Steroids for Bronchopulmonary Dysplasia

Site	All CHB
Setting/ Population	Inpatient NICU (Neonatal Intensive Care Unit)
Clinician	All NICU clinicians

Guideline

Purpose

The purpose of this guideline is to provide a reference for the use of post-natal steroids in the prevention and rescue management of BPD in the neonate.

Procedure

Assessment

1. PREVENTION of BPD in HIGH RISK premature neonates

For infants less than 28 weeks gestational age and between 14-21 days of life, who are at high risk for development of bronchopulmonary dysplasia, the clinical team should consider use of low dose steroids for BPD prevention. Steroids used for prevention of BPD may help reduce inflammation, promote extubation, and reduce additional barotrauma. The goal is to intervene prior to formation of fibrosis and reduce rates and severity of BPD. While there are concerns for adverse neurodevelopmental outcomes at 18-22 months of age when high dose dexamethasone is broadly used, there are likely subpopulations with high risk of mortality and morbidity who could benefit from lower dose dexamethasone or alternative corticosteroids for prevention of severe lung disease.

Definition of high risk neonates:

High risk neonates are defined using the BPD calculator (***http://bit.ly/BPDcalc***). Consider steroids if there is a > 60% risk of of moderate or severe BPD or death. Consider excluding patients if the cause of respiratory failure is felt to be transient (e.g. intubated after an operating room procedure), and consider deferring the decision to start corticosteroids if the patient is undergoing active treatment of sepsis or necrotizing enterocolitis/spontaneous

intestinal perforation. Avoid concurrent use with indomethacin medication given increased incidence of spontaneous intestinal perforation.

2. RESCUE Therapy for Severe BPD

The use of systemic steroids should be reserved for exceptional clinical circumstances (i.e. when an infant is on maximal ventilatory support at high risk for mortality), or when the child has **severe BPD** and alternative treatment choices (tracheotomy, transfer to rehabilitation facility) are less acceptable than the potential side effect profile of steroids.

Definition of severe BPD:

1) Approaching EDC and unable to wean off of vent and therefore considering tracheotomy.

2) Past EDC and unable to wean off of NCO2 > 1L/min flow and therefore unable to discharge home.

Regardless of whether indicated for prevention or rescue therapy, if steroids are used, the following are recommend:

1) Parents should be fully informed about the known short- and long-term risks and agree to treatment with corticosteroids. While a formal consent is not required, a note documenting the discussion should be written in the patient's chart.

2) Other medical management should already be optimized.

3) If a patient does not show a response, the use of steroids should be discontinued after 72 hours.

Steroid Characteristics

	Benefits	**Risks**	**Properties**
Dexamethasone	Most widely studied. Decreased rates of BPD and improvement in mortality.	***Highest rates*** of hyperglycemia, hypertension, hypertrophic cardiomyopathy, poor weight gain and neurodevelomental impairment/CP risk	No mineralocorticoid Relative potency: 25 Biological ½ life: 32 hrs
Methyl-prednisolone	Improvement in weaning off oxygen in BPD patients	No data on long-term neurodevelopment outcomes	Negligible mineralocorticoid activity Relative potency: 5 Biological ½ life: 18 hrs
Hydrocortisone	Mixed and conflicting results on effect on rates of BPD and mortality.	Increased risk of spontaneous intestinal perforation with concurrent indomethacin use	Has both glucocorticoid and mineralocorticoid activity Relative potency: 1 Biological ½ life: 8 hrs

Implementation

1. Prevention

If steroids are to be used as PREVENTION therapy for high risk neonates, **Low- Dose Dexamethasome (DART) is recommended.** Dexamethasone is the most widely studied

steroid preparation. Please see clinical pathway for details of eligibility and dosing. Hydrocortisone is also acceptable.

The majority of the studies showing adverse results used relatively high dose, long duration therapy with dexamethasone started within the first week of life. Therefore, the minimum dose of steroid that achieves a clinical response and starting after the first week of life (recommended timing day 14-21) is recommended. The following treatment recommendations are adapted from literature review and expert opinion. They attempt to expose the infant to the lowest, shortest course of dexamethasone.

