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Successful Treatment of an Ultra-Premature Infant with a Gestational Age of 24 Weeks

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Abstract

At present, it is more common for ultra-premature babies with gestational age less than 25 weeks to survive in foreign countries without obvious sequelae, but there are few reports in China. In this article, a case of a premature infant with a gestational age of 24+1 weeks was successfully treated, but no sequelae were found during follow-up. It is reminded that the Neonatal Intensive Care Unit (NICU) of tertiary hospitals in China through careful and standardized management, enables children to smoothly pass through the three major barriers of breathing, nutrition, and infection, as well as the subsequent kangaroo care and family participatory management, which can fully realize the Preterm infants aged 24 to 25 weeks survived without obvious defects.

Keywords: Super premature infants; Gestational age 24 weeks; Dyspnea; Sequelae

Introduction

Hospital admission

The patient, a female, was admitted to the hospital on September 24th, 2019 because of "gestational age of 24+1 weeks and dyspnea for 40 min after birth". The child is the second child of the second child, and the gestational age is 24+1 weeks. The mother's prenatal measurement of blood pressure is high, urine protein is +, suffering from" bacterial vaginosis" and given "cefoxitin anti-infection and topical vaginal medication" treatment. Before childbirth, "dexamethasone needle 1 course" has been given to promote fetal lung maturity. She gave birth naturally and weighed 770 g. Amniotic fluid, umbilical cord, and placenta were normal. After birth, the child breathes like breath, weak spontaneous breathing, Apgar score of 1 min, 5 min and 9 points (respiration deduction 1 point), the gestational age of the child is less than 26 weeks, and requires prophylactic administration of pulmonary surfactant and endotracheal intubation the rewarmed porcine lung phospholipid injection 160 mg was dripped into the tube. After the drug was used up, he still had difficulty breathing and had weak spontaneous breathing. He was transferred to the neonatology department under tracheal intubation and resuscitation balloon positive pressure ventilation. Both mother and father are 32 years old. One brother is 5 years old and healthy. Physical examination: Body temperature 36.6°C, heart rate 145 beats/min, breathing 68 beats/min, weight 770 gm. Ultra-premature babies have appearance, poor response, thin and shiny skin, nails not reaching the fingertips, unobvious foot texture, no nodules in the breast, and unobvious areola. The fontanelle is flat and soft, the spontaneous breathing is weak, the mouth is cyanotic, and the three concave signs are positive. Breath sounds in both lungs were low, and no wet rales were heard. The heart sounds are strong, regular and without noise. The abdominal examination was normal. The labia majora does not cover the labia minor. The muscle tone of the limbs is low, and the original reflex is not elicited. Admitted to the hospital for diagnosis of Extremely Preterm Infants (EPI) and ultra-low birth weight infants.

Diagnosis and treatment process

Keep warm in an advanced incubator with a humidity of 90%. Give the ventilator assisted breathing SIMV mode, initial parameters: Peak Inspiratory Pressure PIP 14 cmH20 (1 cm$H_2$0=0.098 kPa), Positive End Expiratory Pressure PEEP 5 cm H_2O, Respiratory frequency (Respiratory Rate RR) 35 times/min, inhaled oxygen concentration (Fraction of Inspired Oxygen FiO_2) 30%, Inspiratory time (Inspiratory time Ti) 0.35 S. Blood sugar and blood pressure were normal on admission. No pathogenic bacteria grow in sputum culture. Afterwards, the ventilator parameters were gradually lowered. On the third day of admission, the ventilator parameters were: PIP 12 cm

