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Case report

Extremely preterm infant weighing 350 g: too small to survive?

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Abstract

Every year around 15 million premature neonates are born in the world, and this number is continuously increasing. The incidence of premature birth varies between 5% and 18% throughout the world. Despite advancements in medicine and technology and increased evidence-based diagnostic and treatment recommendations, prematurity is the most common cause of death among children under 5 years of age. The sequelae in the survivors of extreme prematurity are mental disability, cognitive impairment, cerebral palsy, blindness, deafness and chronic illness. Considering ethical and economic implications, neonatal survival and morbidity prognosis, resuscitation of neonates of borderline gestation differs in various countries and many international organisations do not recommend active resuscitation and treatment of newborns of up to 25 weeks of gestation. We present a case study of one of the smallest newborns in the world and the smallest newborn known to survive in Lithuania.

Keywords

Extreme prematurity, lobular emphysema, thoracotomy, 22 weeks of gestation, borderline viability, hypotrophia.

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Introduction

In Lithuania, a newborn is registered and resuscitated from 22^{+0} weeks of gestation, and if the duration of the pregnancy is unknown, the decision is based on the newborn's weight (at least 500 g). According to the Lithuanian Institute of Hygiene, 5-6% of neonates are born prematurely each year, and about 2.6% of them are of borderline gestation. In the year 2018, the perinatal mortality of neonates of 22-23 weeks of gestational age reached 50% in Lithuania [1].

Case report

A 29-year-old G2P1 woman presenting with fever was admitted to the Hospital of the Lithuanian University of Health Sciences at 21^{+3} weeks of gestation. Due to suspected chorioamnionitis, the patient was prescribed antibiotic treatment. Since the gestational age was too low, therapy for fetal lung maturation was not prescribed. At 22 weeks of gestation, the mother no longer had a fever, and the subjective complaints and laboratory indicators of inflammation had regressed. Therefore, the possibility for cervical cerclage was considered; however, labor progressed at 22^{+1} weeks of gestation, and the mother gave birth via breech vaginal delivery to a female neonate with Apgar scores of 6 and 7 at 1 and 5 minutes, respectively. The newborn's weight was 350 g (< 5^{th} centile), length – 25 cm (3-10^{th} centile), head circumference – 18 cm (10^{th} centile), according to the WHO Fetal-infant Growth Chart for Preterm Infants.

The neonate was born active, and the umbilical cord was clamped immediately after birth. Flexed posture, active movements, facial expressions, and some spontaneous breaths were observed. Mechanical ventilation was initiated by mask, but due to continued poor breathing effort, it was followed via endotracheal intubation (2 minutes after birth), FiO_2 – 0.6. Heart rate remained > 100 bpm throughout stabilization, and there were no circulatory disturbances. After stabilizing the neonate's condition, she was brought to the Neonatal Intensive Care Unit (NICU) for further assessment and treatment.

During the first days of life, 3 doses of the surfactant Curosurf® were prescribed due to respiratory distress syndrome, but the effect was minimal and short-term. Chest X-ray showed reduced aeration bilaterally, signs of pulmonary interstitial emphysema were later also observed. High-frequency oscillatory ventilation (HFOV) was commenced. Umbilical venous and arterial catheters were inserted, and parenteral nutrition, as well as antibacterial treatment with benzylpenicillin, gentamicin and caffeine were started. Trophic enteral feeding with mother's expressed colostrum and milk was started. Due to cardiovascular insufficiency, dobutamine infusion commenced. Right side grade I intracranial hemorrhage was diagnosed.

During the first month of life, emphysema of the right lower lobe of the lung progressed clinically and radiographically, dislocating the mediastinum and interfering with blood circulation. The HFOV parameters were increased (mean airway pressure – 14 mmH_2O, deltaP – 25, tidal volume 1 – 2.2 ml/kg/breath, MV 1.1 – 2.5 l/kg/min), FiO_2 increased to 1.0, blood gas analysis indicated decompensated respiratory acidosis (pH – 7.12, pCO_2 – 84 mmHg), hypoxemia and significant glycemic fluctuations, which were difficult to control (3.2-33.1 mmol/l) with insulin therapy.

