



Correlation Between the Severity of Coronary Heart Disease and QT Dispersion in Patients with Obstructive Sleep Apnea

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ABSTRACT

Introduction

Obstructive sleep apnea (OSA) is increasingly associated with cardiovascular complications, including coronary heart disease (CHD). QT dispersion, an electrocardiographic marker of cardiac electrical instability, has been investigated as a key link between these conditions. This review synthesizes literature on the correlation between CHD severity and QT dispersion in patients with OSA.

Methods

This abstract is based on a literature review synthesizing findings from multiple clinical studies. The review examined the association between OSA, QT dispersion, and CHD severity, and evaluated the impact of OSA on arrhythmogenic risk in various patient populations, including those with stroke and heart failure.

Results

Severe OSA is consistently associated with increased corrected QT (QTc) interval dispersion. A pivotal study conducted in Indonesia revealed a weak positive correlation between the severity of CHD and prolonged QT dispersion in patients with OSA.

Prolonged QTc intervals in OSA patients are linked to severe desaturation events and are particularly pronounced in deeper sleep stages, increasing the risk of sudden cardiac death (SCD). The assessment of QT dispersion via electrocardiogram is a simple method to anticipate arrhythmias in this population.

Discussion

QT dispersion serves as a valuable, non-invasive marker of cardiac electrical instability induced by OSA. While the direct correlation with CHD severity is modest, the consistent link between OSA, increased QT dispersion, and arrhythmogenic risk highlights a critical pathophysiological pathway. This relationship is complex, influenced by factors like nocturnal hypoxemia and sleep architecture, necessitating a comprehensive patient assessment.

Conclusion

A clear association exists between OSA and increased QT dispersion, a vital indicator of cardiovascular risk. While its direct correlation with CHD severity may be weak, monitoring QT dispersion remains a crucial and accessible strategy for identifying OSA patients at higher risk for arrhythmias and sudden cardiac death.

Keywords

Obstructive Sleep Apnea, QT Dispersion, Coronary Heart Disease, Sudden Cardiac Death, Arrhythmia, Electrocardiography.

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INTRODUCTION

The correlation between the severity of coronary heart disease (CHD) and QT dispersion in patients with obstructive sleep apnea (OSA) has garnered significant attention in recent years. The literature reveals a complex interplay between these conditions, emphasizing the need for a deeper understanding of their interrelations. (Bilal et al., 2017) established a foundational link by demonstrating that severe obstructive sleep apnea is associated with increased QT corrected interval dispersion. Their findings underscore the potential for OSA to exacerbate cardiac electrical instability, a critical factor in the management of patients with cardiovascular concerns.

Building on this premise, (et al., 2019) conducted a pivotal study that specifically examined the correlation between the severity of CHD and QT dispersion in OSA patients. This research is notable for being the first of its kind in Indonesia, revealing a weak positive correlation between the severity of CHD and prolonged QT dispersion. The authors highlight the utility of QT dispersion assessment in electrocardiograms as a simple yet effective method for anticipating potential arrhythmias and sudden cardiac death in OSA patients.

In a broader context, (N. Blackwell et al., 2019) explored the implications of OSA on sudden cardiac death (SCD), particularly in patients with congestive heart failure (CHF). They noted an emerging pattern of increased nocturnal implantable cardioverter-defibrillator (ICD) therapy and SCD, suggesting that changes in ventricular repolarization, including prolonged QT intervals, may mediate this risk. This article calls for further investigation into the therapeutic effects of interventions like continuous positive airway pressure (CPAP) on SCD in OSA patients, particularly those with underlying ischemic cardiomyopathy.

(Sillanmäki et al., 2022) expanded the discussion by focusing on stroke patients with OSA, revealing that QTc prolongation is significantly associated with severe desaturations. Their findings indicate that OSA is a prevalent risk factor for cerebrovascular incidents, with implications for cardiac arrhythmogenicity and increased risk of SCD. They emphasize the need for more research on the

relationship between respiratory events and cardiovascular changes to enhance clinical understanding and prevention strategies.

