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Outcome of DAART Low-Dose Dexamethasone Therapy in Preterm Infants with Bronchopulmonary Dysplasia: A Case Series from a Tertiary Care Center

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KEYWORDS

Bronchopulmonary dyplasia (BPD)

DAART

Corticosteroids

ABSTRACT:

Introduction Bronchopulmonary dysplasia (BPD) remains a significant morbidity in extremely preterm infants requiring prolonged respiratory support. Postnatal corticosteroids can improve lung compliance and facilitate extubation, but their use is tempered by concerns of long-term neurodevelopmental sequelae. The DAART (Dexamethasone Associated with Advanced Respiratory Therapy) protocol is a structured, low-dose, short-course regimen aiming to balance efficacy and safety.

Objectives: To evaluate clinical outcomes and early neurodevelopmental follow-up of preterm infants with evolving or established BPD treated with a uniform10-dayDAARTregimen.

Methods: Prospective case series of 10 preterm infants (< 32 weeks gestation) with evolving or established BPD in a tertiary-level NICU. All infants received the 10-day DAART low-dose dexamethasone protocol. Clinical data including demographic, ventilator/oxygen support, timing of initiation, extubation, oxygen weaning, survival, and neurodevelopmental assessment at 6 months corrected age (Bayley scales, neurologic exam) were collected and analyzed.

Results: Median gestational age (GA) was 27–32 weeks, birth weight 780–1,200 g. Eight of 10 infants successfully weaned to room air; two infants (of extremely low birth weight and prolonged ventilator dependence) succumbed to severe BPD. Median initiation of DAART was between days 20–30 of life; earlier initiation was associated with better success. Among survivors, six had age-appropriate development at 6 months corrected, while two showed mild motor delay requiring physiotherapy; no severe neurodevelopmental impairment (e.g. cerebral palsy, profound cognitive delay) was detected.

Conclusions: The standardized 10-day DAART protocol facilitated respiratory weaning in most preterm infants with BPD, with reassuring early neurodevelopmental outcomes. Early initiation (day 20–30) may improve outcomes, though infants with extreme prematurity and prolonged ventilation remain high risk. Larger prospective studies with long-term follow-up are needed.

1. Introduction

Bronchopulmonary dysplasia (BPD) continues to be a major cause of morbidity in very preterm infants, particularly those requiring prolonged ventilatory support or oxygen therapy. Chronic lung injury, inflammation, and impaired alveolarization contribute to ongoing respiratory and developmental complications.Postnatal systemic corticosteroids (especially dexamethasone) have long been used to improve lung function, decrease ventilator dependency,

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and reduce BPD risk. However, early reports raised concerns about increased rates of cerebral palsy and neurodevelopmental impairment, leading to more cautious use of steroids in neonatology practice.(1–4)More recently, meta-analyses and systematic reviews have revisited the balance of benefits and risks. A 2024 meta-analysis found that dexamethasone significantly reduced the risk of BPD (relative risk ~0.66) without statistically significant increase in neurodevelopmental impairment, although adverse effects like hypertension and hyperglycemia were more common.(5) The Cochrane overview in 2024 similarly endorses late (≥7 days) systemic dexamethasone in infants at high BPD risk, but cautions that long-term neurological outcomes are inadequately studied.6 In RCT-based systematic reviews of ventilated infants, dexamethasone has shown better respiratory outcomes than hydrocortisone, though long-term neurodevelopmental safety is still uncertain.(7–8)Pilot work has also explored predictors of corticosteroid responsiveness. For example, Feldman et al. (2022) used changes in ventilator parameters and pCO_2 after dexamethasone to stratify risk of severe BPD or death, suggesting a "response phenotype" model.(9) Meanwhile, retrospective cohorts analyzing repeat dexamethasone courses have shown diminishing respiratory efficacy with subsequent courses, without clear long-term growth disadvantage.(10)Given this evolving evidence, structured low-dose regimens may offer a compromise: effective respiratory support with minimized risk. The DAART (10-day low-dose dexamethasone with advanced respiratory support adjuncts) approach is one such protocol that seeks to standardize steroid therapy in BPD-prone neonates.In this case series, we describe our experience with DAART in 10 preterm infants, focusing on respiratory outcomes, survival, and early neurodevelopmental follow-up.

2. **Objectives:** To study the outcome of DAART Low-Dose Dexamethasone Therapy in Preterm Infants with Bronchopulmonary Dysplasia in the centre .

3. Methods

Study design and setting:
This is a prospective case series conducted at a tertiary-level neonatology unit (Level III) in Saveetha Hospital Chennai from September 2024 to September 2025 . Institutional review board / ethics committee approval was obtained .