On day 27 of life, a decision was made to surgically remove the right lung lower lobe with cystic formations (**Fig. 1**). Thoracotomy and right lower lobectomy were performed successfully on the neonate weighing 495 grams. During the postoperative period, the neonate was treated for pneumonia. The observed small amounts of free air and fluid in the right pleural cavity spontaneously resolved and glycaemia normalized. On day 44 of life, the newborn was extubated, and oxygen therapy was continued via nasal continuous positive airway pressure (nCPAP) (FiO_2 0.3-0.5). The neonate was reintubated in the later course of treatment during an infection.

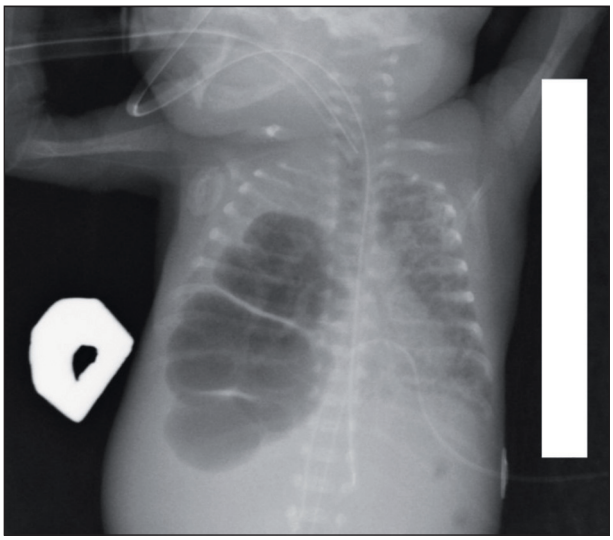

Figure 1. Signs of pulmonary interstitial emphysema before surgery.

Cytomegalovirus (CMV) infection (2,336 DNA copies/ml) was diagnosed at 63 days of life and was treated with ganciclovir and valganciclovir. At week 8 of treatment, an increase (from 42 to 391 copies/ml) was observed in the number of DNA copies. After assessing the mother, high levels of CMV immunoglobulin G were detected; therefore, the neonate began feeding on pasteurized milk from her mother. The number of DNA copies decreased with continued treatment with the same doses.

From day 124 of life, oxygen therapy was continued via high-flow nasal cannula (HFNC) followed by free-flow oxygen delivery by mask.

In total, the newborn spent 168 days in the hospital, 130 of them in the NICU. Mechanical ventilation of the lungs was continued for 75 days, of which HFOV – 65 days, nCPAP – 46 days, HFNC – 37 days. The need for supplemental oxygen (FiO_2 0.3-0.5) remained throughout the entire treatment period.

The treatment included 2 courses of dexamethasone (0.05 mg/kg/dose twice a day for 6 days) for weaning from mechanical ventilation, 2 courses of ibuprofen for closure of patent ductus arteriosus, and 14 red blood cell transfusions to correct anemia.

During the whole stay, the patient was treated for 2 episodes of sepsis, 3 episodes of pneumonia, and 1 episode of pyelonephritis.

Parenteral nutrition was continued for 21 days through the entire treatment period (9 days after birth, 8 days after mentioned surgery, 4 days because of suspected necrotizing enterocolitis). Full enteral nutrition was achieved on day 9 and was continued while fortifying with Aptamil® FMS (from day of life 14). The neonate started eating from the bottle on her own at 44 weeks of corrected age. Postnatal growth restriction was observed during the entire period (shown in **Fig. 2**).

While performing a repeated head ultrasound examination and being diagnosed with calcifications in the subcortical nuclei and ventriculomegaly ex vacuo, the patient was diagnosed with stage I retinopathy of prematurity. The OAE hearing screening test was negative, and formal audiology testing was arranged.

The neonate was sent home at 46 weeks of corrected gestation with continued treatment with valganciclovir and 36-60% free-flow oxygen. She was fed expressed and pasteurized mother's milk from a bottle. Discharge weight was 3,558 g (3rd permillile), length – 45 cm (< 3rd permillile), head circumference – 33 cm (< 3rd permillile).

