



## Neonatal resuscitation in the ward: The role of nurses

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### ABSTRACT

Cardiopulmonary resuscitation (CPR) is necessary in about 1–2% of all newly born infants in their first minutes of life. However, CPR may also be needed in newborns beyond the time of birth, particularly in high risk categories of infants admitted in the NICU or in other less specialised units. In all these scenarios, the role of nurses is essential for several aspects, including early recognition of a deteriorating infant, with the aim to prevent cardiac arrest, as well as the starting of immediate basic life support manoeuvres at the bedside, whenever needed. Furthermore, nurses have a special part in family care during cardiopulmonary resuscitation.

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### 1. Introduction

In any subject, a timely and appropriate resuscitation can mean the difference between intact survival, survival with neurological sequelae, or death. This principle does apply also to newborns, who are even more exposed to the risk of cardiopulmonary arrest compared to older age populations. In fact, resuscitation is necessary in about 1–2% of all newly born infants in their first minutes of life, indicating that qualified personnel should always be present during the delivery phase, ready to provide supportive manoeuvres if required [1,2]. However, cardiopulmonary resuscitation (CPR) may also be needed in newborns beyond the time of birth, particularly in high risk categories of infants admitted in the NICU, such as those born prematurely, affected by congenital anomalies, with perinatal asphyxia, undergoing major surgery, dependent by technological devices, and so forth [3–6]. CPR may be occasionally required also in lower intensity units, such as in the nursery or in the general paediatric ward. In these settings, the monitoring level is often less sophisticated and strict, exposing the patients to a higher risk of unwitnessed life-threatening episodes, which may imply aggressive treatment in emergency circumstances.

In all these scenarios, the nursing staff is of paramount importance for many critical aspects, which can be schematically summarized in the following three main tasks:

- 1) Early recognition of a deteriorating infant and prevention of cardiac arrest (CA);
- 2) starting of immediate basic life support manoeuvres and acting as an active member of the resuscitating team;
- 3) family care during cardiopulmonary resuscitation.

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### 2. Early recognition of a deteriorating infant and prevention of cardiac arrest

In a neonatal intensive care unit (NICU), despite the highly sophisticated medical technology and the best efforts of expert nurses and physicians, tiny infants spending days or weeks in the unit remain at high risk for sudden adverse events or progressive deterioration due to their underlying conditions. Causes for such life-threatening episodes are quite variable, including acute respiratory failure secondary to airway obstruction, malfunctioning of ventilatory devices, infections, acute haemodynamic compromise, etc. Babies weighing less than 1500 g are particularly at risk for their intrinsic vulnerability and because they can require months of care [7,8].

Clearly, early recognition of any deterioration in terms of vital signs may be effective in avoiding or limiting the risk of cardiac arrest, prompting an appropriate intervention by the medical team. Indeed, in older children, preemptive management have been shown to be effective in preventing cardiopulmonary arrest and improve mortality, at the same time avoiding the morbidity associated with urgent resuscitation, such as the development of multiple organ dysfunction [9,10].

However, the provision of preemptive care relies on the timely identification of patients at risk and referral to the responsible medical team. In older children, this may be obtained by using predefined warning criteria, where patients meeting one or more specific triggering criteria are quickly identified. Alternatively, early warning scores may be used, where severity of illness scores, combining clinical parameters into a single score, can identify patients “at risk” with scores greater than a predefined threshold [9–11]. These “at risk” patients may then benefit of prompt interventions, including closer monitoring, higher nurse–patient ratios, more frequent physician review or ICU admission. Unfortunately, such early warning scores or preset warning criteria have not been established in the neonatal population as yet. So, in clinical practice, early recognition of any deteriorating infant still relies upon the classical monitoring system, with preset alarm parameters, and most importantly on the ongoing

clinical surveillance of the nursing and medical staff. Actually, in this respect nurses are certainly at the fore front: spending most of their time at the infant's bedside, they must be properly trained in the early identification of vital signs derangements, according to the different ages and underlying clinical conditions of neonatal patients they are taking care of. Indeed, at least in some situations, their prompt intervention may prevent a subsequent cardiac arrest. Such important observation task may be sometimes hampered by different factors, such as an excessive nursing workload, simultaneous emergencies, little clinical experience, etc. In addition, early recognition of infants at risk for cardiopulmonary arrest is often difficult because of the infrequent nature of such events and the fact that nurse–patient ratios in many neonatal facilities may be far from optimal.