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$H_2$0, PEEP 4 cm H_2O, RR 30 times/min, FiO_2 23%, Ti 0.35 S. The gestational age was corrected at 26+1 weeks (2 weeks after birth) and mechanical ventilation was stopped. Because of apnea, a noninvasive ventilator was given bi-level positive pressure ventilation. Corrected the gestational age of 28+3 weeks and stopped the non-invasive ventilator, changed to nasal cannula oxygen inhalation, corrected the gestational age of 29 weeks, changed to incubate oxygen. Correct gestational age and stop oxygen at 31 weeks. After admission, he was given penicillin combined with ceftizoxime for anti-infective treatment, penicillin for 1 week, and ceftizoxime for 10 days. Pulmonary infection occurred at 36 weeks of gestational age was corrected, cefoperazone and sulbactam anti-infective treatment was given for 1 week and the drug was stopped after recovery. Correct gestational age at 37 weeks and start kangaroo care. After birth, he was given umbilical vein catheterization for 14 days, and then PICC catheterization was given for 2 times, which was maintained until drug withdrawal. After 2 weeks of admission, the rat nerve growth factor was used to nourish the nerves. After the condition was stabilized, the premature infants were treated with massage and music. On the second day of admission, caffeine citrate was given to treat apnea, and the maintenance dose was 10 mg/kg until the gestational age was corrected 36 weeks. After birth, give vitamin K and sulfacetamide to prevent bleeding for 3 days, keep quiet, avoid sound and light stimulation, reduce movement, and maintain internal environment stability. Head ultrasound was monitored once a week, and there was no abnormality. Cardiac color Doppler ultrasound examination was performed 2 weeks after birth: Atrial level and left-to-right shunt were recorded, aortic level and small left-to-right shunt were recorded, and the shunt beam width was about 1 mm to 2 mm, indicating patent foramen ovale and patent ductus arteriosus. The child had no hemodynamic changes, and the arterial catheter was not given special treatment. Correction of gestational age at 27 weeks and re-examination of cardiac color Doppler ultrasound showed that the foramen ovale was patent and the arterial duct was closed. Reexamination of cardiac color Doppler ultrasound every two weeks afterwards showed that the foramen ovale was patent. After admission, he began to actively support parenteral and parenteral nutrition, monitor height and head circumference every week, and monitor weight gain trends every day. Nasal feeding started on the 4th day after birth, micro-feeding, deep hydrolyzed milk powder, and non-nutritive sucking. Each time the stomach tube was fed 1 ml, once every 3 h, and then every 3 to 5 days with 1 ml each time, the feeding was well tolerated, and the gestational age was corrected 26+2 weeks and the breast milk nasal feeding was started. Correct the gestational age of 28+4 weeks and start partial oral feeding. After correcting the gestational age at 32 weeks, all oral breast milk was fed 13 ml/time, weighing 1300 g, and breast milk fortifier was added. Amino acids were administered intravenously within 24 h after birth to prevent negative nitrogen balance, fat emulsion was added 24 h later, and parenteral nutrition was used to supplement energy and various nutrients. Three weeks after birth, the blood routine examination revealed anemia, and erythropoietin was added, oral iron was used to prevent anemia, and a blood transfusion was given. Corrected the gestational age from 32+4 weeks, check the ophthalmology fundus every 2 weeks, and continue to return to the ophthalmology clinic after discharge. No abnormalities were found. Corrected for 41 weeks of gestational age, the head MRI showed no abnormalities. The patient was hospitalized for 128 days. At discharge, his length was 50 cm, his head circumference was 34 cm, and his weight was 3210 g. The Neonatal Behavioral Neurological Assessment (NBNA) score was normal. Six months after birth (corrected age of 2 months), the length is 58 cm, the head circumference is 38 cm, the weight is 4900 g, the NBNA score is normal, and the hearing screening and brainstem auditory evoked potential are normal.

Discussion

EPI less than 28 weeks has a high mortality rate, mainly due to perinatal asphyxia, intracranial hemorrhage, congenital malformations, hyaline membrane disease, pulmonary hemorrhage, persistent pulmonary hypertension, and various infections. In recent years, there have been more and more reports on the successful treatment of preterm infants with gestational age less than 28 weeks. There have been reports of survival at the minimum gestational age of 21 weeks [1]. The survival rate of EPI at 23 weeks and 24 weeks in European and American countries is 44.4% and 69.2% [2]. There is still a big gap between my country and foreign countries.

Our department successfully treated a case of 25+3 EPI in 2016, and the follow-up developed well. The patient who has been successfully treated is one of the youngest premature babies in the region. The experience is summarized as follows:

Body temperature management

Close cooperation with obstetrics and pediatrics medical staff, the temperature of the delivery room is 24 to 28 degrees, the radiant table is preheated, the umbilical cord ligation is delayed for 1 min after the baby is born, and then placed on the radiant table to keep warm, the child has weak breathing, provide rescue treatment such as tracheal intubation and intra tracheal application of pulmonary surfactant, which is the first step for the successful treatment of children. After entering the neonatology department, live in an advanced incubator, maintain a constant temperature and humidity, and a humidity of 90% to avoid excessive weight loss, reduce insignificant water loss, and restore birth weight 10 days after birth [3].

