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Interventional Pulmonology: A Focused Review for Primary Care Physicians  399
Christopher M. Kniese and Ali I. Musani

- Intervventional pulmonology (IP) has evolved in recent decades, and recent advances have greatly expanded the services offered by IP physicians. IP is best defined as the use of advanced techniques for the evaluation and treatment of benign and malignant pulmonary disorders. The field has further advanced with the recent establishment of a board certification via the American Association of Bronchology and Interventional Pulmonology and the release in 2017 of accreditation standards for specialized fellowship training. This article provides a broad overview of the field to serve as a resource for primary care physicians.

Pulmonary Hypertension  413
Darlene Kim and M. Patricia George

- Pulmonary hypertension (PH) is a chronic and progressive disease that presents like many other lung diseases, often leading to a delay in diagnosis, and therefore a delay in optimal therapy. This article provides a review of PH for internists, covering clinical presentation, diagnostic algorithm, different types of PH, and overview of treatments. In addition, it emphasizes the importance of early referral to, and partnership between, PH specialists and physicians on the front lines to improve early diagnosis and optimize management of these complex patients.

Lung Transplantation  425
Vivek N. Ahya and Joshua M. Diamond

- Lung transplantation is an appropriate therapeutic option for select patients with end-stage lung diseases and offers the possibility of improved quality of life and longer survival. Unfortunately, the transplant recipient is at risk for numerous immunologic, infectious, and medical complications that threaten both of these goals. Median survival after lung transplantation is approximately 6 years. Optimizing outcomes requires close partnership between the patient, transplant center, and primary medical team. Early referral to a transplant center should be considered for patients with idiopathic pulmonary fibrosis and related interstitial lung diseases due to risk of acute exacerbation and accelerated development of respiratory failure.
Asthma in the Primary Care Setting 435
Tianshi David Wu, Emily P. Brigham, and Meredith C. McCormack

Asthma is one of the commonest respiratory diseases in the United States, affecting approximately 8% of adults. This article reviews the epidemiology, diagnosis, and treatment of asthma, with integration of recommendations from professional societies, with special attention to differential diagnosis. A framework for outpatient management of patients with asthma is presented, including indications for subspecialist referral. With integration of objective diagnostic information, systematic approach through modification of disease triggers and adjustment of controller medications, and patient empowerment to respond to varying symptoms using an asthma action plan, most individuals with asthma are successfully managed in the primary care setting.

Chronic Obstructive Pulmonary Disease: Evaluation and Management 453
Sean P. Duffy and Gerard J. Criner

Chronic obstructive pulmonary disease (COPD) is a leading cause of death nationally and worldwide. Cigarette smoking is the most common risk factor in the development of COPD. Disease course is variable with some patients having a high degree of obstruction and minimal symptoms, whereas others with better lung function have a greater symptoms burden. The goal of pharmacologic therapy is to minimize symptoms, improve exercise tolerance, and reduce exacerbation risk. No pharmacologic therapy has been shown to improve survival in COPD. Pulmonology referral is recommended for patients with COPD with symptoms despite first-line inhaled therapy, frequent exacerbations, any hospitalizations, or moderate-to-severe disease.

Lung Cancer 463
Faria Nasim, Bruce F. Sabath, and George A. Eapen

Lung cancer is the world’s leading cause of cancer death. Screening for lung cancer by low-dose computed tomography improves mortality. Various modalities exist for diagnosis and staging. Treatment is determined by subtype and stage of cancer; there are several personalized therapies that did not exist just a few years ago. Caring for the patient with lung cancer is a complex task. This review provides a broad outline of this disease, helping clinicians identify such patients and familiarizing them with lung cancer care options, so they are better equipped to guide their patients along this challenging journey.

Update in the Management of Pleural Effusions 475
Matthew Aboudara and Fabien Maldonado

Pleural effusions are a common clinical problem for the primary care physician. Over the past 10 years, there has been a paradigm shift in the field due to emergence of new evidence, which includes the ubiquitous use of thoracic ultrasound, the reemergence of pleuroscopy as a diagnostic and therapeutic modality, the widespread use of indwelling pleural catheters for malignant pleural effusions, and the evidence-based approach to
management of complex parapneumonic effusions. This review focuses on these advancements with an emphasis on practical clinical application.

**Community-acquired Pneumonia and Hospital-acquired Pneumonia**

Charles W. Lanks, Ali I. Musani, and David W. Hsia

Pneumonia is among the leading causes of morbidity and mortality worldwide. Although Streptococcus pneumoniae is the most likely cause in most cases, the variety of potential pathogens can make choosing a management strategy a complex endeavor. The setting in which pneumonia is acquired heavily influences diagnostic and therapeutic choices. Because the causative organism is typically unknown early on, timely administration of empiric antibiotics is a cornerstone of pneumonia management. Disease severity and rates of antibiotic resistance should be carefully considered when choosing an empiric regimen. When complications arise, further work-up and consultation with a pulmonary specialist may be necessary.

