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Neonatal emergency management in a 25-day-old infant with prematurity, extremely low birth weight, and respiratory distress syndrome

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Abstract:

Preterm birth, extremely low birth weight (ELBW), and respiratory distress syndrome (RDS) often coexist and remain leading causes of neonatal death, especially in resource-limited settings. This case report describes the midwifery and neonatal management of a preterm infant with ELBW and RDS in an Indonesian referral hospital and discusses it against current evidence. Following the CARE guidelines, data came from bedside observation and the medical record, and care was organised with Varney's seven-step process. The male infant was born vaginally at 28 weeks, weighing 950 g, with Apgar scores of 4 and 6. At the start of care he had tachypnea (70 breaths/min), nasal flaring, intercostal retractions, central cyanosis, an oxygen saturation of 84% in room air, and a Downes score of 7. Care included incubator thermoregulation, orogastric feeding with expressed breast milk, continuous positive airway pressure (CPAP), exogenous surfactant, empirical ampicillin and gentamicin, hourly monitoring, and parental counselling on kangaroo mother care (KMC). After 12 days, oxygen saturation was 95% on CPAP, weight was 1,120 g, vital signs were stable, and he was discharged to a high-risk clinic. Integrated respiratory, thermal, nutritional, infection-prevention, and family-centred care is feasible in a referral hospital in a middle-income setting.

Keywords:
prematurity; extremely low birth weight; respiratory distress syndrome; neonatal care; kangaroo mother care

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INTRODUCTION

Preterm birth, defined as birth before 37 completed weeks of gestation, affects roughly one in ten newborns worldwide. An estimated 13.4 million babies were born preterm in 2020, and the global rate showed no measurable decline between 2010 and 2020 (Ohuma et al., 2023). About 4% of these births occurred before 28 weeks of gestation, the group that needs the most intensive neonatal care (Ohuma et al., 2023). Complications of preterm birth are the leading cause of death among children under five years of age (Perin et al., 2022), and many of these deaths could be averted with timely and affordable care (Lawn et al., 2014).

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Extremely low birth weight (ELBW), defined as a birth weight below 1,000 g, usually accompanies extreme prematurity. These infants have immature lungs, thin skin that loses heat quickly, small energy stores, and an immature immune system. The most common early respiratory problem is respiratory distress syndrome (RDS), which arises from surfactant deficiency and an underdeveloped lung structure and becomes more frequent as gestational age decreases (Sweet et al., 2023). Survivors remain at risk of bronchopulmonary dysplasia (BPD), a chronic lung disease with lasting effects on health and development (Jobe & Bancalari, 2001; Thébaud et al., 2019). Prematurity and low birth weight also affect growth and cardiometabolic health later in childhood (Jańczewska et al., 2023).

Several interventions have changed the outlook for these infants. Early continuous positive airway pressure (CPAP) allows many extremely preterm infants to avoid routine intubation without increasing death or BPD (Morley et al., 2008; SUPPORT Study Group, 2010). Early surfactant administration to infants who need it reduces air leaks and chronic lung disease (Bahadue & Soll, 2012; Stevens et al., 2007). Kangaroo mother care (KMC) lowers mortality and severe infection in low-birth-weight infants (Conde-Agudelo & Díaz-Rossello, 2016; WHO Immediate KMC Study Group, 2021), and donor human milk lowers the risk of necrotizing enterocolitis when the mother's own milk is unavailable (Quigley et al., 2019). In high-income research networks, most infants born at 28 weeks now survive (Stoll et al., 2015). In many low- and middle-income countries, however, access to neonatal intensive care, trained staff, and surfactant remains uneven (Lawn et al., 2013). Indonesia is among the ten countries with the largest number of preterm births (Blencowe et al., 2012), and low birth weight has been linked to maternal and environmental factors, including pesticide exposure in agricultural communities (Damiri et al., 2025; Kurniyawan et al., 2024).

In addition to medical treatment, the care of ELBW infants requires continuous assessment, accurate documentation, and close collaboration among midwives, nurses, and physicians. Midwives contribute to respiratory monitoring, thermal regulation, feeding support, infection prevention, and family education, while identifying early signs of deterioration. A structured approach, such as Varney's seven-step management process, can help organize these activities and evaluate the infant's response to care. Family involvement is also important because parents need support to prepare for kangaroo mother care, breastfeeding, and follow-up after discharge. These measures align with recommendations for improving the quality of care for preterm and low-birth-weight infants (Lawn et al., 2014; Sweet et al., 2023; World Health Organization, 2022).

