene inhibitors. Researchers are currently investigating the efficacy and safety of omalizumab in this subgroup of asthmatics.

Asthma Clinic Programme at Primary Health Care Level

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An asthma clinic programme was formulated under the auspices of the Omani Ministry of Health and the Oman Respiratory Society. Their aims were to: evaluate the current management of asthma in Oman; standardise management across all primary health care centres; improve outcomes, and to minimise management costs. The programme, to be completed in an 18–20 month period, was designed in four phases: (I) Health centres located in focal points of the region establish an asthma team consisting of doctors, nurses and pharmacists; (II) Each health centre collects baseline data on the current management of asthma, including information on exacerbations and the availability of asthma-related resources in their centre; (III) Asthma teams attend workshops covering strategies for establishing the clinic, the management of asthma in adults and children (including non-pharmacological aspects of management), the use of spirometry and conducting clinical audits, and (IV) Clinical audits are performed to assess the centres' compliance with the programme requirements, their patient outcomes and management cost minimisation. Based on the feedback from these audits, the main challenges facing these clinics are identified and corrective measures applied. All the asthma clinics follow standardised protocols and guidelines and have common procedures, charts and forms. Between 2011 and 2013, 42 asthma clinics were established across Oman and more than 600 health care providers attended the workshops from different governorates. Although there were initially a limited number of asthma teams, the programme will later be implemented in Oman's remaining health centres and polyclinics.

Management of Bronchiectasis

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Bronchiectasis refers to the abnormal permanent dilatation and destruction of the bronchi. This leads to the stasis of mucus in the respiratory tract, which results in recurrent chest infections. It can be congenital, as in ciliary dyskinaesia, cartilage deficiency and immunological problems, or it may be an acquired condition, such as in post-infectious states like tuberculosis, local airway obstructions or secondary to connective tissue diseases. Currently, the diagnosis of bronchiectasis is made using high-resolution computed tomography (HRCT). Characteristic features on a HRCT scan include airway dilatation, lack of airway tapering, bronchial thickening and cystic changes. The treatment goal is to prevent progression of the disease, maintain or improve lung function, reduce exacerbations, improve quality of life and, in children, to achieve normal growth. The management of this condition includes the identification and treatment of its underlying cause, education of the patient and their family, airway clearance strategies, airway drug therapy, antibiotics, surgical interventions and the management of complications. In children it is very important to identify the cause of the condition, as specific goal-directed therapy can improve the outcome in these patients. These include an immunoglobulin deficiency, foreign body aspiration, typical and atypical cystic fibrosis and ciliary dyskinaesia. Patients should be educated about the disease process, management principles and the early identification of exacerbations. Airway clearance using physiotherapy, exercise, mucolytic and hyperosmolar therapies are vital in the management of this condition. Drug therapies targeting the airways, such as inhaled bronchodilators and inhaled corticosteroids, are useful for patients with obstructive airways. Exacerbations are identified by the worsening of respiratory symptoms like coughing, wheezing, breathlessness, sputum purulence, increased sputum volume and a change in viscosity, with or without systemic upset. The judicious use of antibiotics, including the selection and duration of therapy, is vital in the management of exacerbations.

Cystic Fibrosis in Oman

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Cystic fibrosis (CF) is an autosomal recessive disease. It is the most common lethal genetic disease in the Caucasian population, occurring in one per 3,500 newborns. CF is caused by a mutation in the CF transmembrane conductance regulator (CFTR) gene, which is located on the long arm of human chromosome seven, at the q31.2 locus with 27 exons. The clinical features of CF present in the organs affected by the CFTR gene dysfunction. An involvement of the gastrointestinal system manifests as meconium ileus in about 10–15% of newborns, obstruction of the small bile ducts and pancreatic insufficiency which results in a failure to thrive (FTT) from early infancy. In the respiratory system, thick mucus secretions lead to chronic airway obstruction and infections, which can cause bronchiectasis and respiratory failure. In 95% of male CF patients, there is a congenital absence of the vas deferens, resulting in infertility. The sweat glands have a very high concentration of sodium chloride, which can lead to hyponatraemic dehydration in the summer months and patients may present with a blood chemistry suggestive of Pseudo-Bartter syndrome (hypokalaemia, hyponatraemia and metabolic alkalosis). In most children, a diagnosis of CF depends on the clinical manifestations, a positive sweat test and/or two disease-causing CFTR mutations. Among 74 Omani CF patients, who were followed-up in Sultan Qaboos University Hospital and Royal Hospital, we found that the median age of onset was two months, although the median age of diagnosis was five months. Of these cases, 80% were diagnosed by the age of three years and 60% had a positive family history of CF. Furthermore, 35% of the subjects presented with only recurrent chest infections, 20% presented with chest infections and FTT, 7% with diarrhoea and FTT, 5% with only FTT and 19% with meconium ileus. The treatment of CF is complex and relies on a multidisciplinary team including a CF specialist, a nurse, a dietician and a physiotherapist.

