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REVIEW ARTICLE

PREVENTION OF POST-INTENSIVE CARE SYNDROME IN PAEDIATRICS – A CURRENT REVIEW

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ABSTRACT

Mortality rates in paediatric intensive care have remained low in the past few decades due to significant advances in medical technology and clinical care. Today, survival alone is no longer the sole indicator of successful care. As survival has improved, growing attention has shifted toward long-term outcomes, particularly post-discharge quality of life and morbidity acquired during or after intensive care. There is a growing recognition within the paediatric critical care community of the need to address broader aspects of recovery, many of which are potentially modifiable through evidence-based interventions and improvements in clinical practice.

Post-intensive care syndrome in paediatrics (PICS-p) describes newly developed or worsened impairments in physical, psychological, cognitive and/or social aspects following discharge from paediatric intensive care units. Recognition, treatment and prevention of this syndrome is crucial to maximize long-term outcomes.

This paper aims to review the existing literature to assess the current state of research on preventive measures for PICS-p. Published studies were identified through systematic searches of major databases, followed by a thorough extraction of relevant data on PICS-p and its prevention.

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Introduction

The evolution of medicine, with new techniques, complementary exams, evaluation tools and treatments, has led to a reduction in mortality in paediatric intensive care, with some studies reporting mortality rates as low as 1,3%.[1] As a result, mortality and 28-day survival rates have become less relevant as a reliable indicator for evaluating the standard of care.[1,2]

Optimizing long-term outcomes has become a primary goal, with a focus on newly acquired morbidities resulting from intensive care admissions and hospitalization. Evaluating quality of life and post-discharge survival is increasingly important.[3] These factors are now considered key indicators of positive outcomes in paediatric critical care, which professional teams aim to improve.

Patients admitted to Intensive Care Units (ICU) undergo a challenging period, characterized by changes that affect not only their physical health due to severe illness but also other aspects of their lives. These changes are well-documented in the literature for adult patients and are commonly referred to as post-intensive care syndrome (PICS). This term describes a range of physical, psychological, cognitive and/or social impairments experienced by patients after discharge from the ICU.[1] Recent growing evidence regarding these changes in paediatric patients led to the term PICS-p (post-intensive care syndrome- paediatrics). Considering that the admission of a family member in the ICU is related to significant changes in daily family life and a high emotional burden, another important concept to be mentioned is PICS-f (post-intensive care syndrome-family).

Signs and symptoms

PICS-p is present in approximately 70% of children after PICU discharge.[4]

As previously mentioned, PICS-p affects various domains. The signs and symptoms may vary according to the domain affected and even within the same domain, they can differ among children depending on age, clinical conditions and previous medical history.[3] It is crucial to document the patient's previous baseline function in order to accurately assess any newly acquired impairments. There are validated scales that may be used for this purpose, including the Paediatric Overall Performance Category, the Paediatric Cerebral Performance Category and the Functional Status Scale.[5]

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Physical impairment is the most studied and easiest to recognize. It is typically evident through widespread muscle weakness, fatigue, respiratory issues, feeding difficulties, sensory changes, pain and psychomotor agitation.[1,3,5,6] However, involvement of specific muscle groups may lead to less obvious manifestations, such as chronic respiratory failure or difficulty weaning patients from mechanical ventilation due to diaphragmatic weakness. Awareness of these presentations is essential to avoid misdiagnosis. Severity can range from mild to severe, potentially requiring interventions such as positive pressure ventilation, parenteral nutrition, or other forms of technology dependence.[3]

Cognitive impairment refers to delirium, reduced attention capacity, memory and concentration problems, lower intelligence quotient (IQ) and decreased communication abilities and school performance.[1,3,6]

Psychological impairment is usually characterized by sleep disturbances, anxiety, post-traumatic stress, depressive symptoms, mood lability, delusional memories, fears and behavioural problems. Impairment in self-esteem has also been described as a result of the emotional burden associated with hospitalization, changes in body appearance and long-term school absenteeism.[1,3,6]

Along with social isolation affecting peer relationships, social anxiety and family disturbances, school absenteeism is part of the social domain.[1,3,6] Children often struggle to talk about their experiences and may feel ashamed of their limitations or appearance after discharge, avoiding social interaction.[5]

