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DOI: 10.15225/PNN.2021.10.1.6 JNNN/PNN 2021;10(1):42–47 **Case Report**

Problems of Nursing Care of Prematurely Born Children with Haemorrhagic Hydrocephalus — Case Report

Problemy opieki pielęgniarskiej nad dzieckiem urodzonym przedwcześnie z wodogłowiem pokrwotocznym — opis przypadku

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Abstract

Introduction. Hydrocephalus is a pathological condition leading to excessive accumulation of cerebrospinal fluid in the ventricular system of the brain. Hemorrhagic hydrocephalus is a result of an intracranial hemorrhage, which is among the most common neurological complications in prematurely born newborns.
Case Report. A male patient was born by caesarean section at 31 weeks, in severe condition. During ultrasonography, intraventricular hemorrhage III° was found. The patient was transported to a surgical clinic for the implantation of Rickham reservoir. The duty of the midwife was to solve a number of nursing problems, including: the risk of increased intracranial pressure, slow weight gain, infection or apnoea.
Discussion. Intraventricular bleeding occurs mainly in children who are born prematurely. Prognosis in children after intraventricular hemorrhage depends mainly on the severity of bleeding. In order to provide professional medical care, children with neurological complications should be treated in centres with the highest reference level, and the decisive factor conditioning their proper psychomotor development in the future is early rehabilitation.
Conclusions. Care for patients born prematurely with hemorrhagic hydrocephalus requires collaboration between the medical staff and parents. The task of the midwife is to mitigate the negative effects of hydrocephalus as well as support and educate parents. **(JNNN 2021;10(1):42–47)**
Key Words: hemorrhagic hydrocephalus, nursing care problems, prematurity

Streszczenie

Wstęp. Wodogłowie jest stanem patologicznym, w którym dochodzi do nadmiernego gromadzenia się płynu mózgowo-rdzeniowego w układzie komorowym mózgu. Wodogłowie pokrwotoczne powstaje w wyniku krwawień śródczaszkowych, które należą do najczęstszych powikłań neurologicznych u noworodków urodzonych przedwcześnie.
Opis przypadku. Pacjent płci męskiej urodził się drogą cięcia cesarskiego w 31. tygodniu życia płodowego, w stanie ciężkim. W badaniu USG stwierdzono krwawienie dokomorowe III°. Pacjenta przewieziono do kliniki chirurgicznej w celu implantacji zbiornika Rickhama. Podczas hospitalizacji obowiązkiem położnej było rozwiązanie szeregu problemów pielęgnacyjnych towarzyszących niemowlęciu, m.in.: ryzyko wzrostu ciśnienia wewnątrzczaszkowego, małego przyrostu masy ciała, infekcji, czy występowanie bezdechów.
Dyskusja. Krwawienia dokomorowe występują głównie u dzieci urodzonych przedwcześnie. Rokowanie u dzieci po przebytych krwawieniach dokomorowych zależy w głównej mierze od ciężkości krwawienia. W celu zapewnienia profesjonalnej opieki medycznej, dzieci z powikłaniami neurologicznymi powinny być leczone w ośrodkach o najwyższym stopniu referencyjności, a decydującym czynnikiem warunkującym ich prawidłowy rozwój psychomotoryczny w przyszłości jest wczesna rehabilitacja.

Wnioski. Opieka nad pacjentem urodzonym przedwcześnie z wodogłowiem pokrwotocznym wymaga współpracy między personelem medycznym a rodzicami dziecka. Zadaniem położnej jest łagodzenie negatywnych skutków wodogłowia. Ponadto położna pełni funkcję wspierającą oraz edukacyjną wobec rodziców dziecka. **(PNN 2021;10(1): 42–47)**

