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CLINICAL CASE REPORT ARTICLE

NURSING CARE TO THE NEWBORN IN THERAPY WITH INHALED NITRIC OXIDE ON PERSISTENT PULMONARY HYPERTENSION

CUIDADO DE ENFERMAGEM AO RECÉM-NASCIDO EM TERAPIA INALATÓRIA COM ÓXIDO NÍTRICO NA HIPERTENSÃO PULMONAR PERSISTENTE

ATENCIÓN DE ENFERMERÍA AL RECIÉN NACIDO EN LA TERAPIA INHALATORIA CON ÓXIDO NÍTRICO EN LA HIPERTENSIÓN PULMONAR PERSISTENTE

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ABSTRACT

Objective: identify the main nursing care to newborns with diagnosis of persistent pulmonary hypertension and using nitric oxide in the neonatal intensive care unit. ***Method***: descriptive case study with three infants with severe respiratory failure, admitted at a tertiary hospital, in Fortaleza-CE, Brazil. Data was collected through medical records of neonates and non-participant direct observation from May to June 2009. The study was approved by Ethics Committee in Research of institution investigated under protocol n. º 070512/09. ***Results***: we present the case reports and the category: Nursing care of newborn in nitric oxide. The medical prescription included therapeutic support of controlled nitric oxide, the first five days of life of neonates, and in nursing interventions, the priority was the effective monitoring of equipment and hemodynamic data, as well as humane ambiance. ***Conclusion***: the neonates showed significant improvement in arterial oxygenation after administration of nitric oxide and monitoring of nursing care. ***Descriptors***: hypertension; pulmonary; nitric oxide; infant, newborn; nursing care child.

RESUMO

Objetivo: identificar os principais cuidados de enfermagem aos recém-nascidos com diagnóstico médico de hipertensão pulmonar persistente e em uso de óxido nítrico em unidade de terapia intensiva neonatal. ***Método***: estudo de caso, descritivo, com três recém-nascidos, com insuficiência respiratória acentuada, internados em hospital terciário, em Fortaleza-CE, Brasil. Os dados foram coletados por meio de prontuários dos neonatos e observação direta não participante, de maio a junho/2009. O estudo foi aprovado pelo Comitê de Ética em Pesquisa da instituição investigada sob n.º 070512/09. ***Resultados***: apresentam-se os relatos de caso e a categoria: Cuidado de enfermagem ao recém-nascido em óxido nítrico. A prescrição médica incluiu suporte terapêutico de óxido nítrico controlado, nos primeiros cinco dias de vida dos neonatos e, nas intervenções de enfermagem, priorizou-se monitorização eficaz dos equipamentos e dos dados hemodinâmicos, além da ambiência humanizada. ***Conclusão***: os neonatos mostraram melhora significativa na oxigenação arterial, após administração de óxido nítrico e monitorização dos cuidados de enfermagem. ***Descritores*:** hipertensão pulmonar; óxido nítrico; recém-nascido; assistência de enfermagem; cuidado da criança.

RESUMEN

Objetivo: identificar las principales atenciones al recién nacidos con diagnóstico de hipertensión pulmonar persistente y en uso de óxido nítrico en unidad de terapia intensiva neonatal. ***Método***: estudio de caso, descriptivo, con tres recién nacidos con insuficiencia respiratoria grave, en hospital de tercer nivel, en Fortaleza-CE, Brasil. Los datos fueron recolectados a través de registros médicos y observación directa no participante, de mayo a junio de 2009. El estudio fue aprobado pelo Comité de Ética en la Investigación de la institución estudiada bajo n.º 070512/09. ***Resultados*:** presentación de los relatos y de la categoría: Atención de enfermería al recién nacido en óxido nítrico. La prescripción incluyó apoyo terapéutico de óxido nítrico controlado, en los cinco primeros días de vida, y en las intervenciones de enfermería, la prioridad fue el control efectivo de los equipos y datos hemodinámicos, así como del ambiente humano. ***Conclusión***: los recién nacidos presentaron mejora significativa en la oxigenación arterial después de la administración de óxido nítrico y del seguimiento de la atención de enfermería. ***Descriptores*:** hipertensión pulmonar; óxido nítrico; recién nacido; atención de enfermería; cuidado del niño.