Regarding the impact on family members (e.g. parents and siblings), the most commonly described consequences are psychological, namely depression (the most prevalent), anxiety and post-traumatic stress.[6] Trauma is related not only to interventions involving their relatives but also to events witnessed with other children admitted during the same period.[3]

Family members may also experience social disruption. The most frequent issue is job loss due to extended periods off work while caring for their children, resulting in financial strain. Additionally, isolation, loss of social connections and unstable family relationships, sometimes leading to divorce, have been described.[2,3] After discharge and depending on their child's functional impairments, many parents face the need to become full-time caregivers.

Risk factors

Current data identify several risk factors that predispose children to the development of these impairments. Although often categorized by domain, most are transversal.

The most important risk factor related to physical impairment is immobilization, particularly when prolonged. Immobilization, increased catabolism associated with critical illness and microvascular ischemia are strongly associated with muscle mass loss. Invasive ventilation, circulatory support and prolonged sedation are also contributing factors.[1,6]

Regarding cognitive impairment, delirium has been widely studied. Deeper levels of sedation and analgesia, particularly with opioids and benzodiazepines, as well as younger age and pre-existing developmental disorders, increase risk.[5-7] Prolonged hospitalization, trauma-related admissions, non-elective admissions and new oncological or neurological diagnoses are also associated, as are procedures such as invasive ventilation, oxygen therapy, cardiopulmonary resuscitation, renal replacement therapy and extracorporeal membrane oxygenation.[5]

PICU hospitalization is inevitably linked to invasive procedures. Associated pain and discomfort, together with prolonged mechanical ventilation, sedation and physical restraint, significantly contribute to anxiety, post-traumatic stress and depression after discharge.[6] Sepsis has also been associated with post-traumatic stress.[5]

Prevention

There are measures that can be implemented to reduce post-intensive care syndrome in paediatric patients.

ABCDEF bundle

The ABCDEF bundle is the most well-known tool in this regard. It has been studied in adults and is being used in paediatrics more recently, with some authors proposing a more humanistic modified approach.[4] Each letter of this acronym represents one area of possible action: A (Analgesia, Sedation and Withdrawal Management), B (Breathing and Mechanical Ventilation), C (Communication), D (Delirium Monitoring and Management), E (Early Mobilization) and F (Family Engagement and Empowerment).[3-5]

In these modified bundles, two additional letters were added: G (Good Nutrition and Good Sleep) and H (Home Care).[2,4]

A (Analgesia, Sedation and Withdrawal Management)

Children admitted to the PICU often undergo painful procedures during hospitalization, making pain management a crucial component of care. Pain is not only distressing but can also lead to increased stress, longer recovery times and prolonged hospital stays, if not adequately managed. Healthcare professionals must be alert in assessing and managing pain, as it is a preventable risk factor with the wide range of analgesic options available.[5]

Available tools to assess pain in the PICU include the Wong-Baker FACES Pain Rating Scale, the FLACC Scale (Face, Legs, Activity, Cry, Consolability), the Numeric Rating Scale and the COMFORT Scale. These scales standardize evaluation within the same unit.

In pain management, a multimodal approach appears to be the most appropriate. Local and regional analgesia allow effective pain control, reducing painful and traumatic experiences. Collaboration with anaesthesia should be sought whenever pain control is difficult or prolonged analgesia is anticipated.

Achieving appropriate sedation balance is imperative in the PICU. The ideal ventilated patient should be easily arousable, comfortable and synchronized with the ventilator, capable of perceiving the environment and reporting discomfort. Under-sedated patients may accidentally dislodge intravenous lines or catheters, remove endotracheal tubes and potentially harm themselves or healthcare providers. Conversely, over-

sedation can result in prolonged mechanical ventilation due to loss of respiratory drive, withdrawal symptoms and hemodynamic instability.[4,7]

The State Behavioral Scale (SBS) is used to describe sedation and agitation levels in paediatric intubated patients. Evaluation of sedation and pain should be performed every four hours and before any intervention expected to alter analgosedative levels.[7]