Słowa kluczowe: wodogłowie pokrwotoczne, problemy pielęgnacyjne, wcześniactwo

Introduction

Hydrocephalus is not a separate disease entity, but a pathological condition involving excessive accumulation of cerebrospinal fluid (CSF) in the brain ventricles. It is caused by an imbalance between CSF production and its absorption. This process leads to the expansion of the ventricular system of the brain and/or an increase in intracranial pressure. Due to the time of its formation, hydrocephalus can be divided into congenital and acquired. Hemorrhagic hydrocephalus is classified as acquired because it occurs as a result of intraventricular or subarachnoid hemorrhage. This type of hydrocephalus frequently concerns premature newborns due to the immaturity of their nervous system and tendency to this type of hemorrhage [1]. Intraventricular hemorrhage (IVH) is the most common neurological complication occurring in premature infants. The initiating bleeding factor is the presence of a richly vascularized germinal matrix, located under the ependyma. The germinal matrix is the place of development of neurons and glial cells. This area is not resistant to damage and due to numerous and immature blood vessels located there, it is a source of bleeding [2,3]. The risk of IVH decreases with development of foetal maturity, due to the fact that the germinal matrix disappears between the 32nd and the 34th week of pregnancy. Most bleedings begins on the first day of newborn's life, and 90% by the end of its first week of life. Prematurity prevention reduces the number of IVH cases [3].

The first clinical symptom of hydrocephalus observed in newborns and infants is a rapid increase in the head circumference. As long as the fontanelle and cranial sutures are not fused, the CSF increase is compensated by an increase in the capacity of the cranial cavity. Other characteristic symptoms include low eye and ear setting, separation of the cranial sutures, enlarged and bulging anterior fontanelle and enlarged veins, particularly visible on a thin and shiny scalp. Classic signs of hydrocephalus also include the 'sunset eye sign' (also known as the 'setting sun phenomenon') which is marked by eyes fixed downward) and Macewen's sign (cracked pot sound) [4].

There are three different methods of medical neuroimaging of hydrocephalus: ultrasonography (USG), computed tomography (CT) and magnetic resonance imaging (MRI). USG performed through the anterior fontanelle is used to assess the dynamics of the ventricular system extension in newborns and infants, and to diagnose intraventricular hemorrhage in the fetus. USG is a low-cost and minimally invasive exam. In addition, it does not require sedation or transport of the patient [3,5].

Due to the low effectiveness of pharmacological methods, surgical methods are used in the treatment of hydrocephalus [1]. Currently, the standard and long-term solution is the implantation of a ventricular-peritoneal valve system, whose role is to drain excess CSF from the ventricular system into the peritoneal cavity, from where it can be easily absorbed into the bloodstream [6]. Preparation for the implantation of the valve system involves the implantation of the external ventricular drain (EVD) or the Rickham reservoir [1,3].

The aim of the study is to draw attention to the problem of the care of prematurely born patients diagnosed with hemorrhagic hydrocephalus, describe the health and care-related problems that patients encounter and impact thereof on the future development of children as well as to present the importance of the role of parents in the process of childcare.

Case Report

A 41-year-old patient in the 31st week of pregnancy was suddenly admitted to the hospital in Ząbkowice Śląskie due to vaginal bleeding. During the pregnancy the patient suffered from gestational diabetes and urinary tract infection. Emergency caesarean section was performed due to placental abruption.

A premature male patient with asphyxia was born from the first pregnancy by Caesarean section in Ząbkowice Śląskie. The Apgar score in the following minutes of life was: 3/3/4/7 points. After the birth, cardiopulmonary resuscitation with heart massage was performed and adrenaline was administered intravenously. An endotracheal intubation was performed. The patient was transferred to the Neonatal Pathology Department in Wałbrzych. In a severe condition, he stayed in the Neonatal Intensive Care Unit for 9 days. He received ventilatory support and parenteral nutrition. Subsequently, appropriate oxygenation was performed by nCPAP. On day 12, the patient began to breath on his own. On the 2nd day of the patient's life, during ultrasonography, intraventricular hemorrhage III° and dilatation of the lateral ventricles was found. The

neonatologist recommended daily measurements of the head circumference. On the 10th day of newborn's life, the first lumbar puncture was performed to drain excess CSF from the ventricular system. In the third week of his life, due to the diagnosis of hemorrhagic hydrocephalus, it was decided that the patient would be transported to the Department and Clinic of Pediatric Surgery and Urology in Wrocław for the implantation of the Rickham reservoir. A drain was attached to the right lateral ventricle and connected to the reservoir. On admission from the Operating Room to the Neonatal Pathology Ward, the patient's general condition was stable. He was breathing on his own with low-dose oxygen therapy in an incubator (oxygen 30%). The anterior fontanelle remained soft. Enteral nutrition with breast milk was carried out using tube feeding. The vital signs were stabilised except for the feeding periods when desaturation was observed.