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INTRODUCTION

The technological innovations in perinatal care contribute, significantly, in routines of the neonatal intensive care units (NICU), with emphasis on advance therapeutic in resources, knowledge production and innovation in the practice of multidisciplinary team. These factors have favored the reduction of perinatal mortality rate, resulting in the survival of a greater number of newborns (NB), fact that was unworkable before.

It is considered a high number of hospitalizations of newborns as a result of the diagnosis of prematurity, perinatal anoxia, cardiac diseases and among others, such as persistent pulmonary hypertension (PPH), which undertakes the cardiopulmonary system, vital function. For this purpose, the improvement of neonatal intensive care covering ventilator assistance, use of surfactant, nitric oxide (NO), parenteral nutrition, percutaneous central venous access - are fundamental therapeutic supports that benefit early diagnosis and, consequently, the treatment of sick neonates.[1]

Giving focus to PPH, it is a disease that usually occurs of a secondary form to other severe pulmonary diseases, it results from an abnormal transition from fetal circulation to neonatal. Implies the increase of pressure in pulmonary artery to supra-systemic levels, and consequent right to left shunt, through the oval foramen and / or arterial ducts, resulting in increased pulmonary vascular resistance (PVR), wall thickening of the pulmonary artery and heart failure at right side, progressing to acidosis and hypoxemia, irreversible damage or even death of neonate.[2]

Despite advances in the professional ambit, the diagnosis of PPH is often experienced in premature neonates and at term, which evolved from acute respiratory distress syndrome, meconium aspiration, perinatal asphyxia, sepsis, pneumonia, congenital diaphragmatic hernia and pulmonary hypoplasia, considered a severe clinical problem which causes high rate of morbidity in period.[2-3] The pulmonary hypertension (PH) and hypoxemia are two pathophysiological conditions that often emphasize many diseases in clinical practice and can be treated with NO.[3]

The NO is a radical synthesized from L-arginine by the action of NO *synthase* (NOS) and is released after mechanical and chemical activation.[3]Derived endothelial cells, which are essential for vascular homeostasis, as it diffuses from airways into the walls of the pulmonary vessels, causing them dilatation. For this reason, it is considered a specific pulmonary vasodilator, which relaxes exclusively the muscles from the arteries of the lung without any vasoactive effect on systemic circulation. Agents also have vasodilatation such as the two circulations are classified as nonspecific.[4]

Recent studies indicate that the ventilatory mode associated with inhaled nitric oxide (NOi) is a technique that has been used both in treatment of pulmonary diseases such as heart diseases, saving lives of neonate babies.[2-5]The administration of this therapy comprises in correct the clinical and surgical abnormalities of basis, making it possible for pulmonary vasodilatation with low concentrations of NO effectively, and consequently, improvement of clinical course of NB.[4]

The interest for this type of study comes from lived experiences in NICU, working as a nurse and constantly facing with new technological equipments increasingly complex for daily use. Concerning the administration of nitric oxide associated with mechanical ventilation, is currently one of the expensive equipment that is part of a specialized therapy to neonates admitted in neonatal units. In this sense, the question emerged: what are the skills of nurses when caring for newborns with a medical diagnosis of PPH and in use of NOi?

The therapeutic environments are endowed with human and material resources to enable prompt and effective service, however, the multidisciplinary team should focus on treatment and recovery of the baby. The care implemented by nursing staff should prioritize beyond routine techniques and procedures, the perception of human being as unique (singly), life history of each one patient, and thus make individualized and human care.[6]

It is the study of singular importance to nurses working in neonatal units, since that will provide professional development, facing the health issues of this fragile clientele, as well as awareness on individualized cares, which are essential for the improvement of perinatal care and promotion of quality of life of these children.

In this context, the objective was to identify the main nursing care for newborn with a diagnosis of persistent pulmonary

hypertension and use of nitric oxide in neonatal intensive care units.

