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POST-INTENSIVE CARE SYNDROME: RECENT ADVANCES AND PROSPECTS POST-INTENSIVE CARE SYNDROME: RECENT ADVANCES AND FUTURE PERSPECTIVES

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Abstract: Objective: To examine recent evidence on Post-Intensive Care Syndrome (PICS), addressing its pathophysiology, epidemiology, assessment methods, risk factors, preventive strategies and therapeutic options, in order to identify practices that improve the prognosis and quality of life of post-ICU patients. **Methodology:** Narrative Bibliographic Review, which used the Pubmed database, through the search strategy: (post-intensive care syndrome) AND ((rehabilitation) OR (treatment)) in the period from 2019 to 2024. After applying the inclusion and exclusion criteria, 17 articles were selected for this study. **Review:** Post Intensive Care Syndrome (PICS) affects up to 70% of patients in intensive care units (ICUs). Its consequences significantly compromise the quality of life of survivors and can last for months or years after hospital discharge. Prevention and management strategies, such as early mobilization, have proven effective in reducing muscle atrophy and functional recovery, while innovative technologies, such as therapeutic vibration devices and virtual reality, help with physical and cognitive rehabilitation. **Final considerations:** Multidisciplinary support is essential to address the multiple aspects of PICS in an integrated and individualized way. However, the implementation and integration of these new strategies face challenges, such as a lack of resources, inadequate team training and logistical barriers, which limit their consistent and comprehensive application in the hospital and post-discharge environment. Therefore, future research should focus on validating effective interventions and optimizing post-ICU care.

Keywords: Post-intensive care syndrome, Intensive care unit, Rehabilitation, Intensive care.

INTRODUCTION

Post-Intensive Care Syndrome (PICS) is a multifaceted condition that affects patients surviving hospitalization in Intensive Care Units (ICUs), resulting in physical, cognitive and emotional sequelae that compromise the quality of life of individuals and their families (Tejero-Aranguren *et al.,* 2022). These symptoms result from intensive interventions, such as mechanical ventilation, prolonged sedation, immobility, medication use and the stress associated with the severity of the critical condition that led to hospitalization (Yuan *et al.*, 2021).

The onset of PICS is often associated with a complex interaction between several previous clinical syndromes, such as Systemic Inflammatory Response Syndrome (SIRS), Compensatory Anti-Inflammatory Response Syndrome (CARS), Cytokine Release Syndrome (CRS), Acute Respiratory Distress Syndrome (ARDS) or Multiple Organ Failure (MOF), and Persistent Inflammation, Immunosuppression and Catabolism Syndrome (PICS). These conditions influence both the duration and severity of the clinical picture (Parfenov *et al.,* 2022).

Although PICS is recognized as an important post-ICU complication, there are still significant gaps in the epidemiology of the condition, due to the difficulty in diagnosing it and the insufficient preparation of medical teams to identify it. Comparative studies have investigated the relationship between the occurrence of the syndrome and factors such as the type of surgery (emergency or elective), length of ICU stay and the presence of post-discharge symptoms such as weakness and cognitive or behavioral changes. Patients facing prolonged hospital stays are at greater risk of unfavorable outcomes due to their long exposure to the hospital environment (Hiser *et al.*, 2023).

In recent years, significant advances have been made in the understanding and management of PICS, including preventive strategies based on multidisciplinary approaches and the development of more accurate assessment tools. However, despite this progress, many issues remain unresolved, such as the standardization of diagnostic methods and the identification of specific biomarkers. Such gaps highlight the need for more research aimed at new perspectives in post-ICU care (Ahmad; Teo, 2021; Parfenov *et al.*, 2022).

Multidisciplinary management during ICU stay is a central element in the prevention of PICS, and is crucial for minimizing the risk factors associated with its occurrence. The integrated action of the medical team, from admission to discharge, plays an essential role in reducing complications related to the syndrome (Ahmad; Teo, 2021). Therefore, this study aims to examine recent evidence on Post Intensive Care Syndrome, addressing its pathophysiology, epidemiology, assessment methods, risk factors, preventive strategies and therapeutic options, with a view to identifying practices that improve the prognosis and quality of life of post-ICU patients.

METHODOLOGY

This is a narrative literature review developed according to the criteria of the PVO strategy, which stands for: population or research problem, variables and outcome. This strategy was used to develop the research question "How do recent advances in the management and prevention of post-intensive care syndrome (PICS) impact on the quality of life and long-term prognosis of critically ill patients?". The searches were carried out using the PubMed - MEDLINE (Medical Literature Analysis and Retrieval System Online) databases. The search terms were used in combination with the Boolean terms "AND" and "OR", using the following search strategy: (post-in-

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tensive care syndrome) AND ((rehabilitation) OR (treatment)). From this search, 521 articles were found, which were then submitted to the selection criteria. The inclusion criteria were: articles in English; published between 2019 and 2024 and which addressed the themes proposed for this research, studies of the systematic review type, qualitative study, experimental study, retrospective observational study, randomized clinical trial. The exclusion criteria were: duplicate articles, articles available in abstract form, articles that did not directly address the proposal studied and articles that did not meet the other inclusion criteria. After applying the inclusion and exclusion criteria, 17 articles were selected from the PubMed database to make up the collection of this study.