Refinements of appropriate monitoring of physiological signals might be used to guide clinical actions and give early warning of potential adverse events. Automated early warning systems could enhance the nurse's interpretation of data at the bedside, by processing new information and comparing it in real time with previous observations. The implementation of either bedside alerting devices or early warning systems, tailored to the neonatal population, may improve the capability of nurses to promptly detect any clinical deterioration, potentially limiting the number of preventable cardiac arrest episodes.

### 3. The role of nurses during cardiopulmonary resuscitation

Unfortunately, cardiac arrest (CA) episodes are not always prevented or preventable, even in the NICU or in the nursery. Thus, health-care providers must be prepared to intervene as soon as possible, establishing immediate life support manoeuvres, if necessary. In this setting, neonatal critical care nurses are quite often the first to witness any CA episode. Thus, they should be prepared for the unexpected event of a cardiac arrest in the ward, being ready to provide the initial rescue manoeuvres, including BLS and oxygen administration. In general, resuscitation of a newborn should follow the International Liaison Committee on Resuscitation (ILCOR) guidelines [2]. Obviously, some issues pertinent to the resuscitation process in the delivery room, such as meconium aspiration, initial alveolar recruitment, choanal atresia or diaphragmatic hernia, do not apply to the “older” newborn infant suffering a cardiorespiratory arrest event in the ward. Moreover, differently from the delivery room scenario, most of the times these infants are already instrumented and monitored in the unit, facilitating a prompt diagnosis and the immediate onset of resuscitation manoeuvres, including emergency drugs and fluids administration. Similarly to all other ages, the basic steps of resuscitation in the newborn are establishment of airway, ventilation, and circulatory support, regardless the location where the CA episode occurs and the gestational age of the patient. Ideally, nurses should integrate their basic skills with expertise in manual bagging and capability to obtain an emergency vascular access, if needed. Anticipation and preparation are key to successful resuscitation of newborns in this setting. Typically, nurses are in charge to ensure that all appropriate supplies and equipment for neonatal resuscitation are easily available, in a well designated area, to facilitate intubation, ventilation, fluid resuscitation, administration of drugs, or carrying out of any invasive manoeuvre. Furthermore, nurses should seek for immediate help, summoning personnel with expertise in airway, respiratory, and circulatory management to provide advanced support to these infants. As soon as expert physicians become available and take over the supervision of CPR, nurses' contribution remains essential in assisting the team leader, aiding in airway management during tracheal intubation, confirming the tube placement with a CO<sub>2</sub> detector, checking the air entry during manual ventilation, providing chest compressions or ventilation, getting a safe vascular access, preparing and administering drugs and fluids, maintaining the baby normothermic during the whole resuscitation process, and so forth.

Importantly, nurses should be fully involved by the medical team in the discussion and decision-making process about discontinuing, withdrawing, and withholding resuscitative efforts. In most cases, particularly in those situations where adverse events are anticipated and the prognosis is unfavourable, a thorough multidisciplinary discussion should be ideally planned in advance. Such discussion, which should incorporate some key family members as well, may enable the medical and nursing staffs to act in a shared and coordinated fashion in case of emergency.

Finally, any cardiopulmonary arrest episode represents a dramatic occurrence, which requires a complex and highly-specialised approach, particularly in vulnerable patients such as the newborn infants. Then, maintenance of resuscitation skills is essential in this population. In order to achieve this goal, given the relative rarity of cardiopulmonary arrest episodes in the neonatal age, particularly outside the delivery room, it is vital to implement ongoing training programs, based on “mock codes” or “ad hoc” simulation packages. These practice sessions, which include standard resuscitation equipment and training on mannequins, allow physicians and nurses an effective opportunity to maintain skills and assess performance in different case scenarios of neonatal cardiac arrest [12]. This may result to be particularly useful in healthcare providers who are rarely exposed to such dramatic events.