Structured accounts of how these interventions are combined in daily practice remain scarce, especially in midwifery-led care in Indonesia. This case report therefore describes the integrated midwifery and neonatal care of a preterm infant with ELBW and RDS at a referral hospital in Kediri, using Varney's seven-step management process, and discusses the care in light of current evidence and local system constraints.

METHODS

This was a single-patient descriptive case report. It was prepared in accordance with the CARE (Case Report) guidelines (Riley et al., 2017). The infant was cared for in the neonatal

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intensive care unit (NICU) of RSUD Gambiran, a public referral hospital in Kediri, East Java, Indonesia, from 16 to 28 June 2025. The case was selected for reporting because prematurity, ELBW, and RDS occurred together in one patient who received multi-component care.

Data came from (1) direct clinical observation of the infant and (2) the infant's medical record. Extracted variables were perinatal data (sex, gestational age, mode of delivery, birth weight, Apgar scores, maternal age and parity), clinical status at the start of care (respiratory rate, signs of respiratory distress, oxygen saturation, Downes score, reflexes, and feeding ability), interventions delivered, and outcomes (oxygen saturation, weight, vital signs, and discharge plan).

Care was organized using Varney's seven-step midwifery management process (Varney et al., 2004): data collection, data interpretation, identification of potential problems, immediate or collaborative action, planning, implementation, and evaluation. Urgent interventions that required medical orders were handled collaboratively with the medical team.

To place the case in context, we reviewed articles published between 2020 and 2025 and added landmark trials, Cochrane reviews, and guidelines on neonatal respiratory care, kangaroo mother care, and nutrition of preterm infants. Case documentation was approved by the institutional supervisors, and the parents gave consent for the case to be documented. All identifying details were removed to protect confidentiality.

RESULTS

The baseline characteristics are shown in Table 1. The patient was a male infant, the first child of a 27-year-old mother, born vaginally at 28 weeks of gestation with a birth weight of 950 g (ELBW). Apgar scores were 4 at one minute and 6 at five minutes. The care described here began at 25 days of age and lasted 12 days in the NICU.

Table 1. Baseline characteristics of the infant

Characteristic	Finding
Sex	Male
Maternal age and parity	27 years; first child
Mode of delivery	Vaginal
Gestational age at birth	28 weeks (very preterm)
Birth weight	950 g (extremely low birth weight)
Apgar score	4 at 1 minute; 6 at 5 minutes
Age at start of care	25 days
Place and period of care	NICU, RSUD Gambiran, Kediri; 16–28 June 2025 (12 days)

Note: NICU = neonatal intensive care unit.

At the start of care, the infant had severe respiratory distress, with tachypnea of 70 breaths/min, nasal flaring, intercostal retractions, and central cyanosis. Oxygen saturation was 84% on room air, and the Downes score was 7. Reflexes were weak, and feeding ability was poor, consistent with prematurity and ELBW (Table 2).

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Table 2. Clinical status at the start and at the end of NICU care

Parameter	Start of care	End of 12-day NICU care
Respiratory signs	Tachypnea (70 breaths/min), nasal flaring, intercostal retractions, central cyanosis	Vital signs stabilised; individual signs not itemised in the record
Oxygen saturation	84% in room air	95% on CPAP
Downes score	7	Not reported
Body weight	950 g (birth weight)	1,120 g (+170 g; +17.9% from birth weight)
Reflexes and feeding	Weak reflexes; poor feeding ability	Orogastric expressed breast milk, advanced as tolerated
Disposition	Admitted to NICU	Discharged; follow-up in high-risk neonatal clinic

Note: CPAP, continuous positive airway pressure.

Care was organized in seven steps (Table 3). The infant was nursed in an incubator with continuous temperature monitoring to prevent hypothermia. Expressed breast milk was administered via an orogastric tube, starting with small volumes and advancing as tolerated. Respiratory support began with CPAP, followed by exogenous surfactant by endotracheal instillation. Intravenous ampicillin and gentamicin were given empirically to prevent sepsis. Heart rate, respiratory rate, oxygen saturation, and blood glucose were monitored hourly. The parents were counseled on KMC, which was to start once the infant was stable.