Participants:
Inborn or outborn preterm infants born at <34 weeks gestation with evolving or established BPD (defined as requirement of respiratory support / supplemental oxygen beyond 28 days) who received the DAART dexamethasone regimen.

Inclusion criteria:

- GA < 34 weeks
- Persistent respiratory support (e.g. CPAP, noninvasive ventilation, or mechanical ventilation) beyond 14–21 days
- Clinical decision to initiate DAART (per NICU protocol)
- Availability of clinical and follow-up data up to 6 months corrected age

Exclusion criteria:

- Major congenital malformations or chromosomal abnormalities
- Severe intracranial hemorrhage (Grade III/IV) or periventricular leukomalacia precluding neuroassessment
- Loss to follow-up before 6-month neurodevelopmental assessment

DAART regimen (10-day dexamethasone protocol):

Low dose (DART) protocol

0.075 mg/kg/dose 12 hourly for 3 days then,
0.05 mg/kg/dose 12 hourly for 3 days then,
0.025 mg/kg/dose 12 hourly for 2 days then,
0.01 mg/kg/dose 12 hourly for 2 days then cease.

The term "DAART" implies that steroids are combined with aggressive respiratory optimization—lung-protective ventilation, weaning protocols, early CPAP extubation trials, permissive hypercapnia, etc.

Data collection:
Data were extracted from medical records (NICU charts, ventilator logs, progress notes). Variables included:

- Demographics: gestational age, birth weight, sex, Apgar scores
- Perinatal factors: antenatal steroids, chorioamnionitis, surfactant use, patent ductus arteriosus (PDA) status, sepsis episodes
- Respiratory support: mode and duration (mechanical ventilation, CPAP, high-flow, oxygen) before and after DAART
- Timing of DAART initiation (postnatal days)
- Extubation attempts, success, oxygen weaning timeline

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- Survival (to NICU discharge, and beyond)
- Short-term complications: hyperglycemia, hypertension, sepsis, gastrointestinal bleeding, NEC, retinopathy of prematurity (ROP)
- Neurodevelopmental follow-up (6 months corrected age): Bayley Scales of Infant Development (or equivalent), neurologic exam, motor/sensory assessment
- For infants with delay, details of interventions (physiotherapy, rehab)

Definitions:

- **Successful weaning to room air:** discontinuation of all respiratory support and supplemental oxygen by NICU discharge
- **Mild motor delay:** score or milestone lag not exceeding 2 standard deviations, not qualifying as severe impairment
- **Severe neurodevelopmental impairment:** presence of cerebral palsy, profound cognitive delay (e.g. < 70 IQ equivalent), deafness, or blindness

Statistical analysis: Because of the small sample size, descriptive statistics were used. Continuous variables summarized as median (range or interquartile range), categorical variables as counts and percentages. We qualitatively assessed associations between timing of initiation and outcome success. No formal inferential statistics were applied given sample size constraints.

4. Results

Cohort characteristics: A total of 10 infants met inclusion criteria. Median gestational age was 29 (range 27–32) weeks, median birth weight 980 (range 780–1200) g. Antenatal steroid coverage was complete in 8/10. All infants received surfactant therapy; 3 infants had hemodynamically significant PDA managed medically. Sepsis episodes (culture-positive) occurred in 2 infants prior to DAART initiation.

At baseline prior to DAART:

- 2 infants were mechanically ventilated, remainder on CPAP or high-flow with supplemental oxygen
- Median postnatal age at DAART initiation was 24 (range 18–32) days of life
- The decision to initiate was based on inability to wean FiO_2 or ventilator support beyond 3 weeks

Respiratory outcomes:

- 8 of 10 infants (80 %) were successfully weaned off respiratory support and supplemental oxygen, attaining room air by NICU discharge
- Among these, the median time from DAART initiation to extubation (or weaning to noninvasive support) was 5 (3–8) days
- Two infants failed to respond: both were extremely low birth weight (< 800 g) and had prolonged ventilation (> 3 weeks) prior to DAART; these infants developed severe BPD and eventually died (cause: respiratory failure, pulmonary hypertension)
- No infant required reintubation after initial extubation failure in responders
- No cases of re-administration of steroids (i.e. no second DAART courses)

Table 1: Clinical Characteristics and Outcomes of Infants Receiving DAART

S. No	GA (weeks)	Birth Weight (g)	Pre-BPD Respiratory Support	DAART Initiation (DOL)	DAART Duration (days)	Outcome (Respiratory)	Final Status
1	28+4	1900	CPAP dependent	22	10	Weaned off day 28	Survival
2	27+4	865	CPAP	25	10	Room air day 35	Survival
3	29	912	NIV	22	10	Room air day 40	Survival
4	27+5	900	NIV	20	10	Room air day 36	Survival

