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**New Approaches to Diagnosing Sleep-Disordered Breathing** 143

Scott A. Sands, Robert L. Owens, and Atul Malhotra

Novel concepts and technological advances have the potential to change the landscape on which clinical sleep medicine is practiced. Screening for sleep apnea will take advantage of readily available mobile telephone technology (sound, accelerometers) to enable widespread recognition of sleep-disordered breathing. Advanced computer-assisted scoring algorithms will improve efficiency and reliability of sleep apnea diagnoses. As the field adopts a personalized approach to therapies, methods to determine the mechanisms of sleep apnea in individuals will be developed—utilizing simplified tests and available recordings—with the promise of predicting outcomes of novel therapies.

**New Approaches to Positive Airway Pressure Treatment in Obstructive Sleep Apnea** 153

Tomasz J. Kuźniar

Continuous positive airway pressure (CPAP) is a mainstay of therapy in patients with obstructive sleep apnea (OSA). This technology has gone through tremendous changes that resulted in devices that can recognize and differentiate sleep-disordered breathing events, adjust their output to these events, monitor usage, and communicate with the treatment team. This article discusses recent developments in treatment of OSA with PAP.


**Monitoring Progress and Adherence with Positive Airway Pressure Therapy for Obstructive Sleep Apnea: The Roles of Telemedicine and Mobile Health Applications** 161

Dennis Hwang

Technology is changing the way health care is delivered and how patients are approaching their own health. Given the challenge within sleep medicine of optimizing adherence to continuous positive airway pressure (CPAP) therapy in patients with obstructive sleep apnea (OSA), implementation of telemedicine-based mechanisms is a critical component toward developing a comprehensive and cost-effective solution for OSA management. Key elements include the use of electronic messaging, remote monitoring, automated care mechanisms, and patient self-management platforms. Current practical sleep-related telemedicine platforms include Web-based educational programs, automated CPAP follow-up platforms that promote self-management, and peer-based patient-driven Internet support forums.

**Novel Approaches to the Management of Sleep-Disordered Breathing** 173

Todd D. Morgan

 Video content accompanies this article at <http://www.sleep.theclinics.com/>

In the last several years, a variety of novel approaches to the treatment of sleep-disordered breathing have emerged. This new technology holds promise in

serving to re-engage with patients who have previously been lost to follow-up due to continuous positive airway pressure intolerance. With more tools at our disposal, in turn more options can be offered to patients' growing demand for alternatives that are tailored to their individual needs. The key to proper deployment of alternative therapies will often depend on identification of certain phenotypic traits that trend toward a reasonable response to a given therapy.

## **Novel Surgical Approaches for the Treatment of Obstructive Sleep Apnea** **189**

Ryan J. Soose

Novel approaches to upper airway anatomic phenotyping, more reconstructive upper airway surgical techniques, and new implantable hypoglossal neurostimulation technology have very favorable potential to improve symptoms and quality-of-life measures, to reduce obstructive sleep apnea (OSA) disease severity and associated cardiovascular risk, and to serve as an adjunct to continuous positive airway pressure, oral appliances, and other forms of OSA medical therapy. Successful surgical therapy depends critically on accurate diagnosis, skillful knowledge and examination of the upper airway anatomy, proper procedure selection, and proficient technical application.

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David P. White

The concept of pharmacologic therapy for obstructive sleep apnea (OSA) treatment has always been considered, but no agent has had a large enough effect size to drive substantial adoption. A new construct of the pathophysiology of OSA is that there are 4 primary physiologic traits that dictate who develops OSA. These traits vary substantially between patients, meaning OSA may develop for quite different reasons. This encourages new thinking regarding pharmacologic therapy and continued attempts to find the ideal or acceptable drug.

## **The Challenges of Precision Medicine in Obstructive Sleep Apnea** **213**

Abdelnaby Khalyfa, Alex Gileles-Hillel, and David Gozal

Obstructive sleep apnea (OSA) is a highly prevalent condition that remains underdiagnosed and undertreated. The onerous and labor-intensive nature of polysomnography or similar diagnostic multichannel-based approaches paves the way for exploration of biomarkers aimed at diagnosis, morbidity detection, and monitoring of therapy and its outcomes. To this effect, "Omics" technologies coupled with appropriate bioinformatic approaches should enable discovery of unique biomarker-based signatures, enabling simplified and highly precise algorithms for the evaluation and treatment of symptomatic individuals. Such approaches are likely to not only lead to improved outcomes but also permit personalized medicine to become reality in the context of OSA.

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Shahrokh Javaheri, Robin Germany, and John J. Greer

Neurophysiologically, central apnea is due to a temporary cessation of respiratory rhythmogenesis in medullary respiratory networks. Central apneas occur in several disorders and result in pathophysiological consequences, including arousals and desaturation. The 2 most common causes in adults are congestive heart failure and chronic use of opioids to treat pain. Under such circumstances, diagnosis

and treatment of central sleep apnea may improve quality of life, morbidity, and mortality. This article discusses recent developments in the treatment of central sleep apnea in heart failure and opioids use.

**The Role of Big Data in the Management of Sleep-Disordered Breathing** **241**

Rohit Budhiraja, Robert Thomas, Matthew Kim, and Susan Redline

Analysis of large-volume data holds promise for improving the application of precision medicine to sleep, including improving identification of patient subgroups who may benefit from alternative therapies. Big data used within the health care system also promises to facilitate end-to-end screening, diagnosis, and management of sleep disorders; improve the recognition of differences in presentation and susceptibility to sleep apnea; and lead to improved management and outcomes. To meet the vision of personalized, precision therapeutics and diagnostics and improving the efficiency and quality of sleep medicine will require ongoing efforts, investments, and change in our current medical and research cultures.

**Advances and New Approaches to Managing Sleep-Disordered Breathing Related to Chronic Pulmonary Disease** **257**

Ronaldo A. Sevilla Berrios and Peter C. Gay

Chronic obstructive pulmonary disease (COPD) is a common disease affecting about 20 million US adults. Sleep-disordered breathing (SDB) problems are frequent and poorly characterized for patients with COPD. Both the well-known success of noninvasive ventilation (NIV) in the acute COPD exacerbation in the hospital setting and that NIV is the cornerstone of chronic therapy for SDBs have urged the attention of the medical community to determine the impact of NIV on chronic COPD management with and without coexisting SDBs. Early observational studies showed decreased long-term survival rates on patients with COPD with concomitant chronic hypercapnia when compared with normocapnic patients.