ERS Congress 2024: highlights from the Sleep Disordered Breathing Assembly

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Effective management of obstructive sleep apnoea requires accurate patient selection, integrated data analysis and multidisciplinary approaches, with machine learning enhancing disease prediction and treatment outcomes https://bit.ly/4altpxr

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Sleep disordered breathing (SDB) is a major health challenge and has a significant impact on quality of life and general health. During the last European Respiratory Society (ERS) Congress, held in Vienna, Austria, on 7–11 September 2024, the theme “Humans and machines: getting the balance right” focused on the balance between human intervention and emerging technologies, from screening to treatment of different disorders in respiratory medicine. Advanced technologies, machine learning and the use of artificial intelligence (AI) in general are transforming the diagnostic and treatment landscape. A summary of the main topics covered in this highlights article is shown in figure 1.

A number of translational studies aimed at uncovering the pathogenesis of obstructive sleep apnoea (OSA) and identifying new treatment options were discussed. Advancing the understanding of OSA pathobiology and improving the prediction of disease progression remain important areas: emphasis was placed on circulating microRNAs [1] and other non-coding RNAs [2] as potential precision-medicine biomarkers and disease-modifying targets for OSA. In addition, specific attention was paid to nocturnal hypertension, atherosclerosis and cardiovascular function. An inspiring session was entitled “Obstructive sleep apnoea and vascular injury”. The pathophysiological effects of OSA-related intermittent hypoxia as proinflammatory and atherosclerotic mediators were presented, focusing on the therapeutic approaches to these aspects. There is evidence that continuous positive airway pressure (CPAP) treatment, the cornerstone of OSA treatment, can improve endothelial function, a consequence of intermittent hypoxia and a key factor in the atherosclerotic process [3, 4]. The timeline of the development of this kind of vascular damage is also crucial, as early detection increases the probability of recovering from it and preventing further vascular damage. Different surrogate markers of vascular injury and cardiovascular autonomic stress might help define patient phenotypes that may benefit from CPAP therapy, such as the pulse rate response [5] and the pulse wave amplitude drop index [6]. The effects of intermittent hypoxia on the cerebral vasculature were thoroughly assessed, focusing on the increase in sympathetic activity, blood pressure surges, impaired cerebrovascular reactivity, and changes in cerebral blood flow. Moreover, an overview on the higher risk for hypertension, atrial fibrillation and wake-up stroke in patients with OSA was provided, with an in-depth analysis of the risk for stroke in OSA populations, both for first occurrence and recurrence. This has been shown to be higher in severe OSA, especially among younger patients, independent of sex [7, 8]. While discussing cardiovascular risk prevention in OSA, the results of meta-analyses of randomised controlled trials (RCTs) were shown, demonstrating how CPAP can reduce the risk of major adverse cardiovascular events and cardiovascular mortality if mean CPAP usage is >4 h per night [9–12].

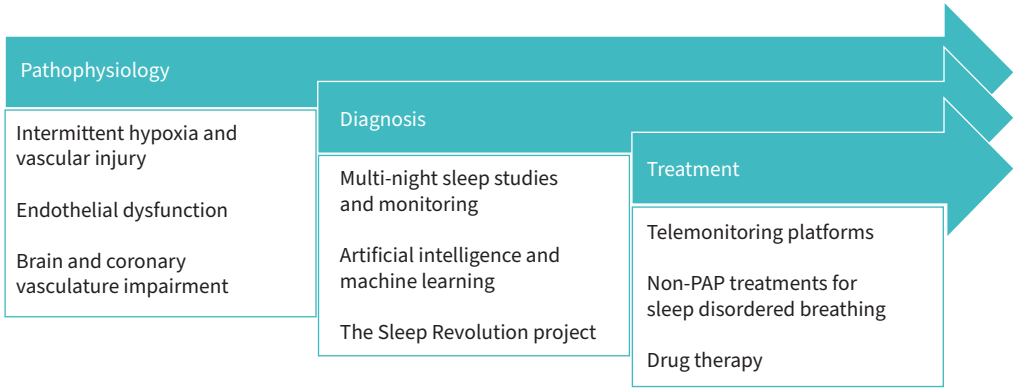

FIGURE 1 The main sleep disordered breathing topics from the 2024 European Respiratory Society Congress. PAP: positive airway pressure.

However, it is important to acknowledge contrasting findings in recent studies in the literature. For instance, the ECSACT study by Cohen *et al.* [13] highlighted heterogeneous effects of CPAP on cardiovascular disease outcomes in non-sleepy OSA patients, revealing that factors like OSA event duration and hypercholesterolaemia critically influence cardiovascular outcomes, emphasising the variability in patient responses. Similarly, research by Peker *et al.* [14] suggested that CPAP might promote an endothelial inflammatory environment, increasing the circulating levels of angiopoietin-2, a proangiogenic factor that amplifies endothelial inflammation in specific contexts, such as after coronary revascularisation. These discrepancies underline the need for further investigation to define patient selection and optimise therapeutic strategies. Depending on the outcome, the type of OSA, and the comorbidities, the effect of OSA treatment on cardiovascular risk reduction might be different.

A further discussion on paediatric SDB showed how a higher prevalence of arterial hypertension among children with OSA correlates with a higher risk of maintaining elevated higher blood pressure values during adolescence and adulthood [15]. Within this research framework, meta-analyses of interventional studies on the effect of adenotonsillectomy in children with OSA showed an apnoea–hypopnoea index (AHI) reduction with blood pressure improvement in children who had arterial hypertension before adenotonsillectomy [16].