Overview of Interstitial Lung Diseases

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Interstitial lung diseases (ILDs) are a diverse group of diseases affecting the pulmonary interstitium or parenchyma, hence the name 'diffuse parenchymal lung diseases'. In fact, the only factor linking these diseases is the location affected—the interstitial part of the lung structure. Otherwise, they are diverse in aetiology, epidemiology, age of onset, clinical presentation, method of diagnosis, management and prognosis. They are commonly classified as idiopathic interstitial lung diseases or interstitial lung diseases with a known aetiology. An important step in the management of these conditions is early detection, as little can be done once the disease is advanced. However, many of these conditions are clinically and radiologically silent in their early phases. Pulmonary function tests measuring diffusion, such as the diffusing capacity of the lung for carbon monoxide (DLCO), can be of help in the early disease stages, however, these are generally underutilised. In some ILDs, a high-resolution computed tomography (CT) scan of the chest is sufficient to make a confident diagnosis, while in others an open lung biopsy is necessary. Management varies from disease to disease and from one variant of the same disease to another. Some require only observation and follow-up, whereas others may need extensive therapy with immunosuppressive medications or even a lung transplant. In this session, an overview of interstitial lung diseases will be presented together with an elaboration on some of the common ILDs in the region, particularly idiopathic pulmonary fibrosis and sarcoidosis.

Beyond Community-Acquired Pneumonia

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Community-acquired pneumonia (CAP) is a global public health concern. It is the seventh most-common cause of death worldwide and the leading cause of infectious disease-related deaths. Up to 75% of CAP patients are hospitalised; among these, 10% require admission to an intensive care unit (ICU). Patients with severe CAP have a mortality rate of up to 50%, despite appropriate antibiotic coverage and supportive measures. CAP puts an enormous strain on healthcare resources and the management of these patients remains a considerable challenge. Since the introduction of penicillin, CAP mortality rates have not changed substantially. Therefore, efforts should be focused on optimising the processes of care and developing new treatment modalities. Over the past few decades, several clinical advances have emerged in a number of areas that may aid in the care of CAP patients. In support of these new concepts, this presentation will focus on some of the most controversial questions related to processes of care for CAP patients. The presentation will outline the different faces of CAP management beyond antibiotic therapy and provide an update on the diagnosis, site-of-care decision-making, classifications and the management of severe sepsis in CAP patients.

Management of Pleural Effusion

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In a case of pleural effusion it is important to determine whether it is exudative or transudative. Transudate implies that there is an extrapleural condition to be diagnosed and treated while exudate reflects a disorder of the pleura and requires adequate treatment of the underlying disease. The intention of this presentation is to shed light on non-invasive diagnoses of pleural diseases and disorders, based on the biochemical properties of the fluid and the presence of certain biomarkers. Light's criteria remain the cornerstone in differentiating between exudative and transudative pleural effusions. If in bias, N-terminal pro-brain natriuretic peptide (NT-proBNP) is a specific marker of cardiogenic transudative effusions. Adenosine deaminase (ADA) is an important biomarker of pleural tuberculosis. Distinguishing benign from malignant pleural effusion remains a challenge. There is a potential role for tumour markers in avoiding more invasive procedures, but these are not sensitive or specific enough for any histological type of malignancy. Potentially, 'fingerprinting' specific disease markers, by means of proteomics and gene profiling, may prove to be of significant diagnostic value in pleural diseases in the future.