In the fourth week of the patient's hospitalization the rehabilitation with the NDT-Bobath method and postural stimulation with the craniosacral method was initiated.

In addition to hemorrhagic hydrocephalus, the prematurely born patient was diagnosed with: hyperammonemia treated with sodium benzoate, anemia — blood transfusion was performed twice, and iron supplementation was administered; symptomatic epilepsy (occurrence of seizures), treated with Luminal, and retinopathy of prematurity (stage 2). Due to the its condition, the infant was provided with multidisciplinary care.

Based on the analysis of the child's condition, the following nursing diagnoses were made. Description of medical actions and procedures aimed at improving the health and the quality of life of the patient.

Problem 1: Risk of Complications Associated with Increased Intracranial Pressure Due to Excessive Accumulation of Cerebrospinal Fluid (CSF) in the Brain Ventricles

Purpose of nursing care: Minimisation of the risk of complications associated with increased intracranial pressure.
Nursing interventions:

1. Monitoring of patient's general condition (taking constant measurements of the pulse, monitoring blood pressure twice a day and the number of breaths every three hours) and daily measurements of the head circumference.
2. Assessment of symptoms of increasing intracranial pressure (pupil reaction, fontanelle tone, dilatation of cranial sutures and venous vessels on the head).
3. Observation of patient's behavior and tolerance of food.
4. Reduction of noise, excessive lighting and other stressors in the hospital ward.

Assessment: During the observation of the patient complications connected with the increased intracranial pressure was not recorded. The patient's vital signs were stabilised. The patient's head circumference did not increase as a result of the regular decompression of the cerebrospinal fluid, which was accumulating in the Rickham reservoir. The infant was calm and did not suffer from sleep disorders and loss of appetite.

Problem 2: Risk of Low Weight Gain Due to a Lack of Appetite Resulting from the Pressure Exerted by Cerebrospinal Fluid on Cranial Nerves

Purpose of nursing care: Appropriate infant weight gain approximately 12–16 g/kg/day.
Nursing interventions:

1. Encouraging the mother to extract breast milk.
2. Feeding the newborn with breast milk through a tube and making attempts at bottle feeding when the patient's condition allows it.
3. Holding the baby's head in a half-high position while feeding with the bottle.
4. Frequent feeding with small portions of milk.
5. Observation of the patient during and after the feeding in the event of desaturation, cyanosis, spitting up or vomiting.
6. Checking the amount of used diapers.
7. Daily weight control at the same time of day.

Assessment: The average daily weight gain of 15 g/kg/day was obtained. While the child was being fed by a tube, it was given a pacifier with a small amount of breast milk. This way, the newborn associated feeding with sucking. Checking the number of used diapers and daily weighing of the patient enabled an objective assessment of the child's weight gain.

Problem 3: Possible Complications Associated with Tube Feeding

Purpose of nursing care: Prevention of complications associated tube feeding.
Nursing interventions:

1. Checking the correct insertion of the tube before each feeding.
2. Taping the tube so that it does not slip out.
3. Heating the liquid to the temperature of 37°C.
4. Ensuring that the liquid flows slowly by gravity into the stomach.
5. The infant should not be left unattended during tube feeding.

6. Observation and care of tube insertion, adequate mucosal hydration and observation for redness and irritation.
7. Limiting the use of tapes and removing them with special preparations facilitating painless removal thereof.
8. Observation of the child's skin color, possible slow breathing or breathing problems, coughing.