Given the negative effects of prolonged sedation, strategies such as daily sedation interruption and drug cycling have been adopted. Drug cycling involves a rotation protocol based on the hypothesis that minimizing receptor occupation helps prevent tachyphylaxis. These strategies are thought to minimize tolerance and withdrawal risk compared to continuous intravenous sedation, although they remain controversial. Some studies report reductions in mechanical ventilation duration, total sedative dose and length of hospitalization, while others report no benefit compared with continuous dose reduction.[4,7-10]

When choosing sedative drugs, available data suggest that dexmedetomidine and clonidine should be preferred over opioids and benzodiazepines, particularly midazolam, which are associated with increased delirium and prolonged mechanical ventilation and hospitalization. These agents appear less neurotoxic and more closely resemble natural sleep architecture, reducing delirium and sleep disruption.[4,7,11-13]

B (Breathing and Mechanical ventilation)

Prolonged mechanical ventilation is associated with deeper sedation, longer immobilization, ventilator-associated infections and increased PICU length of stay. To overcome these outcomes, spontaneous awakening trials and spontaneous breathing trials may be used. Some studies show that a high percentage of children are ready for extubation at the first trial, raising the question of whether extubation could have occurred earlier.[4]

To achieve this goal, non-invasive mechanical ventilation should be considered as early as possible and standardized protocols for assessing extubation readiness are recommended, with clear guidance on initiating ventilator weaning. These trials must be coordinated with analgesia and sedation strategies.[4]

C (Communication) and F (Family engagement and empowerment)

Communication and family engagement are closely intertwined. During PICU hospitalization, some parents feel incapable of caring for their children, experiencing guilt and uncertainty about the future. Fear of causing harm may prevent them from touching or holding their child.[6]

During traumatic events such as cardiorespiratory arrest and invasive procedures, healthcare professionals often ask parents to leave the bedside. This is based on concerns regarding distraction and emotional distress. However, studies suggest that when parents are adequately informed, family presence can improve understanding, satisfaction, coping and grieving. Even when parents choose not to be present, they value having the option.[4,14,15]

Parents should receive psychological support from admission. Participation in care, presence during rounds and involvement in decision-making should be encouraged. In stable patients, routine activities such as feeding and bathing should be promoted, helping parents regain their role. This involvement improves parental experience and well-being and reduces stress and anxiety.[6,16,17]

D (Delirium—assess, prevent and manage)

According to the Diagnostic and Statistical Manual of Mental Disorders (fifth edition), delirium is a temporary condition characterized by a fluctuating disturbance in attention, awareness and cognition. It is not explained by a pre-existing disorder and represents a physiological consequence of illness or its treatment.[7,18]

Risk factors include prolonged PICU stay, illness severity, mechanical ventilation, sleep disturbance and deep or prolonged sedation, particularly with benzodiazepines and anticholinergic drugs.[7,18]

Delirium should be monitored using tools such as the Preschool Confusion Assessment Method for the ICU (PSCAM-ICU) and the Pediatric Confusion Assessment Method for the ICU (PCAM-ICU). The Sophia Observation Withdrawal–Paediatric Delirium Scale is useful for differentiating withdrawal from delirium.[4]

Prevention should include pharmacological strategies, such as reducing benzodiazepines and anticholinergic drugs and non-pharmacological measures, including a calm environment, reorientation, familiar objects and continuous family presence.[4]

E (Early mobility and exercise)

Despite concerns about mobilizing ventilated patients or those with invasive devices, evidence shows that early mobilization is safe and beneficial. Common barriers include limited equipment and safety concerns, although adverse events are rare and usually transient.[19-22]

Early mobilization reduces mechanical ventilation duration, improves muscle strength, accelerates recovery and prevents complications such as pressure ulcers. Nurse involvement is essential, as they perform most mobilization activities.[23]

G (Good nutrition and good sleep)

Good nutrition and sleep are important determinants of recovery. The PICU environment is associated with multiple stimuli that negatively affect sleep quality, resulting in sleep fragmentation and circadian rhythm disruption.[18]

To promote physiological sleep, measures such as noise control, visual alarms, designated quiet periods and minimizing nocturnal interventions should be implemented when safe. Circadian rhythm should be supported through appropriate light exposure, daytime activity and avoidance of abrupt lighting changes. Earplugs and eye masks may be beneficial.[2,6,18]

Critical illness increases energy expenditure and catabolism, making early enteral nutrition and adequate caloric intake essential, ideally guided by a nutrition specialist.[6]

H (Home care)

After discharge, a multidisciplinary team should ensure continuity of care, including long-term follow-up for

early detection and monitoring of post-intensive care syndrome.