METHOD

The present study is characterized as a case study, by means of monitoring the assistance in nursing for three neonates with a clinical diagnosis of PPH and therapeutic implementation with NOi in a NICU, of public hospital, reference to the city of Fortaleza and Ceará State, Brazil.

The following Inclusion criteria were established: newborns, regardless of sex, gestational age and days of hospitalization with a diagnosis of PPH and in use of nitric oxide (NOi).

The operationalization of data collection occurred from May to July 2009, using direct observation, not participant, with relevant notes in field diary. Moreover, the data of identification and daily clinical evolution of NB were extracted from medical records.

Initially, there was a pre-analysis and exploration of the material. Once established understanding of the data, we proceeded to content analysis, which involves the encoding and finally their interpretation.[7]Later, they were presented in two parts: reports of cases of *Gabriel*, *Miguel* and *Rafael* (fictitious names) and the category: Nursing care to the newborn in the use of NOi. This step consisted in the analysis from the perspective of the theoretical background.

The study followed the ethical and legal aspects and attended the resolution recommended by the Brazilian National Health Council of the Ministry of Health, which focuses on research with human.[8]Thus, the project was submitted and approved by the Ethics Committee in Research, Opinion n. º 070 512/09.

RESULTS

• Reports of cases

Gabriel, male, 26 weeks of gestational age (GA), with 880 grams, was delivered by cesarean section, Apgar 8/8, at the first and fifth minutes of life. Diagnosed with extreme prematurity and respiratory distress syndrome was admitted to the NICU, starting mechanical ventilation and keeping hemodynamically stable. On the 5th day of life, he worsened respiratory symptoms, decreased systemic saturation of oxygen, PPH was diagnosed and prescribed dose of 20 ppm of NOi. After a stable of him clinical picture for two days, started the reduction and after three days, the NOi was taken successfully.

Miguel, female, 35 weeks of gestational age, with 2480 grams, she was born by cesarean section, Apgar 7/9, at the first and fifth minutes of life. With a diagnosis of prematurity, respiratory distress syndrome and heart disease, she was admitted to the NICU for use of mechanical ventilation. In her third day of life, was diagnosed with PPH, initiated dose of 20 ppm of NOi, remaining stable, and after three days of use, NOi was successfully removed.

Rafael, male, 40 weeks of gestational age, with 3.358 grams, was born by cesarean section, bathed in meconium, Apgar 8/9, the first and fifth minutes of life. Diagnosed with respiratory distress syndrome and PPH, he was admitted to the NICU, initiating mechanical ventilation. On the second day of life, it was implemented dose of 20 ppm of NOi, the treatment remained until the sixth day.

♦ Category: Nursing care to the newborn in nitric oxide

During the hospitalization of neonates, we observed that the greater concern relating to medical therapeutic and nursing care was to correct the basic cause that produces the HPP. However, in case of infection caused by aspiration pneumonia, apply antibiotics prescribed; in severe respiratory failure, due to cardiac diseases and diaphragmatic hernia, we seek to maintain clinical stability with vasoactive drugs and adequate therapy with oxygen, preferably, ventilatory assistance to decrease the hypoxemia, hypercapnia, PVR and pulmonary vasoconstriction.[9]

In these circumstances to correct the HPP, the nursing care permeate medication administration, intravenous hydration, parenteral nutrition, peripheral access puncture, gastric suctioning, monitoring of arterial saturation of oxygen, ventilator parameters, and prescribed dose of NOi. In addition, it provides the performance of radiography, laboratory and gasometrical tests. These procedures were performed according to clinical therapeutic and the systematization of nursing care.

Install and monitor pulse oximetry is a noninvasive method to measure arterial blood oxygenation and it is essential to the management of NB with chronic or acute pulmonary disease.[9]it must monitor the oxygenation of NB constantly to prevent its toxicity. Furthermore this method, gas analysis, although invasive, is another choice of monitoring.

In the routine of nursing interventions, preventive care of hospital infection are involved such as aseptic technique for installation of mechanical ventilation and NOi, renewal of the circuits of this type, aspiration of secretions from the upper airways (UA) and the orotracheal tube (TOT). Moreover, there is fixation of the cannula, and it may renew when necessary; daily weight measures for installation of prescribed infusions. In this decision, it is necessary to prioritize the use of personal protective equipment (PPE) and hand washing.