Assessment: During the patient's hospitalization possible breathing effort, coughing and changes in skin colour was not observed. Adequate warming of the liquid given to an infant reduced the risk of gastric retention.

Problem 4: Tendency to Periodic Apnea Associated with the Immaturity of the Central Nervous System

Purpose of nursing care: Reducing apnea incidents.
Nursing interventions:

1. Monitoring the patient's pulse, oxygen saturation, breathing rate and pattern as well as skin color.
2. Placing the infant in the prone position and placing its head and neck in a neutral position.
3. Mechanical stimulation (gentle rubbing of the soles of the feet or the chest).
4. Monitoring with an apnea mattress.
5. Keeping a patient observation card, in which all saturation level drops, and heart rate disturbances are recorded.
6. If necessary, making a tracheobronchial tree toilet and provision of an operational medical suction device in the patient's room.
7. Ensuring easy and quick access to a complete intubation kit and Ambu bag.
8. Readiness to apply passive oxygen therapy in the event of the deterioration of saturation parameters.
9. Encouraging parents to use the kangaroo care method (skin-to-skin contact between the baby and parent).

Assessment: Due to the undertaken procedures the frequency of apnea incidents decreased. Placing the patient in the prone position improved diaphragm function while placing the head and neck in the neutral position helped to keep the airway open. Mechanical stimulation had an effect on mild forms of apnea.

Problem 5: Risk of Pressure Ulcers or Local Inflammation on the Infant's Scalp

Purpose of nursing care: Prevention of the development of pressure ulcers or inflammation on the infant's scalp.
Nursing interventions:

1. Conducting a daily assessment of the risk of pressure ulcers using appropriate scales, e.g. Norton, Douglas.
2. Observation of early symptoms of pressure ulcers (erythema, redness, increased body temperature).
3. Care of the scalp and the Rickham reservoir implantation site (keeping the skin clean and dry, using oiling substances) and placing the head on a soft surface.
4. Repositioning of the patient and his head due to the increase in its size and the difficulties in moving it (every 2 hours).
5. Educating parents about the essence of anti-decubitus prophylaxis.

Assessment: During the patient's observation the pressure ulcers or inflammation on the infant's scalp were not found. The use of an emollient, an oil or a cream containing panthenol as an active ingredient, helped to maintain the physiological protective barrier of the skin.

Problem 6: Parents' Anxiety Related to the Condition of the Infant in the Neonatal Pathology Ward

Purpose of nursing care: Reducing anxiety of the parents.
Nursing interventions:

1. Providing up-to-date and comprehensible information about the health of the child and the procedures performed in relation thereto.
2. Acquainting parents with the medical equipment used to monitor the infant.
3. Engaging parents in childcare activities (changing a diaper).
4. Encouraging parents to kangaroo the infant (keeping skin-to-skin contact between the parent and the child), reading fairy-tales to it, being close to the child.
5. Conversation with parents about the positive impact of touch and giving a Shantal massage's instruction.
6. Educating parents about hydrocephalus and caring for a child with hydrocephalus.
7. Showing of kindness and understanding to parents by the medical staff.
8. Enabling a conversation with a psychologist.

Assessment: Thanks to the support of the medical staff, the parents felt more confident in caring for the child and were more willing to engage in nursing activities.

Discussion

Intraventricular hemorrhage results in a number of developmental issues that a child will have to face in the following years of its life [8]. According to Mandera, the prognosis in children after intraventricular hemorrhage depends mainly on the severity of the bleeding [3,9]. This is confirmed by the results of research conducted

by Fuchs et al., according to which 80% children who have undergone IVH, I^0, II^0, III^0 develop correctly and do not show permanent neurological defects. On the other hand, children after IVH IV^0 do not develop any psychomotor skills, except for the social smile. Nevertheless, children who have undergone IVH of lower grades are at risk of neurological complications; therefore, monitoring of their development is of great importance [10]. In the present case, the infant was diagnosed with IVH III^0, which is associated with hemorrhagic hydrocephalus and the risk of neurodevelopmental complications in the future [9]. Therefore, in order to prevent long-term effects of hydrocephalus and prevent the child from permanent neurological deficits, its psychomotor development should be supported by adequate treatment from the very first moments of its life.