Metastatic Non-Small-Cell Lung Cancer: *Expanding the molecular horizon*

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Non-small-cell lung cancer (NSCLC) is one of the few solid tumours to undergo a recent expansion in treatment options. The last few years have brought new hope to the treatment of metastatic NSCLC. There is a very poor prognosis for those with stage IV NSCLC as the five-year survival rate does not exceed 1%. Considering all of the stages, the five-year survival is approximately 15%. The histopathological subtyping of NSCLC is mandatory in order to explore potential options for targeted therapy. Due to two genetic alterations that are key oncogenic events in NSCLC, selective pathway-directed systemic therapy is now a possible treatment. The presence of epidermal growth factor receptor (EGFR)-activating and -sensitising mutations is predictive of a response to EGFR inhibitors, such as erlotinib and gefitinib. Anaplastic lymphoma kinase (ALKA) gene rearrangement is present in about 5% of NSCLC cases; however, this is effectively suppressed by ALKA inhibitors like crizotinib.

Tuberculosis: *Where we are*

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In 2012, there were 8.7 million cases of tuberculosis (TB) and 1.4 million TB-related deaths worldwide. The vast majority of deaths were in cases of human immunodeficiency virus (HIV) co-infection and multidrug-resistant (MDR) TB. In Oman, the incidence of TB is low, with 375 new cases in 2012 and 13 deaths. The incidence of TB/HIV co-infections and MDR TB is also low, with 13 cases and four cases, respectively, reported in 2012. However, there is a rising number of TB cases among non-Omanis, especially house-maids. The main risk factors for nationals are a family history of TB and a history of smoking and diabetes mellitus. The low incidence of TB in Oman causes diagnostic challenges, including delays in diagnosis and low detection rates in primary health centres. However, the national sputum

conversion and treatment success rates are excellent. There is also a satisfactory level of contact screening and treatment of latent TB cases where indicated. The national TB control programme is acquiring new tools to meet some of the current challenges. This includes the acquisition of rapid molecular diagnostic tools along with the introduction of the public-private mix (PPM) and practical approach to lung health (PAL) strategies. There is a continuous TB training programme at the central and regional levels. In addition, the social welfare of families affected by TB is being given special attention.

Acute Respiratory Distress Syndrome: *Current concepts*

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Acute respiratory distress syndrome (ARDS) is a life-threatening condition affecting patients in all age groups. The syndrome was first described by Ashbaugh in 1967. Since then, there have been two main challenges associated with ARDS—diagnostic criteria and effective management. Until recently the definition used was based on criteria set by the American-European Consensus Conference in 1994. However, the reliability and validity of this definition and criteria have been questioned. A panel of experts convened in 2011 (an initiative of the European Society of Intensive Care Medicine, the American Thoracic Society and the Society of Critical Care Medicine) and developed the 'Berlin' definition, which focuses on feasibility, reliability, validity and an objective evaluation of performance. This panel came up with new and practical criteria to define ARDS. It has always been a great challenge to manage patients with severe ARDS. Very few management strategies have shown to improve the survival rates of these patients. The treatment strategies that have demonstrated some efficacy include protective lung ventilation, prone position and extracorporeal life support.

Non-Invasive Ventilation in the Management of Acute Respiratory Failure

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Non-invasive ventilation (NIV) refers to the delivery of positive airway pressure via a non-invasive interface, as opposed to invasive ventilation through an endotracheal or tracheostomy tube. Over the past 15 years, NIV has become a standard of care in managing commonly encountered cardio-respiratory emergencies, namely acute hypercapnic respiratory failure in patients presenting with acute exacerbation of chronic obstructive pulmonary disease (AECOPD) and cardiogenic pulmonary oedema. As there is a wealth of data demonstrating the efficacy of NIV, the National Institute of Clinical Excellence in the UK recommends that NIV should be available in all hospitals admitting patients with COPD. The only absolute contraindication for NIV is when there is a need for emergency intubation. However, it could also be argued that cardio-respiratory arrest is another contraindication, as NIV, in essence, is applied on conscious patients and those breathing spontaneously. NIV should be started within the first hour of the patient's arrival at the hospital, in a well-monitored area, such as a high-dependency or intensive care unit. Prior to this, it is important to counsel the patient and obtain verbal consent as some may be initially reluctant. Every two NIV patients should be monitored by at least one nurse. A patient's response to NIV is assessed by evaluating a combination of clinical and physiological parameters, including their effort in breathing, heart rate, chest expansion, oxygen saturation, serial arterial carbon dioxide levels and level of consciousness. On average, patients may require continuous NIV for 48 hours, after which they can be weaned off if their clinical condition permits. However, the treating clinician must assess the NIV's efficacy in the first four hours, as delaying invasive ventilation for those who need it can worsen their prognosis and even increase mortality.

