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Comprehensive midwifery care for a preterm infant with respiratory distress syndrome managed with CPAP and kangaroo mother care in a hospital without surfactant: a case report

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Abstract:

Respiratory distress syndrome (RDS) is a leading cause of illness and death in preterm and low birth weight (LBW) infants, and surfactant is often unavailable in hospitals in resource-limited settings. This case report describes the comprehensive midwifery care of a 9-day-old preterm infant (34 weeks of gestation, birth weighs 2,100 g) with RDS in the Panji Ward of Gambiran General Hospital, Kediri, Indonesia, a type B hospital without surfactant, from 2 to 14 June 2025. The case was selected purposively, reported according to the CARE guideline, and managed with Varney's seven-step midwifery process. On admission, the infant had grunting, chest retractions, a respiratory rate of 68 breaths per minute, an oxygen saturation of 86%, and a temperature of 36.2 °C. Care comprised non-invasive continuous positive airway pressure (CPAP), monitoring of oxygen saturation and vital signs every 2–3 hours, feeding of expressed breast milk through an orogastric tube, and kangaroo mother care (KMC), with KMC education for the mother two days before discharge. After seven days, oxygen saturation was 96%, respiratory rate was 44 breaths per minute, temperature was 36.5–36.8 °C, and weight gain was 15–20 g per day. The infant was discharged at 2,200 g with stable breathing. This single case cannot establish effectiveness, but it shows how midwives can combine independent and collaborative actions to stabilize a preterm infant with RDS when surfactant is not available.

Keywords:
preterm infant; low birth weight; respiratory distress syndrome; CPAP; kangaroo mother care; midwifery care

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INTRODUCTION

Preterm birth and low birth weight (LBW) remain major challenges for neonatal health. An estimated 14.9 million babies were born preterm in 2010, which is 11.1% of live births worldwide (Blencowe et al., 2012; Walani, 2020), and complications of preterm birth are a leading cause of death in children under five years of age (Perin et al., 2022). LBW infants also contribute a large share of the global burden of neonatal disorders, particularly in low- and middle-income countries

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(Zhang et al., 2024). Improving the care of these infants is therefore central to reducing neonatal mortality.

Respiratory distress syndrome (RDS) is one of the most common complications of prematurity. It arises from lung immaturity and surfactant deficiency, leading to alveolar collapse, hypoxemia, and a high risk of respiratory failure (Sweet et al., 2023). In low- and middle-income countries, RDS has been estimated to account for about 45% of deaths attributed to prematurity (Ekhaguere et al., 2022). Effective measures exist across the care pathway: antenatal corticosteroids, delivery-room stabilization, non-invasive respiratory support, and surfactant (Sweet et al., 2023). Cost, equipment, and infrastructure, however, limit their availability in many hospitals, and in some settings surfactant cannot be given at all (Ekhaguere et al., 2022; Singh et al., 2024).

Where surfactant is unavailable, continuous positive airway pressure (CPAP) becomes the main treatment. Early CPAP in preterm infants reduces the need for mechanical ventilation and its complications, and non-invasive support is now the usual first step for infants with RDS (Boel et al., 2022; Subramaniam et al., 2021). Lower-cost bubble CPAP systems and oxygen blenders have been developed and tested for low-resource hospitals (Dundek et al., 2021; Rauschendorf et al., 2023; Wu et al., 2024), and experiences with introducing CPAP in such settings have been reviewed (Dada et al., 2021). Bedside scoring of the work of breathing helps to assess severity when blood gas analysis and radiology are limited (Singh et al., 2024).

Kangaroo mother care (KMC), which combines skin-to-skin contact, breastfeeding, and close follow-up, is a second low-cost approach. In a large trial, starting KMC immediately after birth lowered mortality among small infants (WHO Immediate KMC Study Group, 2021). A Cochrane review found that KMC reduces mortality, severe infection, and hypothermia in LBW infants (Conde-Agudelo & Díaz-Rossello, 2016), and a systematic review reported better weight gain in premature newborns (Bueno-Pérez et al., 2025). A recent randomized trial in neonatal units also found improved survival and clinical outcomes when nurses implemented KMC for preterm infants with RDS (Ramadan et al., 2025). Putting KMC into practice can still be difficult because of missing protocols, limited staff support, and limited parental involvement (Kwesiga et al., 2022; Sahoo et al., 2025).