Table 3. Midwifery management of the infant organized by Varney's seven steps

Step	Application in this case
1. Data collection	Perinatal history; respiratory rate 70 breaths/min; oxygen saturation 84%; Downes score 7; weak reflexes; poor feeding
2. Interpretation of data	Very preterm infant (28 weeks) with ELBW and severe respiratory distress, consistent with RDS
3. Potential problems	Hypothermia, hypoglycemia, sepsis, and feeding intolerance
4. Immediate or collaborative action	CPAP; exogenous surfactant; empirical intravenous ampicillin and gentamicin
5. Planning	Incubator care; orogastric expressed breast milk; hourly monitoring; KMC counselling once stable
6. Implementation	Interventions delivered as planned and recorded in the medical record
7. Evaluation	Oxygen saturation 95% on CPAP; weight 1,120 g; stable vital signs; discharge with follow-up

Note: CPAP, continuous positive airway pressure; ELBW, extremely low birth weight; KMC, kangaroo mother care; RDS, respiratory distress syndrome.

Over 12 days of NICU care, oxygen saturation rose to 95% on CPAP, weight increased to 1,120 g (170 g, or 17.9%, above birth weight), and vital signs stabilized (Table 2). The infant was discharged with follow-up arranged in the high-risk neonatal clinic.

DISCUSSION

This report describes a very preterm infant with ELBW and severe respiratory distress who improved over 12 days of NICU care. Care combined respiratory support, thermal protection,

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enteral nutrition, infection prevention, and early family involvement. Each component aligns with current recommendations, and the case demonstrates that they can be delivered together within a structured midwifery process at a referral hospital in a middle-income country.

RDS results mainly from surfactant deficiency and structurally immature airways. It usually appears within hours of birth, and its risk is highest at the lowest gestational ages (Sweet et al., 2023). In this case, the infant was 25 days old at the start of the reported care, which is later than the usual onset of RDS. At this age, respiratory distress in an infant born at 28 weeks may reflect several overlapping processes, including persistent surfactant deficiency, infection, and evolving chronic lung disease (Jobe & Bancalari, 2001; Thébaud et al., 2019). The clinical data reported here do not allow these causes to be separated, so we kept the diagnosis of RDS made by the treating team and treat this uncertainty as a limitation. The Downes score of 7 supported the judgment of severe distress, but one score cannot define the underlying disease. Serial scoring, chest imaging, and blood gas results would strengthen future reports.

Non-invasive support is the cornerstone of current practice. European consensus guidance recommends initiating CPAP early in infants at risk of RDS and administering natural surfactant early when oxygen requirements rise, preferably via a less invasive technique. The guidance applies primarily to infants beyond 24 weeks' gestation (Sweet et al., 2023). Randomized trials in infants born at 24 to 28 weeks found that early CPAP did not increase death or BPD compared with routine intubation, and many infants managed with CPAP avoided intubation (Morley et al., 2008; SUPPORT Study Group, 2010). One of these trials also reported a higher incidence of pneumothorax with CPAP (Morley et al., 2008), which is why close observation of breathing and chest movements is part of CPAP care.

In this case, CPAP was followed by surfactant. Early selective surfactant lowers the risk of air leak and chronic lung disease compared with delayed treatment (Bahadue & Soll, 2012), and the intubate–surfactant–extubate approach shortens mechanical ventilation compared with selective surfactant and continued ventilation (Stevens et al., 2007). The surfactant was administered via endotracheal instillation. Where staff are trained, less invasive administration is now preferred because it avoids ventilation (Sweet et al., 2023). A CPAP saturation of 95% at the end of care suggests a good response. European guidance suggests a target of 90–94% for preterm infants receiving oxygen (Sweet et al., 2023), so a value of 95% is at the upper end, and avoiding hyperoxia remains important. The oxygen concentration, CPAP pressure, and surfactant dose are not reported here and should be given in future cases.

ELBW infants lose heat quickly, and hypothermia worsens their outcomes. Incubator care with continuous temperature monitoring, as used here, follows guideline advice on thermoregulation and the basic package of essential care for preterm babies (Lawn et al., 2013; Sweet et al., 2023). Hourly glucose monitoring also helped detect hypoglycemia early. For feeding, the mother's own milk is the first choice. When donor milk is unavailable, it is preferred to formula because it lowers the risk of necrotizing enterocolitis (Quigley et al., 2019). Breastfeeding also brings benefits that extend into later life (Victora et al., 2016). Starting with small volumes of expressed milk by orogastric tube and advancing according to tolerance suits an infant with weak reflexes and poor feeding ability.

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Infection and chronic lung disease are common complications among survivors of extremely preterm birth (Stoll et al., 2010; Stoll et al., 2015). Empirical ampicillin and gentamicin are a conventional regimen when sepsis is suspected. As a general principle, the need for antibiotics should be reviewed daily, and the course should be stopped early when cultures are negative to limit resistance and adverse effects. Culture results and antibiotic duration were not reported in this case.