Obstructive Sleep Apnoea

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Sleep is a physiological phenomenon divided into two main stages—non-rapid eye movement (NREM) and rapid eye movement (REM). Obstructive sleep apnoea (OSA) is the main sleep-related breathing disorder, affecting 4% of men and 2% of women. OSA is characterised by repetitive nocturnal airway obstructions associated with hypoxaemia. Excessive daytime sleepiness is a major complication of OSA. The main risk factors for this condition are obesity, tonsillar and adenoid enlargements, gender (male) and facial deformities. The standard treatment is continuous positive airway pressure using different interfaces. Untreated OSA may result in serious complications such as hypertension, diabetes and ischaemic heart diseases. In addition, daytime sleepiness carries a high risk of causing or being involved in road traffic accidents.

Obesity Hypoventilation Syndrome

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Obesity hypoventilation syndrome (OHS) is a disease entity that is distinct from simple obesity and obstructive sleep apnoea. OHS was described well before obstructive sleep apnoea—in 1956 Burwell popularised the term 'Pickwickian syndrome' by noting the similarities between his patient and a character in the Charles Dickens's novel, *The Posthumous Papers of the Pickwick Club*. OHS is characterised by the triad of obesity (body mass index ≥30 kg/m^2), chronic awake alveolar hypoventilation (partial pressure of carbon dioxide [PaCO2] >45 mmHg and partial pressure of oxygen [PaO2] <70 mmHg at sea level) and a sleep-related breathing disorder, in the absence of other causes of hypoventilation. As OHS is a diagnosis of exclusion, pulmonary parenchymal or obstructive diseases, neurological disorders, musculoskeletal diseases, hypothyroidism and medication-induced hypoventilation must be ruled out. Its prevalence is estimated to be 10–20% in obese patients with obstructive sleep apnoea and 0.15–0.3% in the general adult population. The presentation is usually indolent with symptoms arising due to hypercapnia and sustained hypoventilation (hypersomnolence, altered cognitive functioning, headaches, peripheral oedema, hypertension and congestive cardiac failure). The pathophysiology of OHS is complex, as obesity is not the only risk factor; this may explain why some obese individuals develop OHS while others maintain a normal gas exchange. Generally, it is thought that obese subjects who have developed daytime hypoventilation will have a reduced sensitivity to the rising level of PaCO2 as well as leptin resistance. The interaction between these factors, amongst others, leads to the development of OHS. The management of patients with OHS requires a multidisciplinary approach combining different medical and surgical subspecialties. Affected patients

will require the input of: an internist and endocrinologist regarding diabetes mellitus, hypertension, hyperlipedaemia, heart failure and hypothyroidism; a dietician for advice on weight reduction; a respirologist for the management of respiratory failure (positive airway pressure ventilation), and a surgeon regarding potential bariatric surgery.