Midwives are often involved in the daily care of preterm infants and their mothers, but written case reports that show how midwifery management is applied to a preterm infant with RDS in a hospital without surfactant are scarce. This report therefore aimed to describe the comprehensive midwifery care of a preterm infant with LBW and RDS at Gambiran General Hospital, Kediri, Indonesia, using Varney's seven-step management process, with CPAP and KMC as the main strategies, and to discuss the care in light of current evidence.

METHODS

This was a descriptive single-case study that aimed to document the comprehensive midwifery care provided to a preterm infant with LBW and RDS. The report follows the CARE guideline for case reports (Gagnier et al., 2013). The study took place in the Panji Ward of Gambiran Regional General Hospital, Kediri City, East Java, Indonesia, from 2 to 14 June 2025.

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The hospital is a type B hospital under the Indonesian hospital classification, and surfactant was unavailable at the time of the study.

The case was selected purposively because it met three criteria: a premature infant, clinical signs of RDS, and care in a type B hospital without surfactant. The participant was a 9-day-old premature neonate, with a gestational age of 34 weeks and a birth weight of 2,100 g, who was admitted because of breathing difficulty. Data were collected during the assessment step of Varney's process, which includes subjective data from the mother and family, objective data from physical examination and vital signs, and supporting data from the medical record. Vital signs recorded were respiratory rate, heart rate, temperature, and oxygen saturation (SpO_2), together with signs of respiratory distress (grunting and chest retractions) and body weight.

Care followed Varney's seven steps: data collection, interpretation of data, identification of potential problems, immediate action and collaboration, planning, implementation, and evaluation. Management of RDS followed international guidance (Sweet et al., 2023). The main interventions were non-invasive CPAP, monitoring of SpO_2 and vital signs every 2–3 hours, feeding of expressed breast milk through an orogastric tube (OGT) because the infant could not breastfeed directly, and KMC. KMC was introduced when the infant was moved to the care unit, and the mother received education and practice in KMC two days before discharge. Antenatal corticosteroids had not been given because of limited antenatal services.

Outcomes were respiratory status (respiratory rate, SpO_2, and signs of distress), body temperature, and weight gain, evaluated after seven days of care and at discharge. The data were analyzed descriptively. Findings from admission and from the evaluation were compared, summarized according to Varney's steps (Tables 1 and 2), and discussed against published evidence. No statistical tests were used because the report describes a single case. Parents gave informed consent, and the identity of the infant and family is kept confidential.

RESULTS

A 9-day-old premature neonate with a birth weight of 2,100 g and a gestational age of 34 weeks was admitted to Gambiran Regional General Hospital because of breathing difficulty. On examination, the infant showed grunting and chest retractions, a respiratory rate of 68 breaths per minute, an oxygen saturation of 86%, a temperature of 36.2 °C, and a heart rate of 148 beats per minute. RDS was diagnosed. Table 1 shows the clinical findings at admission and after seven days of care.

Table 1. Clinical findings at admission and after seven days of care

Parameter	At admission	After seven days
Respiratory rate (breaths/min)	68	44
Oxygen saturation (%)	86	96
Temperature (°C)	36.2	36.5–36.8
Heart rate (beats/min)	148	142
Signs of respiratory distress	Grunting, chest retractions	Reduced
Weight (g)	Birth weight 2,100	2,200 at discharge; gain 15–20 g/day

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Non-invasive CPAP was initiated, SpO_2 and vital signs were checked every 2–3 hours, and expressed breast milk was administered via OGT because the infant could not breastfeed directly. When the infant was moved to the care unit, KMC was introduced, and the mother received education and practice in KMC two days before discharge. Table 2 summarizes the care according to Varney's seven steps.