### 4. The nurse and the presence of family members during CPR

Caring for families is integral to the role of any nurse, in particular of critical care nurses. This is true also in the NICU setting, where parents are often overwhelmed by the dramatic situation of their little baby, showing a strong need of support, solidarity and comprehension, which are usually best given by the nursing team. In the last decade, the concept of “family-centred care” has attained increasing consensus within many hospitals in several different countries, even in emergency settings [13,14]. The main goal of family-centred care is to meet the needs of patients' families, including their requests for information and support and the opportunity to be near their loved ones. In paediatrics, this special approach to care has recently led to important changes in many hospitals' policies, including the possibility for parents to stay in the intensive care unit 24 h a day, or to assist to invasive manoeuvres, even during resuscitation [15]. Nurses appear to be particularly sensitive to this matter. This may be partly explained by the fact nurses usually establish an intense relation with families, being in constant contact with them and their babies within the unit, thus developing a natural sense of solidarity and compassion. However, the practice of family member presence during neonatal and paediatric resuscitations remains a controversial issue within the medical community. In 1993, the American Emergency Nurses Association has developed a position statement supporting family presence during invasive procedures and resuscitation, subsequently approved in 2001 (Emergency Nurses Association [16]). Supporters of this position tend to emphasize the basic human right of patients and their relatives for the families to be present. Opponents are concerned with possible disruption of the resuscitation team, traumatic memories for patients' families, and the risk of litigation. In fact, most patients' families want to be present during resuscitation and would make the choice again. Concerns that having a patient's family present during resuscitation would be disruptive and traumatic psychologically for the family are unsubstantiated. No evidence supports the notion that litigation occurs as a result of family presence during resuscitation. Though, information is still limited for children. Indeed, children's and newborns' vulnerability and inability to care for themselves are unique, but similarly to adults, available data suggest that presence of family members should be encouraged during cardiopulmonary resuscitation, provided ongoing support can be offered by an appropriately qualified health professional, usually an experienced nurse, whose responsibility is to care for family members witnessing CPR. In fact, some parents may be frightened or become aggressive during the CPR process, if not adequately contained and informed by a supportive staff. Nurses may be of great help in these situations, updating parents during the CPR process, while maintaining a

professional but caring and sympathetic attitude toward the infant and the family. Recently, the European Federation of Critical Care Nursing Associations (EfCCNa), the European Society of Paediatric and Neonatal Intensive Care (ESPNIC) and the European Society of Cardiology Council on Cardiovascular Nursing and Allied Professions (CCNAP) have ratified a joint position statement on the decision to enable family members to be present during a resuscitation attempt [17]. The position statement was formulated as a response to the controversies that exist around family-witnessed CPR and the small number of intensive care units that had resuscitation policies that included guidance on family members' presence. Actually, it appears that not all European countries are supportive of family member presence during CPR [18]. Furthermore, very little research has been done focusing on implications for parents and for healthcare staff when dealing with newborns and children undergoing CPR manoeuvres. Nevertheless, although additional study is needed, risks associated to family members' presence during resuscitation seem to be outweighed by potential benefits, which include improved family grieving, enhanced healthcare provider self-confidence and professionalism, and consolidation of a family-centred holistic approach.

First steps to facilitate successful implementation of family presence may include initiating family presence protocols with a focus on preparing the healthcare staff for the participation of patients' family members. Again, nurses do have an important role for accomplishing this task. In fact, the level of family participation may be influenced by the amount of support provided to them by nurses and by nurses' perceptions of family presence. Many critical care nurses believe it as important for families to be valued as partners in the care of their family member, encouraging family involvement in decisions related to end-of-life care and supporting the family during extreme events such as CPR episodes. Giving families the option of being present during resuscitation could positively impact the patient, family members, and the healthcare providers–family relationship. Written guidelines supporting the needs of patients' family members and health professionals in this critical time may produce a more unified and consistent approach to this sensitive aspect of clinical practice.

Finally, it is also important to recognize the heavy emotional impact of caring for critically ill and dying children and newborns and their families. For this reason, it is essential that both health care professionals and families are supported during, and after, the resuscitation process. Identified supports include a dedicated staff member for the family witnessing the resuscitation, follow-up for families following a death, and help for staff dealing with the stress of cumulative grief.

## 5. Conclusions

Cardiopulmonary resuscitation may be needed in newborns beyond their first hours of life, either in the NICU or in other less specialised units. A strict surveillance provided by the nursing staff and an adequate monitoring system should allow a prompt identification of unstable or deteriorating patients, with the goal to avoid a progressive worsening of clinical conditions, ultimately leading to cardiac arrest. Ideally, early warning systems tailored to the neonatal populations should be tested and validated, giving support to the nursing staff in the significant task of reducing the preventable episodes of cardiac arrest.

Nonetheless, nurses should be prepared for any unexpected adverse event in the ward, including those requiring resuscitation, being ready to provide the initial rescue manoeuvres, including basic airway manage-

ment, ventilation, and circulatory support, while awaiting further help by trained personnel with critical care expertise.

To provide optimal care, the neonatal critical care nurse should facilitate partnerships and decision making with family members. It is crucial that nurses and doctors provide families with the option of being present during the resuscitation of their loved one and to respect their decision, at the same time collaborating with families to provide them with compassionate and supportive care.