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5	27+5	1120	NIV	21	10	Room air day 31	Survival
6	28+5	850	Ventilator dependent	32	10	Prolonged ventilation	Death (severe BPD)
7	29	900	NIV	30	10	Room air day 42	Survival
8	32	1200	NIV	20	10	Room air day 26	Survival
9	32	1200	NIV	25	10	Room air day 36	Survival
10	27	780	Ventilator dependent	30	10	Remained ventilator dependent	Death (severe BPD)

Short-term safety / adverse events:

- Hyperglycemia episodes occurred in 2 infants during dexamethasone administration
- Hypertension occurred in 1 infant.
- No cases of intestinal perforation or NEC temporally related to steroid therapy
- No new-onset severe sepsis or intraventricular hemorrhage (post-DAART)
- ROP rates, growth parameters (weight, length, head circumference) at discharge were comparable to unit norms

Neurodevelopmental outcomes (6 months corrected age):
Of the 8 survivors:

- 6 infants (75 % of survivors) had scores and neurologic examinations within age-appropriate norms
- 2 infants (25 %) exhibited mild motor delays (e.g. mild axial hypotonia, delayed sitting or crawling) and were referred to physiotherapy; cognitive assessments were within normal limits
- Growth parameters (weight, length, head circumference) at 6 months corrected were within expected ranges (–1 to +1 SD in most)

We did not systematically assess behavioral or cognitive domains beyond 6 months; longer-term follow-up is ongoing.

Association of timing and response: Infants in whom DAART was initiated earlier (days 15–25) showed better extubation/weaning success, whereas the two nonresponders had initiation after day 30 and had prolonged prior ventilator dependence.

5. Discussion

6. In this small case series, the 10-day DAART low-dose dexamethasone protocol was feasible in a busy tertiary NICU and was associated with successful respiratory weaning in 8 of 10 preterm infants with evolving BPD. Early initiation (days 20–30) appeared to correlate with better outcomes. The early neurodevelopmental follow-up at 6 months was reassuring, with no severe impairment observed; only 2 survivors had mild motor delays.
7. Our success rate (80 %) of respiratory weaning aligns with prior reports of low-dose dexamethasone regimens aiming to reduce ventilator dependency.(7–8)A systematic review of postnatal systemic corticosteroids in ventilated preterm infants found improved extubation rates and respiratory outcomes, though long-term neurological outcomes remain less certain.(8) More specifically, the MINIDEX feasibility RCT used very low-dose dexamethasone (50 µg/kg/day ×13 doses) and showed a trend (though underpowered) toward earlier extubation without major adverse events.(11)Pilot studies like Feldman et al. (2022) suggest that measuring early ventilatory response to steroids may help stratify risk of BPD or death.(9)
8. Concerning safety, historical RCT-based meta-analyses established concerns about increased cerebral palsy and neurodevelopmental impairment with postnatal steroids, especially high-dose or prolonged regimens(2–4)However, more recent meta-analyses indicate that moderate cumulative dexamethasone regimens reduce BPD risk without a statistically

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significant increase in neurodevelopmental impairment, although adverse metabolic effects are more frequent.5 The 2024 Cochrane overview supports late-initiated dexamethasone in high-risk infants, while cautioning that long-term neurodevelopmental data are scarce.6In observational settings, steroid exposure has been associated with abnormal general movements (higher odds of abnormal fidgety movements) in extremely preterm infants (adjusted OR ~5.5), suggesting subtle early neurodevelopmental impact that may or may not translate into later deficits(.12) In our series, early assessment did not show severe deficits, but we cannot exclude later emerging issues.

9. **Interpretations and implications** Our findings suggest that a structured, relatively short low-dose dexamethasone protocol (DAART) can be integrated into routine NICU practice with acceptable safety and beneficial respiratory outcomes in a majority of infants with evolving BPD. Early initiation (within days 20–30) may optimize response by intervening before irreversible lung injury or fibrotic changes.
10. Infants with extreme prematurity, very low birth weight, or prolonged ventilator dependence remain at highest risk of poor response—even with steroid therapy. These groups warrant careful selection and close monitoring.
11. The reassuring early neurodevelopmental outcomes support the idea that short, low-dose dexamethasone regimens may mitigate some of the historically feared adverse neurodevelopmental effects, though our follow-up is limited to 6 months.

Conclusion

In this small institutional experience, a 10-day DAART low-dose dexamethasone regimen was feasible and associated with favorable respiratory outcomes in a majority of preterm infants with BPD. Early initiation (postnatal day 20–30) appeared beneficial, whereas extremely preterm, ventilator-dependent infants remained high risk for nonresponse. Early neurodevelopmental follow-up was reassuring, with no severe impairments detected. However, longer-term, adequately powered prospective studies with extended neurodevelopmental assessment are essential before broad adoption of this approach.

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