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SDB: Systemic Impacts, Mechanisms and Treatments

Qing Li*

Department of Airway Disorders, Shanghai Medical Research University, Shanghai, China

Introduction

Sleep-disordered breathing (SDB) profoundly impacts the relationship between SDB and cardiovascular disease. It details how SDB contributes to various cardiovascular complications through mechanisms like sympathetic activation, oxidative stress, and systemic inflammation. The authors discuss emerging biomarkers that can help identify high-risk individuals and review current and novel management strategies to mitigate cardiovascular risk in patients with SDB[1].

Narrative review investigates the intricate connection between obstructive sleep apnea (OSA) and insulin resistance. It explains how intermittent hypoxia, sleep fragmentation, and altered inflammatory responses caused by OSA contribute to the development and exacerbation of insulin resistance, independently of obesity. The authors emphasize the importance of recognizing and treating OSA to improve metabolic health outcomes, particularly in individuals at risk for or with type 2 diabetes[2].

Review explores the significant neurocognitive consequences of pediatric sleep-disordered breathing (SDB). It highlights how SDB in children can lead to deficits in attention, executive function, memory, and academic performance. The article discusses underlying mechanisms, including intermittent hypoxia and sleep fragmentation, and underscores the critical need for early diagnosis and intervention to prevent long-term adverse impacts on brain development and cognitive abilities[3].

Review emphasizes the importance of an integrated clinical approach to central sleep apnea (CSA) in patients with heart failure. It details the complex pathophysiology, including ventilatory instability and hemodynamic factors, that contributes to CSA in this population. The article discusses diagnostic considerations and reviews current therapeutic strategies, stressing that addressing CSA is crucial for improving patient outcomes and quality of life in heart failure[4].

Systematic review evaluates the utility of wearable devices for diagnosing and monitoring sleep-disordered breathing (SDB). The authors assess the accuracy, reliability, and clinical applicability of various wearable technologies, including smart rings, watches, and patches, in detecting SDB events and parameters. The review concludes that while wearables show promise for screening and remote monitoring, further validation against polysomnography is needed for definitive diagnostic use, highlighting their potential to improve access to care[5].

Review explores the bidirectional relationship between obstructive sleep apnea (OSA) and metabolic syndrome. It details how OSA contributes to components of metabolic syndrome, such as insulin resistance, dyslipidemia, and hypertension, through mechanisms like chronic intermittent hypoxia and sympathetic overactivity. Conversely, features of metabolic syndrome can exacerbate OSA severity. The article emphasizes that managing both conditions concurrently is vital for improving overall patient health and reducing cardiovascular risk[6].

Review summarizes current and emerging pharmacological treatments for obstructive sleep apnea (OSA). It discusses agents targeting various physiological pathways involved in OSA pathogenesis, including upper airway muscle tone, ventilatory drive, and arousal threshold. The authors evaluate the efficacy and safety profiles of established and novel drugs, highlighting their potential as adjunctive therapies or alternatives for patients who cannot tolerate or benefit from CPAP. This provides a comprehensive look at the evolving landscape of medical management for OSA[7].

Review delves into the complex relationship between sleep-disordered breathing (SDB) and pulmonary hypertension (PH). It elucidates the pathophysiological mechanisms, such as chronic intermittent hypoxia, sympathetic activation, and systemic inflammation, by which SDB contributes to the development and progression of PH. The article discusses diagnostic challenges and highlights the clinical implications, emphasizing the importance of screening for SDB in PH patients and vice versa to improve treatment outcomes and patient prognosis[8].

Systematic review investigates the impact of sleep-disordered breathing (SDB) on cognitive function in adults. It synthesizes evidence demonstrating how SDB, particularly obstructive sleep apnea, is associated with impairments across various cognitive domains, including executive function, attention, memory, and processing speed. The review discusses the potential neurobiological mechanisms, such as intermittent hypoxia and sleep fragmentation, and underscores the need for effective SDB treatment to preserve or improve cognitive health in adult populations[9].

Relationship between sleep-disordered breathing (SDB) and type 2 diabetes mellitus (T2DM). It explains the underlying mechanisms by which SDB, particularly obstructive sleep apnea, contributes to impaired glucose metabolism, including increased sympathetic activity, inflammation, and insulin resistance. The review highlights the importance of screening for SDB in T2DM patients and discusses how effective SDB treatment can positively impact glycemic control and reduce diabetes-related complications[10].