Table 2. Midwifery care process for the infant according to Varney's seven steps

Varney step	Findings and care provided
1. Data collection	9-day-old premature neonate, 34 weeks, birth weighs 2,100 g; breathing difficulty with grunting and chest retractions; respiratory rate 68/min, SpO_2 86%, temperature 36.2 °C, heart rate 148/min.
2. Interpretation of data	Premature LBW neonate with RDS who could not breastfeed directly.
3. Potential problems	Risk of respiratory failure and hypoxemia, hypothermia (temperature below the usual neonatal range), and inadequate nutrition and weight gain.
4. Immediate action and collaboration	Start of non-invasive CPAP in collaboration with the medical team and nursing staff.
5. Planning	CPAP, monitoring of SpO_2 and vital signs every 2–3 hours, breast milk feeding through an OGT, KMC, and KMC education for the mother before discharge.
6. Implementation	Collaborative: CPAP. Independent: monitoring, OGT feeding with expressed breast milk, introduction of KMC on transfer to the care unit, and KMC education and practice for the mother two days before discharge.
7. Evaluation	After seven days: SpO_2 96%, respiratory rate 44/min, temperature 36.5–36.8 °C, weight gain 15–20 g/day; discharged at 2,200 g with stable respiration.

After seven days, oxygen saturation had increased to 96%, the respiratory rate had fallen to 44 breaths per minute, the temperature had stabilized at 36.5–36.8 °C, and weight had increased by an average of 15–20 g per day. The infant was discharged at a weight of 2,200 g with stable respiration.

DISCUSSION

This report describes a preterm infant with RDS who improved over seven days of care that relied on non-invasive CPAP, monitored closely by the midwifery and nursing team, together with breast milk feeding and KMC. Respiratory rate fell from 68 to 44 breaths per minute, oxygen saturation rose from 86% to 96%, temperature moved into the normal range, and the infant gained weight. These findings are descriptive. With one infant and no comparison group, the improvement cannot be attributed to any single intervention, and part of it may reflect the natural course of the illness. What the case does show is that a coordinated package of simple measures was feasible in a hospital without surfactant.

The clinical picture deserves comment. RDS usually appears within the first hours after birth, and its risk falls as gestational age increases (Sweet et al., 2023), so the presentation of this late-

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preterm infant at 9 days of age warrants explanation. Other causes of respiratory distress should be considered and documented, and the basis for the diagnosis, such as a radiograph or a bedside score, should be reported. In resource-limited hospitals, the severity of distress is often judged from the work of breathing with scoring systems such as the Downes or Silverman–Andersen scores (Ekhaguere et al., 2022; Singh et al., 2024). Reporting such a score at admission and during follow-up would make future reports of this kind easier to interpret and compare.

Non-invasive CPAP was the central medical intervention. Prophylactic or very early CPAP, compared with mechanical ventilation, reduces bronchopulmonary dysplasia and the combined outcome of death or bronchopulmonary dysplasia in preterm infants (Subramaniam et al., 2021), and non-invasive support is now widely used as primary respiratory support (Boel et al., 2022). European guidelines recommend CPAP from birth for infants at risk of RDS (Sweet et al., 2023). In low-resource hospitals, CPAP is also the practical choice because it does not require a ventilator or surfactant, and guidance for such settings describes its indications, application, and complications (Singh et al., 2024). Experience with introducing CPAP in these settings shows that success depends on equipment, training, and staff support (Dada et al., 2021), and several lower-cost bubble CPAP systems and oxygen blenders have been developed and evaluated (Dundek et al., 2021; Rauschendorf et al., 2023; Wu et al., 2024). In this case, the device type, pressure, and duration were not recorded, which limits comparison with these studies and should be corrected in future reports.

Midwives and nurses contribute to CPAP care mainly through observation. Regular checks of SpO_2, respiratory rate, and signs of distress every 2–3 hours, as done here, allow early detection of deterioration and of equipment problems. Because the infant's temperature was 36.2 °C at admission, thermal care was also important. Both low and high admission temperatures have been linked to worse outcomes in preterm infants (Lyu et al., 2015), and in this case, temperature stabilized at 36.5–36.8 °C.

