Factors influencing on cardiopulmonary resuscitation and prognosis in a neonatal ICU

ABSTRACT
Objective: to verify the main factors influencing on cardiopulmonary resuscitation and prognosis in a neonatal intensive care unit (NICU). Method: cross-sectional study with a retrospective nature, quantitative and descriptive, conducted in a NICU in July and August 2012, with data collection from medical records of neonates who suffered cardiorespiratory arrest and were reanimated within the period from January to March 2012, after study approval by the Research Ethics Committee of the School of Medicine of São José do Rio Preto (FAMERP), under the Opinion 32,509. Results: out of the 61 neonates at the NICU within the period, 58 medical records were accessed; 9 (15.5%) were selected for the survey. There were 77.8% of neonates born premature. As for the etiology of cardiopulmonary arrest, 89% had a respiratory origin. Conclusion: the main factors influencing on cardiopulmonary resuscitation and prognosis of neonates at a NICU are: prematurity, prior comorbidities (especially with a respiratory origin), and early intervention by the health team.

Descriptors: Cardiopulmonary Resuscitation; Neonatal Period; Neonatal Intensive Care Units.

RESUMO
Objetivo: verificar os principais fatores que influenciam na ressuscitação cardiopulmonar e o prognóstico em uma unidade de terapia intensiva neonatal (UTIN). Método: estudo transversal de caráter retrospectivo, quantitativo e descritivo, realizado em UTIN em julho e agosto de 2012, com coleta de dados em prontuários de neonatos que apresentaram parada cardiorrespiratória e foram reanimados no período de janeiro a março de 2012, após a aprovação do estudo pelo Comitê de Ética em Pesquisa da Faculdade de Medicina de São José do Rio Preto (Famerp), sob o Parecer n. 32.509. Resultados: dos 61 neonatos internados na UTIN no período, foram acessados 58 prontuários; 9 (15,5%) foram selecionados para a pesquisa. Nasceram prematuros 77,8% dos neonatos. Quanto à etiologia da parada cardiorrespiratória, 89% foram de caráter respiratório. Conclusão: os principais fatores que influenciam a ressuscitação cardiopulmonar e o prognóstico de neonatos internados em uma UTIN são: prematuridade, comorbidades prévias (principalmente de origem respiratória) e intervenção precoce da equipe de saúde. Descritores: Ressuscitação Cardiopulmonar; Período Neonatal; Unidades De Terapia Intensiva Neonatal.

RESUMEN
Objetivo: verificar los principales factores que influyen en la resuscitación cardiolongumonar y el pronóstico en una unidad de cuidados intensivos neonatales (UCIN). Método: estudio transversal con carácter retrospectivo, cuantitativo y descriptivo, realizado en una UCIN en julio y agosto de 2012, con recogida de datos en prontuarios de neonatos que sufrieron parada cardiovascular y fueron reanimados en el periodo de enero a marzo de 2012, después de la aprobación del estudio por el Comité de Ética en Investigación de la Facultad de Medicina de São José do Rio Preto (Famerp), bajo la Opinión 32.509. Resultados: de los 61 neonatos internados en la UCIN en el periodo, se tuvo acceso a 58 prontuarios; 9 (15,5%) fueron seleccionados para la encuesta. Hubo 77,8% de neonatos nacidos prematuros. En cuanto a la etiología de la parada cardiorespiratoria, 89% tenían un carácter respiratorio. Conclusión: los principales factores que influyen en la resuscitación cardiopulmonar y el pronóstico de neonatos en la UCIN son: prematuridad, comorbilidades previas (especialmente con un origen respiratorio) e intervención precoz del equipo de salud. Descriptores: resuscitación cardiopulmonar; periodo neonatal; unidades de cuidados intensivos neonatales.
INTRODUCTION

In Brazil, about 3 million children are born every year, and 300 thousand of them need support to initiate and sustain adequate breathing.1-2 Worldwide, from 4 to 7 million need some kind of assistance at birth, per year, and 395 thousand neonatal deaths are avoided by means of resuscitation techniques at birth.3

The neonatal period, from 0 to 28 days4, is characterized by weakness of the human being, with high risk of sequelae and high rates of morbidity and mortality.5 Neonatal mortality accounts for about 60 to 70% of infant mortality. And it is the first day of life that gathers most of the infant deaths in Brazil, about 25%.2

So, we notice that there is a relation between intrauterine health conditions, at birth and within the neonatal period, with chronic degenerative problems in adulthood2,6, and improving neonatal care can reduce mortality due to preventable causes and reduce individual’s neurological sequelae, which affect the quality of life of children and their families, besides generating expenditures for society.7 There is a need, therefore, for early intervention, preventing the occurrence of cardiorespiratory arrest (CRA) among neonates. To do this, it is of great importance identifying the main factors that lead to this condition.

OBJECTIVE

- Verify which are the main factors influencing on cardiopulmonary resuscitation and prognosis of neonates in a neonatal intensive care unit.

METHOD

According to gestational age at birth, 22.2% were born at term and 77.8% were preterm, ≤ 37 weeks.6

RESULTS

Within the proposed period 61 neonates were admitted to the NICU, but it was possible to access 58 records. Out of these, 9 (15.5%) were used in the survey, because they met the inclusion criteria.

Figure 1 points out that neonates had, on average, 37 hours of life at the time of CRA.

The average weight at birth was 1,957 g and the proportion of neonates per 500 g is illustrated by Figure 2.
Each neonate had, on average, 2.55 comorbidities, mainly pneumothorax (33.3%), neonatal respiratory distress syndrome/hyaline membrane disease (33.3%), and neonatal anoxia (22.2%).