Tobacco Dependence Treatment

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Providing tobacco dependence treatment (TDT) is a growing novel specialty in the Middle East. The World Economic Forum statistics on tobacco use among youth, as well as the cost of resulting non-communicable diseases (NCDs), are staggering. Over the next 15 years the cost of various NCDs, such as cardiovascular diseases, cancer-related respiratory illnesses and diabetes, is expected to exceed USD 15 trillion. This includes the lost income due to mortality and morbidity, as well as the amount required to be invested in healthcare developments in order to manage this epidemic. These numbers are fuelled by the alarming increase in the prevalence of youth smoking and the expected shift in the population age pyramid over the next 15 years. Studies have shown that the treatment of tobacco dependence must move in parallel with education and awareness to reduce the burden of tobacco-related NCDs. TDT and oxygen therapy are the only treatments shown to improve survival in patients with chronic obstructive pulmonary disease (COPD). Smoking cessation in COPD cases minimises symptoms, improves quality of life, reduces hospitalisation and improves survival rates. Combining motivational interviews with pharmacological therapy increases the rate of smoking abstinence. It is recommended that healthcare providers (HCPs) receive special training on approaching patients for TDT. Global collaboration in providing such training is gaining popularity and momentum—an example of such an alliance, Global Bridges, has trained close to 2,000 HCPs worldwide with a total of 600 or more trained in the Eastern Mediterranean region. The impact of this mass training is yet to be measured. However, due to the immense impact of tobacco-related NCDs, as well as the accelerated increase in the prevalence of tobacco use, healthcare providers must apply all necessary interventions in order to prevent an imminent disaster.

The Pulmonary Vasculitides

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The vasculitides are a heterogeneous group of disorders characterised by the histopathological findings of inflammation and necrosis of the blood vessel wall. Pulmonary vasculitis may present in a variety of ways, including an alveolar haemorrhage, pulmonary nodules, cavitating lesions or an airway disease. The American College of Rheumatology and the Chapel Hill Consensus Conference on vasculitis attempted to classify the main pulmonary vasculitides. These classifications do not cover other potential diseases that affect the lungs with similar presentations. These include Behçet's disease, systemic lupus erythematosus, antiphospholipid syndrome and other connective tissue diseases. Fortunately the diagnostic advancements and similarities in therapeutic approaches for the different vasculitides enable clinicians to initiate lifesaving interventions before such diagnoses become clearly marked. Moreover, vasculitides rarely affect a single organ and a detailed clinical history may uncover clues to guide clinicians to the correct diagnosis. Similarly, geographical and ethnic variations show a distinct incidence and prevalence of different vasculitides in different countries. The aim of this presentation is to explore these issues.

Pulmonary Embolism

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The severity of an acute pulmonary embolism (PE) ranges from asymptomatic, incidentally detected subsegmental thrombi to a massive, pressor-dependent PE complicated by cardiogenic shock and multisystem organ failure. Risk factors include venous stasis, hypercoagulable states, immobilisation, surgery trauma, pregnancy, the use of oral contraceptives and oestrogen replacement therapy, malignancy, hereditary factors or an acute medical illness. The classical symptoms are dyspnoea (73%), pleuritic chest pain (66%), coughing (37%) and haemoptysis (13%). The most commonly used method to predict a patient's clinical probability of developing PE is the Wells' score. A positive D-dimer is not synonymous with PE, but a negative D-dimer almost always excludes PE. The positive predictive value of ischaemia-modified albumin (IMA) is more effective than D-dimer, although it cannot confirm a diagnosis of PE without additional investigations. Elevated troponin levels are associated with a higher risk for in-hospital mortality and a complicated clinical course. Brain natriuretic peptide (BNP) and N-terminal prohormone of brain natriuretic peptide (NT-proBNP) are associated with the diagnosis of a right ventricular dysfunction and are significant predictors of in-hospital mortality. Although the gold standard for PE diagnosis is pulmonary angiography, this is seldom used due to the availability of non-invasive techniques. In most cases, computed tomography (CT) pulmonary angiography is the recommended first-line diagnostic imaging test. A ventilation/perfusion scan is also accurate but is not usually freely available. Rapid risk stratification is also important to assess a patient's risk of early death. The Pulmonary Embolism Severity Index (PESI) is currently the most extensively validated prognostic clinical score. Anticoagulant therapy continues to be the mainstay of treatment along with supportive treatments, such as oxygen or analgesia. Unfractionated heparin, low-molecular-weight heparin or fondaparinux is usually administered initially, followed by oral agents like warfarin or rivaroxaban. A massive PE-causing haemodynamic instability is an indication for thrombolysis. The use of thrombolysis in non-massive PEs is not yet clear. A catheter or a surgical embolectomy can be considered in select cases, especially where thrombolysis is contraindicated.

