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UNRAVALING THE COMPLEXITIES OF RESPIRATORY DISTRESS SYNDROME IN PRETERM NEONATES: A CASE REPORT

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ABSTRACT

Respiratory distress syndrome (RDS) remains a significant contributor to illness and mortality among preterm infants, mainly because of insufficient surfactant and immature lungs. This case report focuses on a preterm baby born at 33 weeks who experienced mild RDS, along with neonatal hyperbilirubinemia and sepsis caused by Pseudomonas aeruginosa. At birth, the baby weighed 1.920 kg and needed oxygen support for the mild RDS, phototherapy for the hyperbilirubinemia, and intensive care that included antibiotic treatment tailored to sensitivity results. Blood cultures revealed that Pseudomonas aeruginosa was sensitive to several antibiotics, allowing for effective targeted therapy. The baby also faced some challenges with electrolyte imbalances, like hypocalcaemia and hyperphosphatemia, which were managed appropriately. Despite these complications, the infant responded positively to treatment and was able to go home after 30 days. This case highlights the critical need for early detection and proper management of RDS, emphasising the roles of oxygen therapy and surfactant replacement, as well as careful monitoring and swift treatment of sepsis with the right antibiotics. Advances in neonatal care, which include antenatal corticosteroids and exogenous surfactant therapy, have greatly enhanced outcomes for preterm babies. Nevertheless, ongoing multidisciplinary care is vital to address complications such as electrolyte issues and infections. This case illustrates the intricate nature of caring for preterm infants in the NICU and stresses the importance of personalised, evidence-based approaches to enhance survival and quality of life.

KEY WORDS: Respiratory distress syndrome, preterm neonate, hyperbilirubinemia, neonatal sepsis, Pseudomonas aeruginosa, electrolyte imbalance, neonatal intensive care.

INTRODUCTION

According to the latest definition, acute respiratory distress syndrome (ARDS) is characterised by a sudden and widespread inflammatory injury to the lungs. This condition leads to bilateral radiographic opacities, which are associated with a mix of increased venous admixture, heightened physiological dead space, reduced lung compliance, and greater pulmonary vascular permeability, ultimately resulting in an increase in lung weight.[1]Most cases of RDS occur in infants born before 37 or 39 weeks of gestation. The chances of a baby developing RDS after birth rise significantly with the risk of preterm delivery. This condition is rare in full-term neonates.[2]To diagnose respiratory distress syndrome (RDS), a patient typically needs to show at least two of the following clinical symptoms: tachypnea (breathing rate over 60 breaths per minute), dyspnoea accompanied by subcostal or intercostal retractions during inhalation, nasal flaring, grunting during exhalation, and cyanosis while in room air. The most common causes of RDS within the first 48 hours include infections, meconium aspiration syndrome, perinatal hypoxia, hyaline membrane disease (HMD), and transient tachypnea of the newborn.[3] European nations report a lower incidence of ARDS than the United States, with instances ranging from 1.5 to over 79 cases per 100,000.[4-6] This disorder's pathogenesis has been well-defined. In short, the lung that lacks surfactants and is physically immature has a propensity to collapse. Hypoxaemia and hypercarbia are the outcomes of ventilation/perfusion mismatch caused by regions of the lung that are generally adequately perfused but poorly ventilated. In some situations, pulmonary vasoconstriction can lead to right-to-left shunts through the foramen ovale and/or a patent ductus arteriosus, as well as persistent pulmonary hypertension, which worsens hypoxaemia. When hypoxaemia in preterm children is not responsive to proper support with mechanical ventilation, some physicians are considering the use of inhaled nitric oxide. This condition, which was previously believed to be a trait of full-term newborns, is commonly seen in preterm babies with RDS. The introduction of exogenous surfactant has fortunately changed the normal course of the illness in many low-birthweight infants.[7] All patients met the following criteria:(1) an acute onset; (2) a clear perinatal triggering event or delivery via selective caesarean section; (3) significant clinical symptoms, including severe dyspnoea that required mechanical ventilation for at least 72 hours; and (4) typical findings in arterial blood gas analysis and chest X-ray, where the oxygen tension fraction of inspired oxygen ratio (PaO2/FiO2) was below 200 mmHg, along with identified hypoxia and hypercapnia.[8,9] The significant improvement in RDS patients' outcomes can be attributed to the invention of exogenous surfactant and the use of prenatal drugs to speed up lung maturity.[10-12] In their research, Hack and colleagues discovered that 56% of neonates weighing between 501 and 1,500 grams experienced respiratory insufficiency due to prematurity and/or RDS. Breaking it down further, 86% of these infants were in the 501 to 750-gram range, 79% fell between 751 and 1,000 grams, 48% were from 1,001 to 1,250 grams, and 27% weighed between 1,251 and 1,500 grams.[13] When it comes to caring for premature infants, tackling neonatal respiratory distress syndrome (RDS) is both a remarkable achievement and a persistent challenge. RDS tends to be more common in younger gestational ages, impacting nearly all preterm babies born between 22 and 28 weeks. It also affects about 3% of late preterm infants born between 34 and 36 weeks and a mere 0.12% of full-term babies born at or after 37