Figure 3 shows the neonate’s length of stay in the hospital unit.

Regarding the etiology of CRA, 89% of cases had a respiratory origin and 11% had a nonspecific cause.

As for the techniques used during cardiopulmonary resuscitation (CPR), it was found that: all umbilical cord ligations were performed immediately after birth; the polyethylene plastic bag was not used, because the neonates were housed in heated incubators; therapeutic hypothermia was performed in 11% of cases; volume expansion, with crystalloid and plasma solutions, was performed in 55.5% of neonates; in all cases, airways and trachea were aspirated, by using oxygen therapy and chest compressions. All infants were intubated, ventilated within the CRA period using positive pressure and, at some time, they used the mechanical ventilator. During labor, bag and face mask were used in 11% of them. Neonates already using orotracheal tube (OTT) and ventilated with manual balloon (44%) had a better response to this technique than to the mechanical ventilator. Adrenaline was administered in 78% of cases, out of which 43% with continuous dosing up to 0.5 mcg/kg/min and 57% with a continuous dose of 0.5-1 mg/kg/min (Figure 4).
At birth, 11% of neonates were in the meconium amniotic fluid. Regarding neurological sequelae, data were insufficient for proper evaluation, since 89% of neonates progressed to death and the 11% who were discharged must be subject to evaluation in the future.

FIGURE 4. Percentile of the techniques used during cardiopulmonary resuscitation.

**DISCUSSION**

Immediate umbilical cord clamping when babies need reanimation leads to 30% lower blood volume and 50% fewer red blood cells. It is possible that this effect predisposes ischemic injury. The need for neonatal reanimation may compromise cognitive development among 8-year-old children. Thus, umbilical cord plucking must be documented at all births, so that studies can be performed to analyze the physiology of fetal-neonatal transition and ensure that resuscitation practices do not cause any harm to the neonate.\(^7\) Gestational age at birth was similar to other studies, with a prevalence of prematurity.\(^8\)

In the guidelines for neonatal CPR, there are no specific recommendations taking into account weight or gestational age.\(^9\) However, according to some studies, human viability is 22 weeks and 6 days of gestation, and since 25 weeks and having weight greater 600 g it is possible to perform resuscitation maneuvers.\(^10\)

Despite the highly sophisticated technology and professionals’ efforts, neonates who spend a long time in the ICU are at high risk of adverse events and deterioration of their health conditions, especially those weighing less than 1,500 g, due to their vulnerability and because they require care over months.\(^11\)

The etiology of CRA, similar to that of other studies, had predominantly a respiratory origin. The survival of intubated children is 25% and the rate of children who received adrenaline and survived is lower than that among those who did not receive it.\(^12\)

Studies on the ideal concentration of oxygen to be used for neonatal resuscitation show that oxygen supply must be initiated at 21% and adjusted according to response, preferably by means of pulse oximeter. Preterm neonates resuscitated with 21% of oxygen had higher Apgar scores within 5 minutes, heart rate within 90 s, and they breathed 30 s sooner than those who received 100% of oxygen. Pure oxygen causes damage to organs, such as the brain and kidneys, besides increasing lung contractility and increasing the risk of pulmonary hypertension. There are also associations between cancer during childhood, especially leukemia, and exposure to oxygen at birth. Approximately 1 out of 7 children’s cancers could be avoided by using ambient air during neonatal resuscitation.\(^13\)

In the NICU, the main cause of death is CRA, with 27%, prematurity, with 22.2%, sepsis, with 15.1%, and respiratory disorders, with 11.9%.\(^8\)

Because neonatology is a relatively recent field, with major scientific and technological advances, there has been a change in the profile of infant mortality, with increased survival rate among preterm and low-weight neonates. However, it requires the work of updated, committed, and skilled professionals to identify the unique needs of each neonate.\(^14\)

The assistance to this population is based on the early identification of patients at risk. As nurses remain a longer time along with the child, they shall be adequately trained to identify as early as possible disturbances in vital signs and intervene as quickly as possible.
to establish maneuvers for immediate life support. Attention by the nursing team and an adequate monitoring system may allow rapid identification of unstable patients or those with deterioration, in order to avoid CRA.  

Some limitations should be taken into account when interpreting available data: all studies are retrospective, without characteristics of the episode, the reason to initiate CRA, duration, type of resuscitation, time of CRA prior to initiation of CPR, the use of other medicines, volume expanders, and data on monitoring and control, factors that significantly influence on the outcome/success of reanimation.  

CONCLUSION

The main factors influencing on CPR and prognosis of neonates hospitalized in a NICU are: prematurity, prior comorbidities, mainly those of respiratory origin, and early intervention by the health team.

In the NICU under study, professionals follow up neonates’ evolution and, when faced by any signs of bradycardia or respiratory depression, they intervene, preventing CRA. When CRA occurs, all needed interventions are performed, however, perhaps due to the complexity of health status, there are rare cases where it is possible to reverse them, especially without neurological lesions. Thus, it is relevant to identify previous signs of worsening of clinical condition, as well as complications of the neonate’s general status, so that there is prevention of CRA, and in case it occurs, the team starts resuscitation maneuvers as early as possible.

Due to the scarcity of data on the theme in the international literature and having in mind that all studies are retrospective, it is worth highlighting the importance of further studies, preferably prospective ones, so that key data that directly influence on the outcome of CPR can be observed, in order to increasingly improve neonatal care.

REFERENCES


Factors influencing on cardiopulmonary resuscitation...