ICU diaries are increasingly used to help patients and families understand their hospitalization and reduce delusional memories. Diaries are recommended for patients sedated for more than 48 hours and may include contributions from healthcare professionals and family members, photographs and drawings.[2,3,5,6] However, outcomes remain uncertain, with mixed evidence regarding psychological benefit.[24-26]

The implementation of these measures has been associated with reduced ventilation duration, fewer ventilator-associated infections, improved early mobilization, lower delirium rates and improved survival.[23] Although implementation may be challenging, gradual adoption is feasible.[23]

PICU Up! Programme

Published data shows that there are very few PICU using all elements of ABCDEFGH bundle. A and F appear to be the most commonly implemented, while E is one of the least used.

Early mobility and exercise have been extensively studied and implemented with PICU-Up! programme. Its main goal is getting patients out of the bed as soon as possible. This goal is achieved by mobilising children during daytime and optimising their sleep, minimising sedation.[27]

This programme was originally started in Paediatric Intensive Care Unit at Johns Hopkins Hospital with a multidisciplinary team composed of nursing, physical therapy, occupational therapy, respiratory therapy, child life specialists, nurses practitioners and physicians. Patients are classified in a three-level system and each level corresponds to a set of interventions.[27,28] Exclusion criteria included ECMO, open chest or abdomen, unstable fractures, or medical orders specifying alternate activities. Study results demonstrated that the programme is safe and associated with positive outcomes, such as a higher percentage of children ambulating by day 3.[27]

PICU-Up! programme has been implemented in PICUs internationally and there is a multicenter clinical trial (Trial registration: NCT04989790) being conducted currently in order to understand generalizability and broader impact on patient and family centered outcomes.

Therapeutic cuddlers and animal-assisted therapy

Therapeutic cuddling has been used widely in neonatal intensive care and demonstrates beneficial outcomes in terms of growth, physiologic stability and shorter hospital stays, however, literature related to critical ill pediatric patients is scarce. It is based on physical contact from holding, cuddling and hugging between the child and caregiver.[29,30]

Touch is not only associated with a positive therapeutic interaction, but it is also linked to a quicker recovery process by affecting the neuro, immune and neuroendocrine homeostasis. Therapeutic touch seems to increase vagal tone, oxygen saturation and dopamine levels and decrease cortisol and stress levels.[30]

It is believed that therapeutic cuddling may be a potential beneficial intervention in PICU for management of pain, agitation and delirium.[29]

Another non-pharmacological therapy worth mentioning is animal-assisted therapy. Animal-assisted therapy is the intervention with a trained dog and its accredited professional in charge. Patients must be carefully selected, excluding immunocompromised or those colonized by resistant pathogens.[31]

In spite of few studies evaluating the outcome of animal-assisted therapy, they demonstrated a decrease in pain, fatigue, fear, stress and anxiety and also seem to have a positive effect in mood, orientation and collaboration of the patient in care/treatment. Moreover, there has been a widespread satisfaction between patients, parents and health care professionals.[31,32]

Conclusions

PICU admissions have a significant impact on various aspects of children and their families lives. Health professionals should be informed and alert in order to detect and ultimately, prevent impairments resulting from critical illnesses.

There is still underuse of the ABCDEFGH bundle in PICU worldwide. To improve its implementation as a routine practice, it is compulsory to create a multidisciplinary team and provide regular training for all professionals. Additionally, developing guidelines and protocols that clarify methods for assessment (including validating scales), prevention and symptom treatment is crucial.

PICU-Up! program has demonstrated promising results in reducing physical impairments. However, further studies are needed regarding therapeutic cuddlers and animal-assisted therapy in order to clarify their possible benefits.

Compliance with Ethical Standards
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