Pulmonary Arterial Hypertension

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Pulmonary hypertension (PH) has been defined as an increase in mean pulmonary arterial pressure (PAP) to 25 mmHg at rest, as assessed by right heart catheterisation. The normal mean PAP at rest is 14 ± 3 mmHg, with an upper limit of 20 mmHg. Between 1967 and 1973, a 10-fold increase in unexplained PH was reported in central Europe. The rise was subsequently traced to aminorex fumarate, an amphetamine-like drug introduced in Europe in 1965 to control appetite. The pathogenesis of PH is attributed to a small,

distal pulmonary artery obstruction due to vasoconstriction and thrombosis as well as smooth muscle and endothelial cell proliferation. This leads to severe concentric laminar intimal fibrosis, medial hypertrophy and *in situ* thrombosis of the small residual lumen. PH is classified as (1) pulmonary arterial hypertension; (2) pulmonary venous hypertension; (3) PH associated with hypoxaemia; (4) PH due to chronic thrombotic disease and/or embolic disease, and (5) miscellaneous PH. The symptoms are generally non-specific and patients usually present with progressive dyspnoea on exertion, fatigue, dizziness, palpitations, chest pain, syncope or oedema. Management requires close observation, periodic echocardiographic assessment, oxygen and the judicious use of specific drugs. Pulmonary arterial hypertension is usually treated with prostanoids (epoprostenol and ilioprost), endothelin receptor antagonists (bosentan) and phosphodiesterase inhibitors (sildenafil). Pulmonary venous hypertension is usually treated with diuretics, calcium channel blockers, nitrates, beta-blockers and angiotensin-converting enzymes. Generally, PH associated with lung disease does not require specific therapy other than long-term oxygen and optimal treatment for the primary chronic lung disease. Surgical interventions, such as a pulmonary thromboendarterectomy, can be considered in select cases of PH due to a chronic thromboembolism.

Occupational Lung Diseases

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Occupational lung diseases (OLD) are a group of illnesses caused by the inhalation of toxic substances present in a working environment. They are either caused by a prolonged and repeated exposure to irritant or toxic substances, leading to a chronic illness, or a single severe exposure, potentially leading to an acute medical emergency. Globally, OLD are the most common type of work-related injuries. Potentially harmful materials that can affect the lungs when inhaled can be classified according to their nature; organic dust (cotton dust, grain dust, agriculture dust and toxic chemicals and gases) or inorganic dust (silica, coal dust, asbestos and beryllium). The defence mechanisms in the lungs will fail to expel these particles either during a highly toxic exposure, after repeated exposures or if the particles have an irregular structure. The size and structure of the particles will also determine where it will be deposited in the respiratory tract. OLD include obstructive lung diseases, restrictive lung diseases, respiratory cancer and mesothelioma. Occupational asthma is the most commonly reported form of OLD. Taking the patient's occupational history, as well as information on their living environment, is an important element in the early recognition and diagnosis of OLD. The prevention of OLD is a significant challenge worldwide. Environmental and medical hazard surveillance in the workplace aids in the modification and improvement of the working environment. Furthermore, the application of health and safety hazard control measures (risk assessment and management) and health promotion are the gold-standard strategies for controlling occupational health hazards. In conclusion, OLD are the most common work-related injuries and physicians should be made aware of this group of illnesses.

Video-Assisted Thoracoscopy

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Ever since the introduction of scopes in surgical procedures, their use in thoracic surgery has grown exponentially to include both diagnostic and therapeutic procedures. With the increasing use of computed tomography (CT) scans in diagnoses, the number of thoracic pathologies detected has also increased. Using direct visualisation and biopsies, video-assisted thoracoscopic surgery (VATS) can be used to diagnose mediastinal, pleural and lung diseases. Studies have demonstrated that, despite the increased resolution of CT scans, concordance of the final diagnosis with the radiological diagnosis was as low as 15%, with only 34% of the cases including the final diagnosis in the differential. On the other hand, VATS had almost 98% sensitivity and 90% specificity for reaching diagnoses in pathologies such as interstitial lung disease. With increased experience in the use of VATS, therapeutic applications now include the resection of mediastinal masses, pleural resection and fusion, and the resection of lung masses, including cancers. In the early stages of lung cancer, studies have demonstrated that VATS has the same oncological outcome as a thoracotomy. However, VATS has a lower morbidity rate including bleeding and transfusions, pneumonia, arrhythmias, air leaks and renal failure. As a result, the overall medical cost is lower due to shorter hospital stays and the lower rate of morbidities.