Respiratory management

Respiratory distress syndrome: The child's prenatal mother gave a course of adrenocortical hormone treatment to promote lung maturity. Prenatal application of adrenocortical hormone not only promotes lung maturity, but also accelerates the production of alveolar surfactant and reduces premature birth the incidence and severity of hyaline membrane disease in children [2]. After birth, he was weak in spontaneous breathing and breathing like a wheeze. He was given tracheal intubation and preventive pulmonary surfactant treatment immediately. At the same time, the T combined resuscitator is used to assist breathing, which ensures that a certain end-expiratory pressure is maintained and prevents the open alveoli from collapsing again. After being transferred to the neonatology department, he was given mechanical ventilation and adopted a protective ventilation strategy [4]. The child's breathing was assessed in time, and mechanical ventilation was stopped 2 weeks after birth and changed to non-invasive ventilation [5].

Apnea: The chance of apnea in ultra-premature infants is very high. Caffeine citrate treatment is started on the second day after birth, which shortens the time of mechanical ventilation, reduces the number of apneas, and effectively protects brain cells [6].

Prevention of bronchopulmonary dysplasia: Bronchopulmonary dysplasia is a major cause of death from EPI. We mainly evaluate breathing in time, adopt permissive hypercapnia strategies, constant volume mode, and minimize PIP and tidal air. In order to avoid the

occurrence of bronchopulmonary dysplasia (Bronchopulmonary Dysplasia BPD), early mechanical ventilation was stopped and changed to non-invasive ventilation. Oxygen was completely stopped at 31 weeks of gestational age [7].

Nutritional support

Early micro-feeding: The child will start nasal micro-feeding 48 h after birth, starting from 1 ml each time, once every 3 h, adding milk once every 2 to 3 days, adding 1 ml each time during the feeding process, there was no feeding intolerance such as gastric retention, vomiting, and abdominal distension. Early micro-feeding contributes to the integrity of the gastrointestinal tissue structure, improves the secretion and activity of digestive enzymes, and promotes the development and maturity of gastrointestinal motor function [8].

Early breastfeeding: Premature babies choose breastfeeding first [9], and inform mothers and family members of the importance of breastfeeding. The mother is very cooperative and insists on delivering breast milk until discharged from the hospital. When breastfeeding volume reaches 80 ml/kg.d, add breast milk fortifier, start with half fortification, and give full fortification after 3 days. During the hospitalization of the child, vomiting, abdominal distension, gastro esophageal reflux, and necrotizing enterocolitis did not occur. Mother feeding can reduce the incidence of nosocomial infections, reduce the number of days, and reduce the cost of children with children [10].

Parenteral nutrition: 24 h after birth, internal and parenteral nutrition is given amino acids via the umbilical vein to provide sufficient energy, reduce catabolism and prevent negative nitrogen balance. After 24 h, add fat milk, vitamins, trace elements and other intravenous nutrition to ensure the supply of liquid and calorie [11]. Monitor the baby's weight, length, and head circumference. The growth process is smooth [12], and all indicators are above the 10^{th} percentile when discharged from the hospital.

Infection prevention and treatment: Prevention is the first, strict implementation of aseptic operation technical specifications, attention to hand hygiene, centralized operation, dedicated operation and care, prevention of cross-infection, rational use of antibiotics, and active control of infection.

Prevention of brain injury in premature infants: Brain injury is an important factor affecting the prognosis of the nervous system of EPI. How to reduce and avoid brain damage is a problem that everyone faces. After birth, the patient should minimize movement and irritation, and regularly perform bedside cranial ultrasound monitoring. Hemostatic drugs and a course of neurotrophic therapy were used prophylactically for 3 days after birth. Pay attention to maintaining vital signs and internal environment stability. After the condition is stable, give music therapy and touch premature infants, pay attention to nutritional support, and ensure the needs of brain development [13]. Give kangaroo nursing and family participatory nursing, and teaches parents the methods and skills of nursing premature babies [14]. After active intervention, the NBNA score was normal after correction for age 2 months, and the hearing screening and brainstem auditory evoked potential were normal.

Prevention of retinopathy of prematurity (ROP): Reasonable use of oxygen, the inhaled oxygen concentration is less than 30%, shorten the time of oxygen use as much as possible, and correct the gestational age of 31 weeks and have stopped oxygen. Corrected the gestational age from 32+4 weeks and the fundus were checked every 2 weeks. After discharge, the ophthalmology clinic continued to follow up, and there was no abnormality in the monitoring of the retina [15].

Other aspects: Maintain fluid balance, prevent excessive fluid from causing arterial ducts to open, maintain blood sugar stability, phototherapy to reduce jaundice and prevent bilirubin encephalopathy, erythropoietin and iron agents prevent anemia in premature infants, research suggests that erythropoietin has brain protection [16]. At present, the development of vision, hearing, intelligence, and motor functions are normal, and there is no abnormality in head MRI.

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