Future research efforts should focus on family presence and how it impacts the family members and health care professionals performing or witnessing CPR.

## References

- [1] American Heart Association; American Academy of Pediatrics, 2005 American Heart Association (AHA) guidelines for cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) of pediatric and neonatal patients: neonatal resuscitation guidelines. *Pediatrics* 2006;117. Available at: [www.Pediatrics.org/cgi/content/full/117/5/e1029](http://www.Pediatrics.org/cgi/content/full/117/5/e1029).
- [2] International Liaison Committee on Resuscitation. International consensus on cardiopulmonary resuscitation and emergency cardiovascular care science with treatment recommendations. Part 7: Neonatal Resuscitation. *Resuscitation* 2005;67: 293–303.
- [3] Young KD, Seidel JS. Pediatric cardiopulmonary resuscitation: a collective review. *Ann Emerg Med* 1999;33:195–205.
- [4] Reis AG, Nadkarni V, Perondi MB, Grisi S, Berg RA. A prospective investigation into the epidemiology of in-hospital pediatric cardiopulmonary resuscitation using the international Utstein reporting style. *Pediatrics* 2002;109:200–9.
- [5] Barr P, Courtman SP. Cardiopulmonary resuscitation in the newborn intensive care unit. *J Paediatr Child Health* 1998;34:503–7.
- [6] Peddy SB, Hazinski MF, Laussen PC, Thiagarajan RR, Hoffman GM, Nadkarni V, et al. Cardiopulmonary resuscitation: special considerations for infants and children with cardiac disease. *Cardiol Young* 2007;17(suppl 2):116–26.
- [7] Campbell ME, Byrne PJ. Cardiopulmonary resuscitation and epinephrine infusion in extremely low birth weight infants in the neonatal intensive care unit. *J Perinatol* 2004;24: 691–5.
- [8] Kostelanetz AS, Dhanireddy R. Survival of the very-low-birth-weight infants after cardiopulmonary resuscitation in neonatal intensive care unit. *J Perinatol* 2004;24: 279–83.
- [9] Tibballs J, Kinney S. Reduction of hospital mortality and of preventable cardiac arrest and death on introduction of a pediatric medical emergency team. *Crit Care Med* 2009;10: 306–12.
- [10] Brill J, Gibson R, Luria JW, et al. Implementation of a medical emergency team in a large pediatric teaching hospital prevents respiratory and cardiopulmonary arrests outside the intensive care unit. *Pediatr Crit Care Med* 2007;8:236–46.
- [11] VandenBerg SD, Hutchinson JS, Parshuram CS. Pediatric early Warning System Investigators: a cross-sectional survey of levels of care and response mechanisms for evolving critical illness in hospitalized children. *Pediatrics* 2007;119:e940–6.
- [12] Campbell DM, Barozzino T, Farrugia M, Sgro M. High-fidelity simulation in neonatal resuscitation. *Paediatr Child Health* 2009;14:19–23.
- [13] Academy of Pediatrics, Committee on Hospital Care. Family-centered care and the pediatrician's role. *Pediatrics* 2003;112:691–6.
- [14] O'Malley P, Brown K, Mace SE, American Academy of Pediatrics, Committee on Pediatric Emergency Medicine, American College of Emergency Physicians, Pediatric Emergency Medicine Committee. Patient- and family-centered care and the role of the emergency physician providing care to a child in the emergency department. *Pediatrics* 2006;118:2242–4.
- [15] Gold KJ, Gorenflo DW, Schwenk TL, Bratton SL. Physician experience with family presence during cardiopulmonary resuscitation in children. *Pediatr Crit Care Med* 2006;7:428–33.
- [16] Emergency Nurses Association. Presenting the option for family presence. 2nd ed. Park Ridge, IL: The Association; 2001.
- [17] Fulbrook P, Latour J, Albarran J, de Graaf W, Lynch F, Devictor D, et al. The presence of family members during cardiopulmonary resuscitation: European federation of Critical Care Nursing associations, European Society of Paediatric and Neonatal Intensive Care and European Society of Cardiology Council on Cardiovascular Nursing and Allied Professions Joint Position Statement. *Eur J Cardiovasc Nurs* 2007;6:255–8.
- [18] Fulbrook P, Latour JM, Albarran JW. Paediatric critical care nurses' attitudes and experiences of parental presence during cardiopulmonary resuscitation: a European survey. *Int J Nurs Stud* 2007;44:1238–49.