KMC reduces mortality, severe infection, and hypothermia in low-birth-weight infants compared with conventional care (Conde-Agudelo & Díaz-Rossello, 2016). A large trial across five hospitals in Ghana, India, Malawi, Nigeria, and Tanzania found lower 28-day mortality when KMC was initiated immediately after birth in infants weighing 1.0 to less than 1.8 kg (WHO Immediate KMC Study Group, 2021). Our infant weighed 950 g at birth, below the range of that trial, and KMC was planned after stabilization. Counseling the parents during NICU care is a practical first step. It prepares them for skin-to-skin contact, supports breastfeeding and bonding, and builds the skills needed for safe discharge. Wherever possible, units should move toward earlier and longer skin-to-skin contact for infants who are stable or recovering.

Varney's process gave the care a clear sequence, from assessment to evaluation (Table 3). It also prompted the team to anticipate hypothermia, hypoglycemia, sepsis, and feeding intolerance before they occurred. Midwives are often the first to notice deterioration and coordinate between the family and the medical team, so a shared documentation structure can improve continuity of care. Another important aspect is the role of accurate documentation and structured communication in neonatal intensive care. Recording oxygen saturation, respiratory support settings, temperature, glucose levels, feeding tolerance, and treatment responses helps the team identify deterioration and evaluate progress. Clear handovers between midwives, nurses, and physicians also reduce the risk of information being missed and support consistent care across shifts. In resource-limited settings, standardized documentation can improve clinical decision-making and help identify gaps in equipment, staffing, and treatment. These practices strengthen the application of Varney's process by linking assessment, intervention, and evaluation to measurable clinical findings (Lawn et al., 2014; Sweet et al., 2023).

Survival gaps between high- and low-resource settings remain large (Lawn et al., 2014). Indonesia has one of the world's largest numbers of preterm births (Blencowe et al., 2012), so every referral NICU carries a heavy load. Prevention is as important as treatment. Antenatal corticosteroids for women at risk of preterm delivery are part of current RDS guidance (Sweet et al., 2023), and antenatal care can address modifiable risks for low birth weight. Reviews from Indonesian agricultural settings point to pesticide exposure as one such risk (Damiri et al., 2025; Kurniyawan et al., 2024). Studies from other settings have described maternal and neonatal factors associated with prematurity and low birth weight (Matute et al., 2022). After discharge, follow-up in a high-risk clinic is essential because preterm infants remain at risk of chronic lung disease, poor growth, and later cardiometabolic problems (Jańczewska et al., 2023; Thébaud et al., 2019).

Family preparation should also begin well before discharge. Parents of extremely preterm infants may feel anxious about breathing support, feeding, temperature regulation, and the risk of complications after leaving the NICU. Midwives can help by providing repeated, practical education on recognizing danger signs, maintaining warmth, supporting breast milk feeding, and

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attending follow-up appointments. Discharge planning should include assessment of feeding ability, weight gain, respiratory stability, and the need for specialist follow-up. Because extremely preterm infants remain vulnerable to chronic lung disease and developmental difficulties, coordinated follow-up can support early identification of problems and continuity of care (Thébaud et al., 2019; Jańczewska et al., 2023).

The strengths of this report are its use of a defined care framework, its alignment with the CARE guidelines, and its comparison of the care given with recent evidence. Its limitations are those of a single case: it cannot show cause and effect or be generalized. Follow-up covered only the NICU stay. Numerical data were limited: saturation and weight were available at two time points, and blood gases, chest imaging, culture results, CPAP settings, and the surfactant dose were not reported. The timing of respiratory illness in relation to the infant's age also limits diagnostic certainty. Future reports should include serial measurements, a timeline of care, and longer follow-up.

For practice, this case supports early non-invasive respiratory support, early surfactant when needed, strict thermal control, human milk feeding, careful infection management, and early parental involvement in KMC. For health services, it highlights the need for NICU capacity, reliable access to surfactant, trained neonatal staff, and organized follow-up for high-risk infants.

CONCLUSION

This case shows that a preterm infant with ELBW and severe respiratory distress can be stabilized through combined care: CPAP, exogenous surfactant, incubator thermoregulation, expressed breast milk feeding, empirical antibiotics, close monitoring, and early parental counseling on KMC. A structured midwifery framework helped to organize these elements. As a single case, it cannot be generalized, and the timing of respiratory illness at 25 days of age limits diagnostic certainty. Strengthening NICU capacity, access to surfactant, trained staff, preventive maternal care, and follow-up services remains essential to reduce neonatal mortality and morbidity in Indonesia and similar settings.

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