Furthering this inquiry, (Ebrahimian et al., 2022) examined variations in QTc intervals across different sleep stages in OSA patients, with a particular focus on those with a history of stroke. Their results indicate that stroke history correlates with greater QTc interval prolongation, suggesting an elevated risk for ventricular arrhythmias in this subgroup. The study highlights the intricate relationship between sleep architecture and cardiac health in OSA patients, proposing that deeper sleep stages may pose a heightened risk for arrhythmogenesis.

Together, these articles illustrate a growing body of evidence that underscores the critical relationship between OSA, QT dispersion, and cardiovascular health, particularly in the context of coronary heart disease and stroke. The findings collectively advocate for increased vigilance in monitoring QT intervals and dispersion in patients with OSA, as these metrics may serve as vital indicators of cardiac risk and prognosis.

LITERATURE REVIEW

The article "Obstructive sleep apnea is associated with increased QT corrected interval dispersion: the effects of continuous positive airway pressure" by Bilal et al. (Bilal et al., 2017) provides a significant contribution to the understanding of the cardiovascular implications of obstructive sleep apnea (OSA), particularly in relation to QT dispersion. The authors present compelling evidence that severe cases of OSA correlate with an increase in QT corrected interval dispersion, which is a critical marker for the risk of arrhythmias and sudden cardiac events.

The study employs a well-structured methodology, including a comparative analysis between patients diagnosed with varying severities of OSA and a control group. The authors utilized continuous positive airway pressure (CPAP) therapy as an intervention, allowing them to assess not only the baseline QT dispersion but also the potential reversibility of this parameter with treatment. This approach is particularly noteworthy as it underscores the clinical relevance of managing OSA and its associated risks.

One of the key insights from the article is the implication that increased QT dispersion in patients with severe OSA may serve as an early indicator of cardiovascular dysfunction. The authors highlight that QT interval prolongation and its dispersion can lead to life-threatening arrhythmias, which is especially pertinent given the high prevalence of cardiovascular disease in OSA patients. The findings suggest that monitoring QT dispersion could be an essential aspect of cardiovascular risk assessment in this population.

However, while the article presents robust data, it is essential to consider the limitations inherent in the study design. The authors acknowledge that the sample size may limit the generalizability of their findings, and the cross-sectional nature of the study does not allow for causal inferences. Additionally, the article could benefit from a more in-depth discussion on the mechanisms linking OSA to QT dispersion, which would provide a more comprehensive understanding of the pathophysiological processes involved.

The article titled "Correlation Between the Severity of Coronary Heart Disease and QT Dispersion in Patients with Obstructive Sleep Apnea" by Rasmijon et al. (et al., 2019) presents a significant exploration of the relationship between coronary heart disease (CHD) severity and QT dispersion (QTd) in patients diagnosed with obstructive sleep apnea (OSA). This research is particularly noteworthy as it marks the first study conducted in Indonesia to investigate this correlation, thereby contributing valuable data to the existing body of literature.

The authors highlight a weak positive correlation between the severity of CHD and the prolongation of QTd in patients with OSA, diverging from findings in previous studies. This deviation suggests that the relationship between these variables may be more complex than previously understood. The study's methodology is robust, employing standard diagnostic procedures such as coronary angiography and polysomnography, which were conducted in close temporal proximity. This approach enhances the reliability of the findings, as it mitigates the potential confounding effects of time-related changes in patient condition.

One of the strengths of this research is its focus on the accessibility of QTd assessment through electrocardiography, which is a straightforward and widely

available procedure in primary healthcare settings. This aspect emphasizes the practical implications of the study, suggesting that routine monitoring of QTd could be beneficial for patients at risk of OSA or those already diagnosed. Such monitoring could facilitate early identification of cardiovascular complications in this population.

However, while the study provides important insights, the authors acknowledge the limitations inherent in their research design, including the relatively small sample size and the observational nature of the study. These factors may affect the generalizability of the findings. Additionally, the weak correlation identified indicates that other factors may influence QTd in the context of OSA and CHD that were not explored in this study.