Interpretation of Pulmonary Function Tests

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Pulmonary function tests (PFT) are an essential tool that can be used to detect, follow and manage patients with lung disorders. PFTs can be divided into approximately six basic components: spirometry; flow-volume loop; lung volume; diffusing capacity; bronchial challenge, and cardiopulmonary exercise testing. A spirometry is easily performed with simple instruments, wheras the other tests require more sophisticated apparatus. Values vary with age, stature, gender and ethnic group. Therefore, measurement results must be compared with a reference value based on healthy subjects. The true lower limit of normal (LLN) is better expressed as -1.645 x standard deviation rather than a fixed predicted percentage. Changes in the contour of the flow-volume loop, as well as plotting inspiratory and expiratory flow against volume during the performance of maximally forced inspiratory and expiratory manoeuvres, can provide information on the validity of the test, the site of obstruction and the presence of a restrictive defect. The most important parameter for identifying an obstructive impairment is a low forced expiratory volume in one second (FEV1) to forced vital capacity (FVC) ratio. An airway obstruction is considered reversible if the FEV1 increases 12% after bronchodilator administration. The forced expiratory flow, $FEF_{25-75\%}$, is often checked to identify an obstructive pattern. Lung volume (total lung capacity and residual volume) will generally be high, more so in emphysema. Diffusion will be low in emphysema, but this is not usually the case for asthma or chronic bronchitis. If the FEV1:FVC ratio is normal, the test could be either normal (normal FVC) or indicating a restrictive defect (low FVC). A restrictive defect is further confirmed by the measurement of lung volume. Lung volume is low in patients with involvement of the chest wall (eg. khyphoscolisis) or parenchyma (eg. interstitial lung disease). However, the diffusing capacity for carbon monoxide (DLCO) will be low only in cases of parenchymal involvement. In the simplest sense, the diffusing capacity is the ability of gas to move from the air across the interstitium and into the blood. Although PFTs usually generate a lot of measurements and the results may seem complex, only a few of these values are needed for routine interpretation.

Clinical Cases

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Three interesting cases were presented with clinical pictures, radiology images and videos of bronchoscopies. A young university student presented with a fever, cough, shortness of breath and a history of two previous hospital admissions for pneumonia mostly occurring during long vacations. A computed tomography (CT) scan of the chest showed bilateral patchy ground glass opacities. Basic investigations, including cultures and autoimmune and immunodeficiency work-ups, were all negative. An environmental history revealed that the patient kept a lot of birds, including pigeons, at home. Hypersensitivity pneumonitis (bird fancier's lung) is caused by a sensitisation to the repeated inhalation of dust containing organic antigens. This condition is characterised by the diffuse inflammation of the lung parenchyma and airways. Clinical presentations are categorised as acute, sub-acute and chronic-progressive. A 53-year-old man was referred for an evaluation of a right hilar mass. He had been experiencing a cough and mild haemoptysis for the previous four months. A CT scan of the chest showed multiple pulmonary artery aneurysms with intraluminal thrombi. The patient developed massive haemoptysis after admission. The autoimmune work-up was negative and the patient did not have features of Beçhet's disease. Hughes-Stovin syndrome is a very rare clinical entity, characterised by pulmonary artery aneurysms and deep vein thrombosis. He was managed successfully with high-dose steroids in combination with cyclophosphamide. A young male presented with a persistent right lower zone opacity seen in the chest radiograph and CT scan. The patient had undergone a bone marrow transplant (BMT) for thalassaemia major 10 years previously. A deep swelling was noted in his right thigh. A bronchoscopy showed a well-defined endobronchial lesion. Biopsies from the endobronchial and thigh lesions were consistent with anaplastic large cell lymphoma involving the T-cells. Although secondary malignancies can occur after a BMT, their incidence in patients undergoing BMTs for non-malignant diseases is very similar to that of the normal population. Moreover, the incidence of malignancy in beta thalassemia patients is approximately the same in those who have undergone a BMT and those who have not.