The nurses' performance, especially, in the NICU, is permeated by a complex and specialized care, by new implementations in attendance. In addition to technical skill, it is valued a humanized therapeutic care, which involves tasks relating to the individuality of care, stimulation by the presence of parents, encouragement of affective bonding and caring touch, reduction of external stimulus (sound, noise, light, and temperature). These interventions are relevant, in an attempt to reduce excessive handlings, since they can cause pain, discomfort, physiological and behavioral changes, which compromises the welfare of the newborn.[10-11]

It is believed that the humanized assistance within this unit is relevant, because it is a complex environment, which generates stress not only for babies, but also to parents and health professionals. Therefore, these professionals must continuously provide consistent information to babies' families about the conditions of each neonate.[11]

Currently, there is a focus to the family aspect in the nursing care, indeed, we can see a growing interest in the thematic, by changes in the way of perception of the hospital situation.[6,12] The nurse is responsible for a significant portion of knowledge dissemination, training and qualification of team members, in order to meet the needs of the newborn and its family. Their (nurses) knowledge and skills are involved in caring sensitivity coupled with the technology available at NICU.[12]

DISCUSSION

Considering that NB with PPH be a being in risk, the planning of therapeutic care is a complex and dynamic process that requires thorough and progressive evaluation for determination of its effectiveness. These NB with PPH should be properly treated during the hospitalization period, without the occurrence of iatrogenic diseases, injuries from the pulmonary parenchyma, so they can get considerable chances of survival.

It is relevant to note that the possibility of appearance of changes in the clinical picture of NB are originated from the own physiological condition or caused by the use of therapeutic measures, environment and performance of professionals.[11] Thus, the care provided by nurses in the condition of the neonate with PPH are as important as the specific treatment of pulmonary vasodilatation with NOi administration.

The technique to furnish NOi consists in a delivery and monitoring system, from a cylinder containing NO in nitrogen balance. The portion of the system that furnishes gas is connected to the distal part of the inspiratory line of the ventilator circuit, at 30 cm of the tracheal tube. An electrochemical analyzer remains connected to the proximal part of the inspiratory line of the ventilator, allowing continuous monitoring of levels of NOi of the patient, and the levels of nitrogen dioxide (NO_2) which is being formed, because, NOi reacts with oxygen present in the ventilatory circuit, allowing the formation of NO_2, which is potentially toxic.[4]

The effectiveness of NOi, associated to mechanical ventilator, promotes the specific pulmonary vasodilator effect in NB, without systemic effects, because when inhaled it is rapidly inactivated by combination with hemoglobin. It results in reduction of extra-pulmonary shunts, decreased pulmonary hypertension, and reduction of intra-pulmonary shunts, optimizing the relation ventilation / perfusion and improving oxygenation. Therefore, it is considered the main advantage of NOi compared with intravenous vasodilators.[3]

The application of therapy to newborns with NOi requires specific competence of nurses in relation to its technical and handling. Firstly, it is necessary to know the therapeutic effects of the gas, the basic mechanism of action as well as the inherent care, since the administration of NOi must be strictly observed, due to the toxic effects.

The formation of nitrosyl-hemoglobin, which is converted into methemoglobin, cause oxidative damage in terminal bronchioles and proximal alveoli, however, the methemoglobin levels above 2% of total hemoglobin may impair the oxygen release and worsen the tissue hypoxia.[4]The pulmonary inflammation associated with the VM contributes to the development of bronchopulmonary dysplasia (BPD) thus minimizing the duration of

mechanical ventilation such as for NOi, improves the prognosis of these newborns.[13]

The experience in NICU associated with the knowledge on physiological and pharmacological basis of this new practice of assistance to patients with PPH allows nurses to provide appropriate care, especially as regards the management and implementation of interventions. Nurses are responsible for: Installation of mechanical ventilation, the system of administration of nitric oxide, aspiration of secretions, monitoring of vital signs, ensuring a maintenance system NOi during the moment of disconnection of ventilator. Moreover, it is noted that withdrawal of the therapy must be slow and progressive, with control parameters of pulmonary hemodynamic and also control oxygenation, in order to avoid severe pulmonary vasoconstriction and decreasing arterial saturation.[3-4]