The article "Sleep Apnea and Sudden Cardiac Death" by Blackwell et al. (N. Blackwell et al., 2019) presents a compelling examination of the intricate relationship between obstructive sleep apnea (OSA) and sudden cardiac death (SCD), particularly in the context of patients with congestive heart failure (CHF). The authors highlight the alarming trend of increased nocturnal implantable cardioverter-defibrillator (ICD) therapy and the corresponding rise in SCD rates among this population, suggesting a critical need for further investigation into the underlying mechanisms at play.

A significant aspect of the article is its focus on the QT interval and its implications for cardiac health in OSA patients. The authors note that the prolonged QT interval, along with alterations in ion channel activity, may contribute to the heightened risk of ventricular arrhythmias and, consequently, SCD. This correlation underscores the importance of monitoring QT dispersion in patients with OSA, as it may serve as a predictive marker for adverse cardiovascular events. The article also points to the abnormal frontal and spatial QRS-T angles observed in OSA patients, which further complicates the risk assessment for SCD in this demographic.

The authors critically address the limitations of existing studies, particularly the scarcity of research examining the effects of nocturnal continuous positive airway pressure (CPAP) therapy on SCD outcomes. This gap in the literature is particularly concerning given the potential for CPAP to mitigate some of the deleterious effects

of OSA on cardiac function. However, the findings from the treatment group, which reported higher rates of cardiovascular mortality compared to the control group, raise questions about the effectiveness of CPAP in this context and highlight the need for more robust clinical trials with adequate power to draw definitive conclusions.

Moreover, the article emphasizes the complexity of the relationship between OSA, ventricular repolarization, and SCD, suggesting that patients with OSA who exhibit abnormal QTc or QRS-T angles may represent a higher-risk subgroup. This insight is crucial for clinicians as it points to the necessity of tailored risk stratification and monitoring strategies for patients with OSA, particularly those with existing cardiac conditions.

The article "QTc prolongation is associated with severe desaturations in stroke patients with sleep apnea" by Sillanmäki et al. (Sillanmäki et al., 2022) delves into the critical intersection of obstructive sleep apnea (OSA) and cardiovascular health, particularly focusing on the implications of QT interval prolongation among stroke patients. The authors emphasize that OSA shares numerous risk factors with cardiovascular diseases, which is particularly concerning given that a significant proportion of stroke patients exhibit at least mild OSA. This overlap is critical as it underlines the potential for OSA to exacerbate cardiovascular complications, including sudden cardiac death (SCD).

One of the key insights presented in the article is the relationship between OSA-related desaturation events and the prolongation of the QT interval, which is a vital marker for assessing the risk of arrhythmias. The authors argue that stroke survivors who experience long QT intervals are at an elevated risk for cardiac death, primarily due to the propensity for fatal cardiac arrhythmias that can arise from such electrocardiographic abnormalities. This connection highlights the urgent need for further research into the mechanisms by which OSA influences cardiac repolarization and the subsequent risk of severe outcomes.

The study's findings suggest that desaturation events, particularly those of greater severity, may be correlated with increased QTc prolongation. This relationship is crucial for clinicians, as it could inform monitoring strategies and interventions

aimed at reducing the risk of SCD in patients suffering from both OSA and stroke. The authors advocate for a more profound understanding of respiratory events and their cardiovascular implications, positing that such knowledge could be instrumental in developing preventive strategies against SCD.

However, while the article provides valuable insights, it also points out a significant gap in the existing literature, namely the lack of studies specifically addressing the relationship between QT interval prolongation and desaturation features in the context of stroke patients with OSA. This gap underscores the need for future research to elucidate the nuances of this relationship and to explore the potential for targeted therapeutic interventions.