**Orphan Lung Diseases**

Muhammad Sajawal Ali, Uzair Khan Ghori, and Ali I. Musani

There are hundreds of rare orphan lung diseases. We have highlighted five of them, one from each of the five major categories of pulmonary disorders: pleuroparenchymal fibroelastosis (a rare diffuse parenchymal lung disease), pulmonary alveolar proteinosis (a rare autoimmune and diffuse parenchymal lung disease), lymphangioleiomyomatosis (a rare cystic lung disease), yellow nail syndrome (a rare pleural disease), and Mounier–Kuhn syndrome (a rare airway disorder). The pathogenesis, clinical presentation, diagnostic criteria, treatment options, and prognosis of each disorder is discussed. This review is by no means exhaustive and further research is needed to improve our understanding of these disorders.

**Palliative Care in Chronic Obstructive Pulmonary Disease**

Lubna Sorathia

Advanced chronic obstructive pulmonary disease (COPD), is characterized by high morbidity and mortality. Patients with COPD and their families experience a range of stresses and suffering from a variety of sources throughout the disease’s progression. COPD is the fourth leading cause of death in the world. It exists as a significant contributor to global morbidity and mortality, and it results in substantial economic and social burden. This review provides some key facts regarding disease burden and encourages clinician to familiarize themselves and use both conventional and palliative approach early in the disease progression for a better quality of life.

**Sarcoidosis**

Oscar Llanos and Nabeel Hamzeh

Sarcoidosis is a multisystemic granulomatous disease that affects individuals worldwide. The lungs are most commonly involved but any organ
can be involved. It has variable manifestations and clinical course. Diagnosis of sarcoidosis is based on clinicopathologic findings and the exclusion of other causes of granulomatous disease. Its hallmark is the formation of granulomas in affected organs. Immunosuppressive therapy is the cornerstone of the management of sarcoidosis and is indicated when there is evidence of symptomatic or progressive disease or when critical organs (ocular, cardiac, nervous system) are involved.

**Occupational Lung Disease**

David M. Perlman and Lisa A. Maier

Occupational exposures are a major cause of lung disease and disability worldwide. This article reviews the broad range of types of occupational lung diseases, including airways disease, pneumoconioses, and cancer. Common causes of occupational lung disease are reviewed with specific examples and clinical features. Emphasis on the importance of a detailed history to make an accurate diagnosis of an occupational lung disease is discussed.

**Pulmonary Embolism**

Eno-Obong Essien, Parth Rali, and Stephen C. Mathai

Venous thromboembolism (VTE) includes pulmonary embolism (PE) and deep vein thrombosis. PE is the third most common cause of cardiovascular death worldwide after stroke and heart attack. Management of PE has evolved recently with the availability of local thrombolysis; mechanical extraction devices; hemodynamic support devices, like extracorporeal membrane oxygenation; and surgical embolectomy. There has been development of multidisciplinary PE response teams nationwide to optimize the care of patients with VTE. This review describes the epidemiology of PE, discusses diagnostic strategies and current and emerging treatments for VTE, and considers post-PE follow-up care.

**Pulmonary Function Testing and Cardiopulmonary Exercise Testing: An Overview**

Katherine Krol, Mary Anne Morgan, and Sandhya Khurana

Respiratory symptoms are common reasons for patients to seek care and contribute significantly to use of health care resources. Identifying the underlying etiology of a respiratory symptom is key to management; yet, pinpointing the cause can be a challenge. Familiarity with the tools available to help discern between the various contributing etiologies is crucial in guiding management. Assessment and quantification of pulmonary function can provide an objective measure to guide diagnosis and therapy. We review key points of pulmonary function evaluation, highlighting indications and contraindications, fundamentals of interpretation, and the limitations of each individual component.

**Pulmonary Rehabilitation in the Management of Chronic Lung Disease**

Sharon D. Cornelison and Rodolfo M. Pascual

Pulmonary rehabilitation is a core component of management of patients with chronic lung disease that have exercise or functional limitations.
Causes of these limitations are manifold but include loss of skeletal muscle mass, power and endurance, diminished respiratory capacity owing to respiratory muscle weakness, inefficient gas exchange, and increased work of breathing, and impaired cardiovascular functioning. Besides physical limitations, patients with chronic lung disease have high rates of depression and anxiety leading to social isolation and increased health care use. Pulmonary rehabilitation uses a comprehensive and holistic approach that has been shown to ameliorate most effects of chronic lung disease.

Preoperative Pulmonary Evaluation 585

Angela Selzer and Mona Sarkiss

The preanesthesia evaluation is an opportunity to elucidate a patient’s underlying medical disease, determine if the patient is optimized, treat modifiable conditions, screen for potentially unrecognized disorders, and present the clear picture of the patient’s overall risk for perioperative complications. This article presents the preoperative assessment of pulmonary patients in 2 sections. First, the components of a thorough assessment of patients presenting for preanesthesia evaluation, which should occur for all patients, regardless of the presence of pulmonary pathology, are discussed. Then, the considerations unique to patients with pulmonary diseases commonly encountered are described.