weeks of gestation.[14-16] It turns out that male infants and those of the white race tend to have a higher rate of RDS, especially among late preterm and term babies.[15] The mortality rate for neonatal respiratory distress syndrome (RDS) has dropped significantly, thanks to the widespread use of prenatal corticosteroids in cases of imminent preterm birth.[17] Foetal lung maturation is accelerated by antenatal corticosteroids at physiological stress-like levels because they increase the activity of enzymes involved in surfactant manufacture.[18] Physiologic and morphometric data indicate that the larger alveolar surfactant pool size is accompanied by structural lung development.[19] A newborn is experiencing respiratory distress after being born healthy and prematurely (Figure 1).

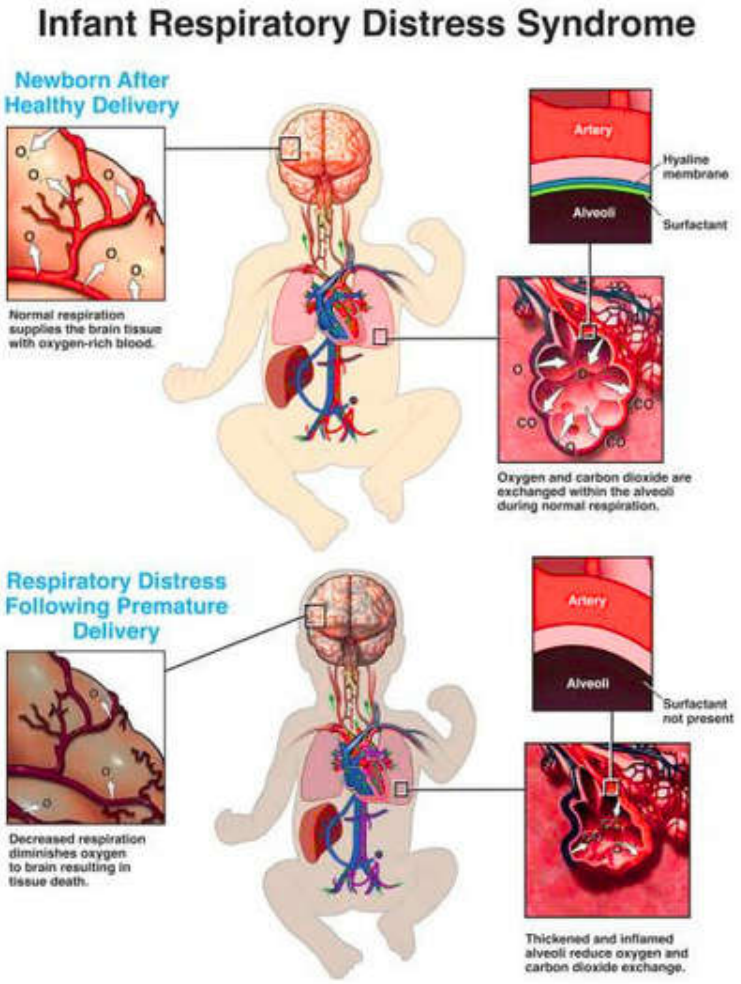

Fig.1 A newborn is experiencing respiratory distress after being born prematurely

2. CASE DESCRIPTION

A baby girl arrived a bit early, born at 33 weeks through a vaginal delivery to a 21-year-old first-time mom. She weighed in at 1.920 kg at birth, and her APGAR scores were 7 and 8 at one and five minutes, respectively. Unfortunately, her respiratory system showed some abnormalities, as indicated by Silverman-Anderson scores of 3 and 4 at birth and shortly after. Upon examination, she exhibited subcostal and suprasternal retractions and developed episodes of apnoea. Additionally, her growth was concerning, and she experienced neonatal hyperbilirubinemia, which caused her skin to appear yellow and progressively worsen, accompanied by dark urine since she was 30 days old, leading to phototherapy treatment. The baby let out a cry right after she was born, weighing in at 1.920 kg. She experienced some mild respiratory distress syndrome (RDS), which meant she needed a bit of oxygen support and spent 30 days in the NICU after her delivery. A neonatal ultrasound of her abdomen revealed gallbladder sludge and mild right hydronephrosis.

During the physical exam, the baby seemed unwell and irritable but was afebrile. Her vital signs showed a decreased respiratory rate and an oxygen saturation (SpO_2) of 94%, which stabilised with 1 L of oxygen.