Description

Sleep-disordered breathing (SDB) significantly impacts cardiovascular health, contributing to various complications through mechanisms like sympathetic activation, oxidative stress, and systemic inflammation. Identifying high-risk individuals and implementing novel management strategies are crucial for mitigating cardiovascular risk in patients with SDB[1]. Central sleep apnea (CSA) in heart failure patients demands an integrated clinical approach, considering its complex

pathophysiology involving ventilatory instability and hemodynamic factors, which is critical for improving patient outcomes and quality of life[4]. The intricate relationship between SDB and pulmonary hypertension (PH) is driven by mechanisms like chronic intermittent hypoxia and sympathetic activation, necessitating careful screening in both patient groups to improve prognosis[8].

Obstructive sleep apnea (OSA) is deeply connected to insulin resistance, with intermittent hypoxia, sleep fragmentation, and altered inflammatory responses contributing to its development independently of obesity. Addressing OSA is paramount for better metabolic health, especially for individuals with or at risk for type 2 diabetes[2]. A bidirectional relationship exists between OSA and metabolic syndrome; OSA exacerbates components such as insulin resistance, dyslipidemia, and hypertension through chronic intermittent hypoxia and sympathetic overactivity. Conversely, metabolic syndrome can intensify OSA severity, making concurrent management crucial for overall health and reducing cardiovascular risk[6]. Furthermore, SDB influences type 2 diabetes mellitus (T2DM) by promoting impaired glucose metabolism via increased sympathetic activity, inflammation, and insulin resistance. Effective SDB treatment is shown to positively impact glycemic control and reduce diabetes-related complications[10].

In children, pediatric sleep-disordered breathing (SDB) leads to significant neurocognitive consequences, manifesting as deficits in attention, executive function, memory, and academic performance. The underlying mechanisms, including intermittent hypoxia and sleep fragmentation, emphasize the critical need for early diagnosis and intervention to prevent long-term adverse impacts on brain development[3]. Similarly, in adults, SDB has a considerable impact on cognitive function, leading to impairments across various domains like executive function, attention, memory, and processing speed. The neurobiological mechanisms, such as intermittent hypoxia and sleep fragmentation, highlight that effective SDB treatment is essential to preserve or improve cognitive health in adult populations[9].

For diagnostics, wearable devices are being evaluated for their utility in detecting and monitoring SDB. These technologies, including smart rings and watches, show promise for screening and remote monitoring; however, they require further validation against polysomnography for definitive diagnostic use, potentially improving access to care[5]. In terms of treatment, pharmacological options for obstructive sleep apnea (OSA) are continually advancing, with agents targeting upper airway muscle tone and ventilatory drive. These emerging therapies demonstrate potential as adjunctive treatments or alternatives for patients who cannot tolerate or benefit from CPAP, offering a comprehensive look at evolving medical management strategies[7].

Conclusion

Sleep-disordered breathing (SDB) profoundly impacts various physiological systems, including the cardiovascular and metabolic systems. It contributes to cardiovascular complications through sympathetic activation, oxidative stress, and systemic inflammation. Obstructive Sleep Apnea (OSA), a common form of SDB, is intricately linked to insulin resistance, independent of obesity, through mechanisms like intermittent hypoxia and sleep fragmentation. The consequences of SDB extend to neurocognitive function, particularly in children, leading to deficits in attention, memory, and academic performance, highlighting the need for early intervention. In adults, SDB is associated with impairments across cognitive domains, including executive function and processing speed, driven by intermittent hypoxia and sleep fragmentation. SDB also has a bidirectional relationship with metabolic syndrome, exacerbating conditions like dyslipidemia and hypertension, while metabolic syndrome can worsen OSA severity. The connection between SDB and pulmonary hypertension is elucidated by mechanisms such as chronic intermittent hypoxia and sympathetic activation, emphasizing the importance of screening in both conditions. Furthermore, SDB, including OSA, contributes to impaired glucose metabolism and type 2 diabetes mellitus (T2DM) through increased sympathetic activity and inflammation. Effective SDB treatment can improve glycemic control. Recent advancements include the evaluation of wearable devices for diagnosing and monitoring SDB, showing promise for screening but requiring further validation. Pharmacological treatments for OSA are also emerging, offering alternatives for patients who may not tolerate traditional therapies like CPAP.

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Conflict of Interest

None.

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Address for Correspondence: Qing, Li, Department of Airway Disorders, Shanghai Medical Research University, Shanghai, China, E-mail: q.li@smru.cn

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