In their material on perinatal injuries of the central nervous system, Matuszczak et al. indicate the need to treat newborns with brain damage in centres of the highest degree of reference. Moreover, they emphasise that these centers should provide appropriate diagnostic equipment and a Neonatal Intensive Care Unit. Patients should be provided with a 24-hour specialist care, including the care provided by pediatric surgeons, neurosurgeons and pediatric neurologists, neonatologists and pediatric anesthesiologists [11]. The infant whose case was described in the paper was born in a severe condition the hospital with the lowest degree of reference, unable to provide adequate care. It was, therefore, necessary to transport the patient to the nearest highly specialised center, with adequate diagnostic and treatment facilities.

According to Bagnowska, early and systematic rehabilitation constitutes an integral part of the care and treatment process in a patient with neurological complications [12]. On the other hand, Napiórkowska-Orkisz et al. believe that physical rehabilitation should take place between the 2nd and 4th month of the child's life [7]. Wojciechowska and et al. indicate that there is need to care for patient's safety during physiotherapy. In addition, they believe that procedures should be performed in cooperation with a neonatologist and a midwife, whose task is to qualify the patient for surgery and monitor their vital signs during rehabilitation [13]. The rehabilitation of the infant presented in the paper began at the end of the 4th week of its life, when the child's vital signs after the implantation of the Rickham were stable and there were no signs of an increase in intracranial pressure.

Michalczak et al. conducted a study in which they asked parents to evaluate various aspects of their child's behavior and functioning before the beginning of a series of instructional meetings on the Shantal massage as well as, then after the completion thereof and a month after the final course. According to parents, the effects of the massage included: calming the child, reducing tearfulness, making it easier to fall asleep and improving sleep quality as well as the ability to forecast its needs and strengthen the bond with the child [14]. On the other hand, in her publication, Wilk demonstrated the positive impact of using the Shantal massage on the functioning of individual systems and organs [15]. At the Neonatal Pathology Ward, a physiotherapist conducted a presentation and demonstrated instructions regarding the Shantal massage. The patient's mother willingly performed the Shantal massage. However, she did not notice significant differences in the child's behavior afterwards.

Łuczak-Wawrzyniak et al. conducted a study in which mothers admitted that after giving birth to an ill child they were had been mainly accompanied by anxiety. In addition, parents were asked about the extent of the stress related to the new situation. In over a half of the respondents the amount of the stress was at the highest possible level. After the child's hospitalisation, a half of the mothers suffered from post-traumatic stress disorder [7,16]. During the first weeks of our patient hospitalisation, the mother experienced anxiety, fear, stress and helplessness associated with her child's condition. As a result of the improvement in the child's condition and the provision of professional medical and psychological help, the mother accepted the contemporary situation and became motivated to act.

Targos et al. paid attention to the following problems of nursing care of a prematurely born child with hydrocephalus after the implantation of Rickham reservoir: the risk of the surgical wound's an implantable device's infection, the risk of decrease in the intracranial capacity, severe pain, self-care deficit and stress overload. The authors pointed also to a significant role in the parent's education in the nursing process. In the described case the risk of complications connected with the increase of intracranial pressure was observed. They also emphasized the significant parental role in taking care of the child with hydrocephalus [17].

Currently, many authors observe similar problems in the care of patients with hemorrhagic hydrocephalus. The challenge of modern neonatology is not only to keep premature infants alive, but also to provide them with professional medical care that will make them fully functional in the future [8,18].

Conclusions

The task of the midwife midwife's task is to provide careful observation of patients with hydrocephalus in search of signs of an increase in intracranial pressure, which could be life-threatening for an infant.

Medical staff should take care of both the patient and his parents, for whom the child's disease is the cause of anxiety and a sense of helplessness.

Early rehabilitation of a child with complications of neurological disorders reduces the negative effects of hydrocephalus and increases the chances of the development of psychomotor skills.

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