The infant did not receive antenatal corticosteroids, and surfactant was not available. Both are recognized elements of RDS management, and their limited availability outside tertiary centers is a known gap in resource-limited settings (Ekhaguere et al., 2022). This case therefore reflects a broader systemic problem, not just a problem of a single unit. Practical responses include earlier identification of mothers at risk of preterm birth, safe referral and transport to facilities that can give surfactant, and local protocols that make the best use of CPAP when referral is not possible. Midwives who work in antenatal and delivery services have an important role in the first two of these steps.

Nutrition and KMC were the second pillar of care. The infant could not breastfeed directly, so expressed breast milk was administered via an OGT, which protected the milk supply and the mother's involvement. KMC is associated with earlier initiation of breastfeeding in preterm and LBW infants (Mekonnen et al., 2019), and breastfeeding combined with KMC further improved weight gain in a systematic review (Bueno-Pérez et al., 2025). In that review, gains of up to 30 g per day were reported in some included studies, so the gain of 15–20 g per day observed here is within that range but should be interpreted with caution given the short follow-up.

The evidence for KMC is strong for small infants. A large trial found that initiating KMC immediately after birth reduced mortality among infants weighing 1.0 to less than 1.8 kg (WHO

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Immediate KMC Study Group, 2021), and a Cochrane review reported lower mortality, severe infection, and hypothermia in LBW infants (Conde-Agudelo & Díaz-Rossello, 2016). In preterm infants with RDS, a randomized trial in Egyptian neonatal units reported better survival and clinical outcomes when nurses implemented KMC (Ramadan et al., 2025). The present infant weighed 2,100 g and started KMC only when moved to the care unit, so these results apply only by extension. Starting KMC as early as the infant's condition allows, and with CPAP in place, is a reasonable aim for the unit.

Education of the mother is a task that midwives can lead. In this case, KMC education and practice began two days before discharge. Qualitative work with mothers and communities shows that post-discharge home practice depends on support, confidence, and continued guidance (Aziz, 2024; Kwesiga et al., 2022), and that an online training program after discharging improved breastfeeding self-efficacy among mothers of preterm infants (Kaynak & Ergün, 2024). Earlier and repeated coaching during the hospital stay, with a plan for follow-up after discharge, may therefore strengthen the effect of KMC. Barriers such as missing protocols and limited staff support should also be addressed at the unit level (Sahoo et al., 2025).

This case also highlights the importance of early recognition, standardized assessment, and continuity of care for preterm infants with respiratory distress. Midwives and nurses should document respiratory rate, oxygen saturation, temperature, heart rate, CPAP settings, feeding tolerance, and weight changes to support timely clinical decisions. When surfactant is unavailable, CPAP, thermal care, expressed breast milk, and kangaroo mother care (KMC) can form an important package of supportive care, provided the infant is closely monitored and referred when higher-level treatment is needed. However, these measures do not replace the use of surfactant when clinically indicated. Future studies should evaluate this integrated approach using standardized respiratory severity scores, complete treatment records, and post-discharge follow-up to better understand its safety and outcomes in resource-limited hospitals (Sweet et al., 2023; Ekhaguere et al., 2022; Singh et al., 2024).

This report has limitations. It describes one infant over a short period, and no comparison group was available. Key details, including the basis for the RDS diagnosis, the CPAP settings, the course between birth and admission, and the heart rate at follow-up, were not recorded. The effects of CPAP, feeding, and KMC cannot be separated, and follow-up after discharge was not included. Its strengths include a structured midwifery management process, a clear description of independent and collaborative actions, and practical value for hospitals caring for preterm infants without surfactant. Future reports should include objective severity scores, CPAP details, and follow-up, and larger studies should test whether a package of CPAP, breast milk feeding, and early KMC improves outcomes in this setting.

CONCLUSION

Comprehensive midwifery care for a preterm infant with LBW and RDS in a type B hospital without surfactant was feasible using non-invasive CPAP, close monitoring, expressed breast milk through an OGT, and KMC with maternal education before discharge. Over seven days, respiratory rate and oxygen saturation improved, temperature stabilized, and the infant gained

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weight. These observations come from a single case and do not prove effectiveness, but they show how midwives can combine independent and collaborative actions within Varney's process. Larger studies and more complete case reports are needed to confirm the value of this approach.

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