REVIEW

In recent years, significant advances in the field of intensive care, such as the development of evidence-based interventions and the integration of interprofessional teams, have resulted in substantial improvements in ICU survival rates (Dunn *et al.,* 2022). However, this improved survival is often associated with high personal and financial costs for patients, including Post Intensive Care Syndrome (PICS). Formally introduced in 2010 during the Global Critical Care Conference, PICS is described as a set of physical, cognitive and psychological dysfunctions that manifest after discharge from the ICU, affecting approximately 50% to 70% of hospitalized patients (Renner *et al.*, 2023).

Among the components of PICS, cognitive impairment is similar to that observed in cases of mild to moderate dementia, affecting domains such as memory, executive functions and processing speed. Factors such as advanced age, female gender, use of mechanical ventilation (MV), delirium and deep sedation increase the risk of cognitive sequelae. On the other hand, a greater cognitive reserve may offer protection against such deficits. In addition, the ICU experience can trigger psychological disorders such as anxiety, post-traumatic stress disorder (PTSD) and depression, and these symptoms are amplified by factors such as prolonged length of stay and episodes of delirium (Navarra-Ventura *et al.*, 2021).

PICS is also strongly associated with physical manifestations, such as ICU-acquired muscle weakness (ICU-AW), muscle atrophy and fatigue, which affect up to two thirds of patients. Muscle loss, accelerated during hospitalization, is influenced by clinical severity and organ failure, as well as being exacerbated by advanced age, which reduces muscle regeneration capacity. This has a direct impact on the functional capacity of patients, especially the elderly, who find it more difficult to resume activities of daily living (ADLs) after discharge (Brummel *et al.*, 2021; Zhang *et al.*, 2024).

The physical and psychological rehabilitation of ICU survivors requires integrated and innovative approaches. Strategies such as early mobilization, included in the ABCDEF package, have been shown to be effective in reducing the physical and psychological sequelae of PICS (Lee *et al.,* 2019). Additionally, technological interventions, such as the therapeutic vibration device (TVD) and virtual reality (VR), offer new possibilities to complement physiotherapy and address psychological symptoms. The TVD, for example, makes it possible to apply whole-body vibration (WBV) to bedridden patients, simulating the benefits of light exercise. VR has been shown to be effective in therapeutic exposure for anxiety and PTSD, helping patients gradually reintegrate into the hospital environment in a controlled manner (Saxena *et al.,* 2021; Vlake *et al.,* 2022).

The management of PICS also requires a multidisciplinary approach. Consultations involving nephrologists, pulmonologists, nutritionists and psychologists allow for a comprehensive assessment of physical, cognitive and psychological deficits, while specific screening tools help to monitor patients' progress. Studies indicate that early follow-up, carried out in the initial weeks after discharge, is crucial to improving long-term outcomes (Akhlaghi *et al.*, 2020).

Caregivers and family members also face significant emotional challenges, such as anxiety, depression and PTSD, a condition called PICS-F. This impact requires psychological support and the creation of support networks. Tools such as ICU diaries and targeted education programs have proven effective in helping caregivers cope with the emotional and practical demands of caregiving, promoting a more integrated recovery (Arlo *et al.*, 2024; Vester; Holm; Deyer, 2021).

Despite the advances described, challenges remain in the implementation of preventive technologies and strategies for the management of PICS. Additional clinical studies are needed to validate the effectiveness and feasibility of interventions such as DBT and VR in real-life settings. In addition, integrating these approaches into healthcare systems requires team training and investment in infrastructure (Lui *et al.,* 2023).

The prevention and treatment of PICS requires a multifaceted approach that combines innovative technologies, consolidated strategies such as early mobilization and psychological support, and structured post-ICU care programs (Watanabe *et al.,* 2023). These efforts should prioritize not only patient survival, but also a full and sustainable recovery, with improvements in quality of life and functional outcomes (Kohei *et al.,* 2024; Bouzgarrou *et al.,* 2024).

FINAL CONSIDERATIONS

Therefore, the importance of a multidisciplinary approach in the recovery of post-intensive care patients is highlighted, from hospitalization to the post-discharge period, reducing physical, cognitive and psychological sequelae. Evidence-based strategies, such as the ABCDEF protocol, have demonstrated a positive impact on rehabilitation, improving survivors' quality of life, while the inclusion of caregivers in therapeutic planning is essential due to the significant impacts they also face. Despite advances, challenges remain, such as the need for early screening to identify patients at high risk of PICS, implementation of structured post-ICU care programs, development of adequate infrastructure and training for healthcare teams. Emerging technologies, such as therapeutic vibration devices and virtual reality, show promise, but require further studies to validate their effectiveness in different clinical contexts. Future studies should focus on updating existing strategies and exploring new alternatives for the prevention and management of PICS, considering different settings and health systems. Thus, the effective management of PICS requires a continuous commitment from health professionals, with the aim of guaranteeing not only patient survival, but also a dignified, functional and sustainable recovery that prioritizes quality of life.

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