A meaningful theme that emerged during the 2024 ERS Congress was the novel diagnostic approach to SDB. As the current single-night diagnostic approach does not take into account night-to-night variability of SDB severity, some new devices, such as under-the-mattress tools, evaluated night-to-night variability by multi-night sleep recording [17, 18]. Other examples are watch devices that are also able to detect cardiac arrhythmias, or simplified sleep studies using signals from mandibular movement [19]. Some novel projects presented in the poster sessions included AI for diagnosis of sleep apnoea or respiratory rate detection using video cameras or devices attached to the bed. Moreover, the application of machine learning can help in estimating novel parameters that go beyond the AHI. New approaches using AI can be used to obtain more information from the traces that have already been recorded, but such new approaches have not yet been used in clinical practice. Novel technologies might be applied, for example for improving diagnostic analyses using photoplethysmography data [20], or for the evaluation of endotypes [21]. In this context, the Sleep Revolution project will be a fertile field for revolutionising SDB diagnostics and management [22]. This is an ongoing project involving many centres in Europe, with the aim of successfully translating the advancement from sleep study records to clinical practice. Sleep Revolution will help in proceeding with the application of new technologies in clinical practice, with the aim of using machine learning to help humans in decision making and not taking decisions away from them. In the evolution of SDB, particular attention needs to be paid to translate this into personalised patient care. Thanks to the availability of accurate diagnostic tests so that consumer sleep technology can screen for SDB, it is possible to move sleep tests from the lab to the patient's home, with the incorporation of the patient's experience [23]. The aim is to improve the diagnosis of SDB by developing novel diagnostic tools, automating scoring and risk prediction, and simplifying recording devices. Novel technologies will facilitate the diagnosis of SDB, but to enable the clinical implementation of the developed tools, they need to be trustworthy and the algorithms generalisable [24]. Indeed, for the evolution of future

diagnostic strategies in SDB, the direction might be hybrid sleep labs, with educated physicians, validated sensors, and reliable machine learning scoring.

The assessment and follow-up of autonomic dysfunction in OSA before and after implementing CPAP therapy was a topic of crucial interest, with particular focus on the pathophysiological consequences of blood pressure and catecholaminergic metabolism and their improvement with CPAP treatment [25]. Moreover, the pathophysiology and the effect of adaptive servoventilation on cardiac function and structure in patients with OSA and central sleep apnoea was discussed [26].

Considering the benefits of positive airway pressure (PAP) treatment in SDB, another subject that was thoroughly discussed was the identification of predictors of PAP therapy response and adherence and the impact of telemonitoring on it. Furthermore, the results of analyses of large population-based studies and *post hoc* analyses of RCTs were presented, focusing on various predictors and OSA cofactors (hypoxic burden, arousal threshold, non-respiratory arousals, age, residual sleepiness) [25, 27, 28]. Expanding this topic, some analyses from large observational studies have focused on the identification of patient categories that might benefit from targeted interventions to improve PAP adherence. In this context, the importance of including aspects that are usually not directly related to OSA (*e.g.* gastrointestinal symptoms, mild cognitive impairment, overlap with COPD) was emphasised in order to obtain a more targeted patient approach [29, 30].

Multiple alternative non-PAP therapies for OSA were introduced, including dietary interventions, positional therapy, electrical stimulation and pharmacological treatments. New drugs for OSA are an important new development of OSA therapy [31]. New technologies applied to PAP algorithms might also improve tolerance and compliance. Telemedicine enables the development of industrialised digitalised care pathways for OSA. Remote monitoring platforms can help increase CPAP adherence and promote overall lifestyle changes, and facilitate timely interventions by detecting potential CPAP failures [32]. The integration of telemedicine in SDB management has shown good intentions, reducing healthcare costs; however, its impact on patient satisfaction, cost-effectiveness and broader economic feasibility is still unclear [33]. Its role in enhancing accessibility and patients' outcomes must be further explored, particularly regarding its integration into daily care management. Further studies are needed to assess its long-term effectiveness, especially in improving and managing SDB.

Some of these aspects mentioned above were the main topics of the state-of-the-art session "Sleep and breathing disorders". Challenges and perspectives for non-CPAP therapies were discussed; such therapies offer a real alternative for patients not adherent to CPAP, although they are not available and reimbursed in some countries, and the selection itself may be difficult due to sometimes limited predictive parameters. Another focus was on the impact of early diagnosis of OSA in chronic respiratory conditions like obesity hypoventilation syndrome, COPD (overlap syndrome) and idiopathic pulmonary fibrosis, highlighting that comorbid OSA can significantly worsen the patients' prognosis. Different patient phenotypes are known to respond to different PAP modalities and early detection of SDB is useful for an optimal treatment approach. To complete the overview of the state-of-the-art discussion, there was also an in-depth look at the importance of closer follow-up visits in SDB, in particular in patients with concomitant neuromuscular disease, in order to detect and manage potential complications early, improving overall patient outcome and quality of life.

One of the key conclusions from the discussions was the need for accurate and targeted patient selection, integration of data and symptoms, and centralised analysis, including the application of machine learning, to improve disease prediction and maximise treatment outcomes. In aid of this purpose, AI and telemedicine could play a pivotal role, but their integration requires further studies to validate their cost-effectiveness and establish standardised protocols for incorporation into routine clinical practice. Multidisciplinary approaches and the integration of different expertise were seen as essential for the optimisation of OSA and other SDB.

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