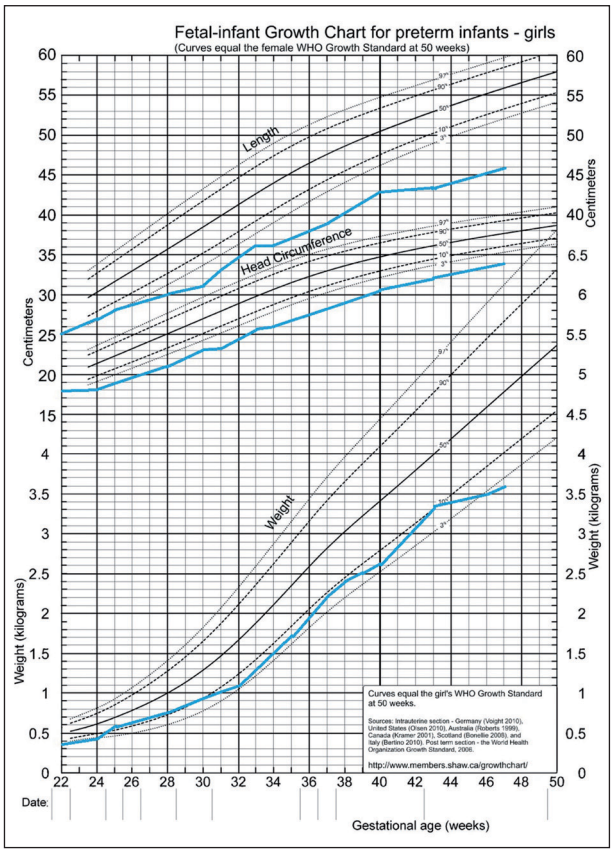

Figure 2. Postnatal growth restriction.

As the girl was of 11 months of chronological age, 7 months of corrected gestational age, her weight was 6,910 g (< 3rd permillile), length – 62 cm (< 3rd permillile), head circumference – 40 cm (< 3rd permillile), developmental age – 5 months (Bayley Scales of Infant Development [2nd edition] score – 33).

Discussion and conclusion

Preterm birth is one of the biggest challenges in perinatology today. There are no unified neonatal resuscitation and treatment guidelines for extremely premature newborns (22-24 weeks) in the world, and the threshold for active care differs throughout the world [2-5]. Most guidelines are based on the gestation; however, this method has been criticised for errors in the calculation of pregnancy duration, disregard for prognostic factors, and even discrimination against extremely premature newborns. Some authors suggest decision individualisation, but there is not enough data on which criteria would justify the decision to give an extremely premature neonate active treatment [6, 7]. It is agreed that the scope of resuscitation and treatment should be discussed in the presence of parents.

With rapid advancements in medicine, the survival rates among extremely premature newborns are improving, but most survivors experience serious medical conditions, which significantly impair their quality of life [8, 9]. Only 2-5% of extremely premature neonates survive without severe neurological damage [9, 10]. It is also important to note that the incidence of neuromotor and sensory damage in newborns of 22-24 weeks of gestation is not significantly affected even with rapid advancements in neonatal treatment, while the survival among newborns of 25-26 weeks of gestation without severe or moderate psychomotor or sensory impairment has improved. The same trend is observed when assessing the incidence of other diseases, such as bronchopulmonary dysplasia, retinopathy of prematurity and periventricular leukomalacia. Therefore, the greatest challenge is not only to improve the survival rates in this gestation group but also to reduce morbidity and improve the quality of life [8].

The guidelines for the perinatal treatment of extremely premature neonates require more evidence-based data. Proactive or flexible and individualised guidelines in the case of pregnancy of 22-24 weeks of duration remain a topic for debate. Studies show that severe morbidity and mortality of extremely premature newborns are significantly higher among the newborns who have not received active antenatal treatment (steroids and magnesium sulphate, cesarean section due to fetal distress). Proactive guidelines are associated with fewer patients with a low Apgar score (< 4) at 1 and 5 minutes of life and an increased survival rate at 1 year of age with no increased morbidity in the group in question [11]. It is interesting that even with sufficient time between the arrival of the mother in labour and birth (> 24 hrs) active antenatal treatment is not always started, even though these neonates are resuscitated and treated in the NICU. This problem is also encountered in Lithuania because, according to current laws, the newborn is registered, resuscitated, and receives full treatment from 22^{+0} weeks of gestation, although active obstetric treatment (therapy for fetal lung maturation and magnesium sulphate administration) are considered only from 23^{+0} weeks of gestation. This situation demonstrates inconsistency between obstetric and neonatal care [12].

Unified perinatal care guidelines and a predetermined time for active antenatal treatment in the cases of specific periods of gestation would allow for more consistent perinatal care for the newborn.

Statement of Ethics

Written informed consent was obtained from the patient's parents for publication of this case report and accompanying images.

Declaration of interest

The Authors have no conflicts of interest to declare. Funding sources: no funding.

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