Antibiotic susceptibility report:

Antimicrobial Agent	Isolate 1
Amoxicillin - Clavulanate	R
Ampicillin	R
Nitrofurantoin	R
Amikacin	S
Cefepime	S
Ceftazidime	S
Ceftriaxone	S
Ciprofloxacin	S
Gentamicin	S
Imipenem	S
Levofloxacin	S
Piperacillin – Tazobactum	S
Trimethoprim - Sulfamethoxazole	S
Meropenem	S

During the neurological exam, she appeared alert and engaged, with pupils that responded to light on both sides. A neurosonogram indicated a prominent third ventricle.

Her blood tests revealed some concerning results: polycythaemia at 16.1 g/dl, hyperbilirubinemia at 14.6 mg/dl, hypocalcaemia at 6.8 mg/dl, hyperphosphatemia at 8.6 mg/dl, and hyperkalaemia at 5.8 mg/dl. On top of that, her C-reactive protein level was also elevated, sitting at 1.2 mg/dl. Blood cultures confirmed the presence of Pseudomonas aeruginosa. The treatment administered included Inj. Amikacin 20mg once daily, Inj. Ampicillin 100mg twice daily, and Inj. Caffeine citrate 10mg. After reviewing the antibiotic

susceptibility report, they found that Inj. Ampicillin was resistant, so they switched to Inj. Piptum 200 mg three times a day.

DISCUSSION:

This case revolves around a preterm baby born at just 33 weeks of gestation who faced some challenges, including mild respiratory distress syndrome (RDS), neonatal hyperbilirubinemia, and sepsis from Pseudomonas aeruginosa. RDS is a frequent issue for preterm infants, mainly due to a lack of surfactant and underdeveloped lungs. Thankfully, advancements like oxygen therapy, mechanical ventilation, and exogenous surfactant have transformed how we manage this condition, leading to much better survival rates. In this instance, the little one needed some oxygen support but didn't develop severe RDS, which suggests they were on the milder side of the spectrum, likely helped by being 33 weeks along, when the body starts to produce enough surfactant.

Neonatal hyperbilirubinemia is another common occurrence in preterm babies, often linked to the rapid turnover of red blood cells and the liver's immature ability to process bilirubin. This baby's bilirubin levels were high enough to require phototherapy, which is the go-to treatment for this condition.

A significant concern in this case was the onset of sepsis caused by Pseudomonas aeruginosa. This bacterium is a notorious opportunistic pathogen found in neonatal intensive care units (NICUs). It's associated with increased rates of illness and mortality, particularly among preterm infants who have compromised immune systems and longer hospital stays. The infection was confirmed through blood culture, and the bacteria showed sensitivity to several antibiotics, including amikacin, cefepime, ceftazidime, and meropenem. Starting the right antibiotic treatment quickly is vital for managing neonatal sepsis and improving the chances of recovery.

Lab tests also showed some electrolyte imbalances, such as low calcium, high phosphate, and high potassium levels. These metabolic issues are often seen in preterm infants due to their immature kidneys, sepsis, and the overall stress of being ill. It's crucial to correct these imbalances to prevent complications like heart rhythm problems and neuromuscular irritability.

The neurosonogram indicated a prominent finding, which we should keep an eye on as part of the ongoing assessment.

CONCLUSION

This case really shines a light on the numerous challenges that come with caring for preterm infants, particularly those facing issues like RDS, hyperbilirubinemia, and sepsis. It's crucial to spot respiratory distress early and provide oxygen quickly to prevent serious issues like severe hypoxaemia and complications such as persistent pulmonary hypertension. Administering the right antibiotics based on culture sensitivity is essential for effectively managing sepsis. Keeping an eye on metabolic abnormalities and correcting them promptly is a key part of comprehensive care in the NICU. Thanks to significant advancements in

neonatal care, like the use of exogenous surfactant and prenatal corticosteroids, outcomes for preterm infants have improved dramatically. Still, careful monitoring and a team-based approach are vital to tackle the complexities that come with preterm birth and its related complications.

PATIENT CONSENT AND ETHICAL COMMITTEE APPROVAL:

This study was conducted in accordance with the Declaration of Helsinki. We ensured that we obtained written informed consent from the participant involved. The case report underwent a comprehensive review and received approval from the Institutional Review Board (IRB) of the Institutional Ethics Committee at Vivekanandha Medical Care Hospital, with the approval number EC/NEW/INST/2024/TN/0529.

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CONFLICTS OF INTERESTS

The authors want to make it clear that there are no conflicts of interest.

AUTHORS CONTRIBUTIONS

Dr. Angelin Grace T conceived the study idea. Dr. Ann Jency A collected the data, participated in patient treatment, and conducted follow-up. Ashmitha N. M. and Abitha M. prepared the manuscript. Dr. Angelin Grace T and Dr. Ann Jency A reviewed and finalized the manuscript. All authors have read and approved the final version of the manuscript.

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