Cardiac Arrest in Pediatric Cardiac ICUs: What Are the Differences?*

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Cardiac arrest (CA) is one of the most important causes of death in childhood. Over the past years, there has been a significant increase in survival rates in pediatric CA, mainly in those who suffer an in-hospital CA (1–4). Better knowledge of cardiopulmonary resuscitation (CPR) recommendations, greater training of teams of health professionals, and better organization in the prevention and early care of children at risk of CA are key factors that have contributed to this improvement (5, 6).

Children with heart disease are those who more frequently suffer CA in hospitals (1, 2) and in the PICU (3, 4), their survival rate varying from 40% to 50% (1, 3, 7). A significant proportion of CA in these children occurs during the perioperative period of cardiac surgery (8).

Pediatric intensive care is developed in the majority of hospitals worldwide through multidisciplinary ICUs, which provide assistance to children with different illnesses. However, some large hospitals in countries like United States have specific ICUs to treat exclusively cardiac patients (PCICU) (9). The Pediatric Cardiac Critical Care Consortium (PC4) is a voluntary clinical registry that includes PCICUs from North America (10).

The majority of pediatric CA studies have analyzed the characteristics and evolution of all CA in children (1–3). Few studies have done this in PCICUs (4, 11).

Alten et al (12) published in this issue of Pediatric Critical Care Medicine the results of the first multiinstitutional epidemiologic study of CA including all admissions in PCICUs. This is a retrospective study that analyzed 492 CA in 23 PCICUs from the PC4 (12). It is the most extensive study of CA in children with heart disease hospitalized in PCICUs.

The study (12) is mainly focused on evaluating risk factors related to CA. The authors have carried out a thorough study of the risk factors, analyzing medical and surgical patients separately, and in the latter the preoperative and postoperative factors.

In surgical patients, prematurity, neonatal age, and the most complex cardiac diseases and those with higher surgical risk were associated with higher frequency of CA. In the analysis of postoperative CA, extracorporeal membrane oxygenation (ECMO), open sternum, mechanical ventilation, and maximum vasoactive inotropic score were associated with postoperative CA. These risk factors are logical because they reflect that the risk of CA is related to the higher severity of illness.

In medical cardiac patients, the independent CA risk factors were prematurity, acute heart failure, lactic acidosis greater than 3 mmol/dL, and invasive ventilation 1 hour after admission. These factors also reflect that higher severity of illness is associated with higher risk of CA.

It is striking that the authors have not analyzed any of the pediatric scores of clinical severity and mortality risk (Pediatric Risk of Mortality, Pediatric Index of Mortality, Pediatric Logistic Organ Dysfunction). It would be interesting that future studies analyze the usefulness of these scores to assess the risk of CA in pediatric medical and surgical cardiac cases.

Survival rate in this study (12) (53.2%) is slightly higher than that described by others of CA in cardiac children in PCICUs. The authors have disclosed that they do not have any potential conflicts of interest.

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Nevertheless, it is difficult to compare results because of the influence of other factors such as patient characteristics (neonates and/or children), or surgical interventions. Actually, one important fact that the authors have not analyzed was the differences in survival rates among the 23 centers included in this study (12).

One important finding of this study (12) is that the prevalence of CA was a 50% higher among children with medical conditions when compared with surgical patients. Furthermore, the survival of medical patients was much lower (37.7%) than that of surgical children (62.5%). On the other hand, half of the CAs occurred during the first 2 days of PICU stay.

One of the most important limitations of this study (12) is its lack in analyzing the influence of presenting previous risk factors for CA, the characteristics of the CA (cause of arrest, electrocardiogram rhythm, etc.), resuscitation manoeuvres (adrenaline, defibrillation), and postresuscitation care in survival (13) or patient’s long-term outcome (14).

Remarkably, 132 patients (27.2%) were treated with extracorporeal CPR (ECPR). Although survival of patients with ECPR in this study (12) was relatively low (37.7%), fast ECPR, which might be more readily available in PCICUs than in general PICUs, could be an important factor to improve the results of CA in these patients (15).

In conclusion, this study (12) offers new data on risk factors for CA in children with both medical and surgical heart disease and on the characteristics and short-term evolution of CA in specific units of cardiac intensive care.

What is the practical application of these results for those pediatricians working in pediatric intensive care?

Is the outcome of CA in pediatric cardiac patients better when treated in PCICU than in general PICUs? We do not know, but it is not an important matter. It probably depends more on the CPR organization and training of each PICU to prevent and treat CA than on the PICU characteristics.

The important thing is to determine what we can do about risk factors. Most of the CA risk factors found in this study (prematurity, age, surgical risk, need for ECMO, mechanical ventilation, or dose of vasoactive drugs) are not modifiable. On the other hand, it is necessary to take into account that children with medical pathology and especially during the first days of admission in the PICU, have an increased risk of CA. Thus, we should have a greater vigilance of these patients to detect the early signs of CA, to be prepared and have all the staff caring for these patients trained in CPR and have the ECMO team forewarned.

It is therefore fundamental to focus our efforts in the first place on the early detection of children at risk for CA and the early signs of cardiac and respiratory deterioration, and secondly, to achieve adequate organization of CPR and continuous training of the staff to achieve a quality CPR and a postresuscitation care. Multicenter registries such as PC4 (12) provide us with valuable information on the risk factors for CA in children with heart disease but, in the future, should include the evaluation of these features.

REFERENCES