The article "Inter-sleep stage variations in corrected QT interval differ between obstructive sleep apnea patients with and without stroke history" by Ebrahimian et al. (Ebrahimian et al., 2022) explores the relationship between obstructive sleep apnea (OSA), QTc interval variations during sleep, and the implications of stroke history on these parameters. The study presents a compelling examination of how QTc intervals fluctuate across different sleep stages, particularly highlighting the significant increase in QTc intervals in OSA patients with a history of stroke, independent of various confounding factors.

A critical evaluation of the material reveals that the authors provide a robust analysis of the interplay between OSA, cardiac autonomic nervous system (ANS) dynamics, and arrhythmogenic risk. The findings indicate that QTc interval prolongation is notably pronounced during N3 sleep, suggesting a heightened risk for ventricular arrhythmias in this sleep stage. This observation aligns with previous literature indicating that deeper sleep stages may exacerbate cardiac vulnerabilities in OSA patients. The progressive increase in QTc intervals leading to N3 sleep, followed by a decrease during REM sleep, provides valuable insights into the temporal dynamics of cardiac electrical activity in relation to sleep architecture.

Moreover, the study employs regression analysis to establish independent associations between specific sleep stages and QTc interval prolongation, controlling for potential confounders such as age, sex, body mass index (BMI), apnea-hypopnea index (AHI), and arousal index (AI). This methodological rigor

enhances the validity of the findings, suggesting a nuanced understanding of how OSA-related pathophysiological mechanisms, including hypoxemia and intrathoracic pressure fluctuations, may disrupt autonomic balance and contribute to arrhythmogenic risks.

However, while the study effectively demonstrates the correlation between stroke history and QTc interval variations, it could benefit from a more extensive discussion on the clinical implications of these findings. For instance, the authors could elaborate on potential interventions or monitoring strategies for OSA patients, particularly those with a history of stroke, to mitigate the risk of arrhythmias. Additionally, exploring the underlying mechanisms linking sympathovagal imbalance to QTc prolongation could provide further depth to the discussion, enhancing the reader's understanding of the complex interactions at play.

CONCLUSION

The reviewed literature presents a comprehensive examination of the correlation between the severity of coronary heart disease (CHD) and QT dispersion in patients with obstructive sleep apnea (OSA). A series of studies underscores the intricate relationship between these conditions, emphasizing the clinical significance of QT dispersion as a potential marker for cardiovascular risk in OSA patients.

The foundational study by Bilal et al. (2021) establishes a crucial link between severe OSA and increased QT corrected interval dispersion, highlighting the exacerbation of cardiac electrical instability associated with OSA. This study lays the groundwork for understanding how OSA can influence cardiovascular health. Rasmijon et al. (2022) further this investigation by documenting a weak positive correlation between the severity of CHD and QT dispersion in OSA patients, marking a significant contribution to the literature as the first study of its kind in Indonesia. The authors advocate for the routine assessment of QT dispersion in electrocardiograms, suggesting its utility in predicting arrhythmias and sudden cardiac death.

In exploring the broader implications of OSA, Blackwell et al. (2022) address the risk of sudden cardiac death (SCD) in patients with congestive heart failure, linking prolonged QT intervals to increased mortality risk. They call for further research

into interventions such as continuous positive airway pressure (CPAP) therapy, which may mitigate these risks. Sillanmäki et al. (2022) contribute to this discourse by investigating QTc prolongation in stroke patients with OSA, revealing significant associations with severe desaturation events, thereby highlighting the cardiovascular risks that accompany OSA in this population. Ebrahimian et al. (2023) delve into the variations of QTc intervals across different sleep stages in OSA patients, particularly those with a history of stroke, indicating that deeper sleep stages may pose a heightened risk for arrhythmias.

Collectively, these articles illustrate a growing body of evidence that emphasizes the critical relationship between OSA, QT dispersion, and cardiovascular health, particularly in the context of CHD and stroke. The findings advocate for increased vigilance in monitoring QT intervals and dispersion in patients with OSA, as these metrics may serve as vital indicators of cardiac risk and prognosis. The literature suggests a need for enhanced clinical strategies to monitor and manage these risks, particularly in vulnerable populations such as patients with existing cardiovascular conditions.

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