After verification of the diagnosis of PPH and prescription of NOi, the nurse prepares all materials and equipment needed, and checks the setting of the endotracheal tube (TOT) inspects the ventilatory parameters, monitors continuously the blood gases and vital signs, among other possible changes. We emphasize the importance of humidification and heating of inhaled gases from the incubator, and the therapeutic positioning, minimal handling of baby and the care with antenatal ambience, according the standardization for a humanized assistance.[10-12]

During ventilatory assistance, the factors associated with complications of airways are humidification and heating, since it is installed improperly, will result in thickening of the mucus and decreased ciliary activity, which can lead to airway obstruction, infection, and atelectasis. Thus, it is important to inspect the need for the aspiration of secretions from the airways, avoiding the formation of obstructions, that can block the ventilation.[9,14]

In this present study, the use of NOi was established during the period in which the babies stood in mechanical ventilation, with an initial dose of 20 ppm (parts per million), it is considered a safe dose. During the hospitalization, NOi level was reduced to 5ppm carefully by gasometrical monitoring, pulse oximetry and radiological control.

The removal was performed by reducing of 5ppm (NOi) until the system had been cleared and then switched off. The progressive withdrawal is necessary to avoid the possibility of a rebound effect on pulmonary arterial pressure (PAP).[4]The withdrawal of NOi delivery system is a nursing care that applies, immediately after the NB show hemodynamic stability, clinical criteria and medical prescription.

Of the three neonates presented in this study, two had radiological test and showed significant improvement, but one had the left side of its pneumothorax committed, unstable handling, prolonging, thus, the period of admission - to six continuous days of NOi. It is worth noting that in pneumothorax, the position of NB in the incubator is essential to improving ventilatory expansion and safer handling of thoracic drainage.

In these circumstances, the nurses must direct their interventions according to clinical and therapeutic evolution of the babies. However, the nursing care of NB hospitalized in the NICU should not be limited to the survival of these little beings.[15] It is necessary to afford a more humane assistance, involving actions that aim to minimize discomfort during the procedure performed and take a look at every moment of the newborn, in a integral and unique form.

FINAL CONSIDERATIONS

The therapeutic with nitric oxide, specific pulmonary vasodilator, has beneficial effects on gas exchange and ventilation in children with severe hypoxia caused by PPH. It is considered a safe method, when administered in an intensive care unit under strictly monitoring by means of good apparatus and direct inspection from the nurse.

Through direct observation and non-participant, we identified that the nurse acted with technical and humanized care during the treatment of NB with NOi. Furthermore, it was perceived, constantly, the applicability of the humanized care, in a global and individualized manner for the child, from a systematic evaluation, because of various clinical changes that could occur during hospitalization, specially, during the treatment of PPH.

The obtained results, in a satisfactory manner, the concerns of the authors related to how the nurse performs the diagnosis and interventions in face of the diagnosis and use of this technology that is very recent in the antenatal units. It is concluded that the nurse must have knowledge and technical skills in planning the assistance; it has a fundamental role in the interdisciplinary team.

This study allowed the organization of knowledge production, which enabled the

presentation of issues related to the diagnosis of PPH and behaviors inherent to own therapeutic practice, equipment for administration of nitric oxide, providing theoretical support for the systematization of nursing care, in order to get effectiveness to this therapeutic practice.

It is hoped that this study contributes to the nurse, regarding the importance of greater cares to the newborns in the use of NOi therapy. In this sense, it is emphasized that the planning of interventions is completely intrinsic to the humanized nursing care, in order to minimize the stresses of the baby, which are due to the complexity of the routines of the NICU, as well as the application of therapeutic diversity.

It is recommended that other studies about this issue can be develop broadly, to evaluate the long-term implications of NOi, the development of competence of nurses on this thematic. Thus, it is believed that nurses should seek professional development, especially, in the acquisition of new knowledge to support advances in nursing practice and, consequently, improve the quality of life of the child.

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