Clinical Pathway

BPD guideline 2 11 21.doc

Boston Children's Hospital
Clinical Pathways

Date of Last Update: 10/15/2020
Date of Last CPAC Review: 10/15/2020
Care Venue: Critical Care

Bronchopulmonary Dysplasia (BPD) Prevention, Steroids

[A]Avoid concurrent use of steroids and NSAIDs due to increased risk of spontaneous intestinal perforation

[B]High risk for BPD:
- Infant intubated (if recently re-intubated, consider excluding patient if respiratory failure due to other causes (i.e. sepsis))
  AND
- Infant's risk of BPD or Death > 60% (death or severe/moderate BPD combined) using the BPD Calculator

[C]Response to steroid treatment indicated by decreased ventilator support, decreased oxygen support, or extubation

[D]Steroids used for prevention of BPD may help:
- To reduce inflammation
- Promote extubation from ventilator
- To reduce additional barotrauma
- Attempt to intervene prior to fibrosis

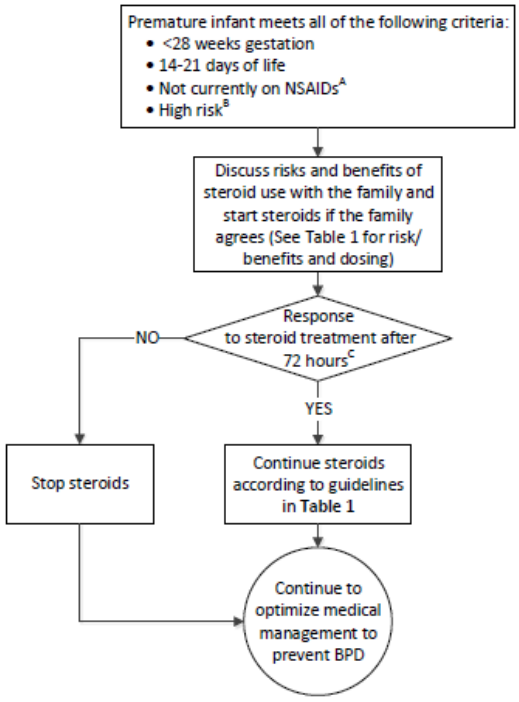

Table 1: Steroid Medication Choice[D]
- Current evidence supports use of low dose dexamethasone (DART protocol[1]) in high risk[B] neonates[2,3]
- Goal to reach anti-inflammatory plasma concentration
- Methylprednisone is an alternative steroid choice for rescue treatment for severe BPD, no clear evidence for use for prevention of BPD.
- Hydrocortisone with mixed data related to efficacy for prevention of BPD[2, 3]
- Consider use of acid-suppressing medications during steroid administration

Steroid	Course Length	Dosing (use NICU steroid powerplan)	Benefits	Risks	Properties
Dexamethasone (enteral/IV)	10 days	• Day 1-3: 0.15 mg/kg/dose q24 hours • Day 4-6: 0.1 mg/kg/dose q24 hours • Day 7-8: 0.05 mg/kg/dose q24 hours • Day 9-10: 0.02 mg/kg/dose q24 hours	• Most widely studied • Decreased rates of BPD and improvement in mortality	• Hyperglycemia, hypertension, hypertrophic cardiomyopathy, poor weight gain and CP risk	• Only Glucocorticoid activity, no Mineralcorticoid activity • Duration of action 36-72 hours

[1]Doyle LW, Davis PG, Morley CJ,McPhee A,Carlin JB ; *DART Study Investigators. Low-dose dexamethasone facilitates extubation among chronically ventilator-dependent infants: a multicenter, international, randomized, controlled trial. Pediatrics. 2006;117(1):75–83*

[2]Onland W, Cools F, Kroon A, et al. *Effect of Hydrocortisone Therapy Initiated 7 to 14 Days After Birth on Mortality or Bronchopulmonary Dysplasia Among Very Preterm Infants Receiving Mechanical Ventilation: A Randomized Clinical Trial. JAMA. 2019 Jan 29; 321(4):354-363.*

[3] Stark AR, Eichenwald E. *Prevention of bronchopulmonary dysplasia: Postnatal use of corticosteroids.* https://www.uptodate.com/contents/prevention-of-bronchopulmonary-dysplasia-postnatal-use-of-corticosteroids, accessed 05/06/20.

Dexamethasone

Low dose dexamethasone for PREVENTION (DART dosing):

- Day1-3: 0.15 mg/kg/dose q 24hours
- Day 4-6: 0.1 mg/kg/dose q24 hours
- Day 7-8: 0.05 mg/kg/dose q24 hours
- Day 9-10: 0.02 mg/kg/dose q24 hours

Hydrocortisone

- Day 1-2: 1 mg/kg/dose q6 hours
- Day 3-5: 0.5 mg/kg/dose q6 hours
- Day 6-8: 0.5 mg/kg/dose q12 hours
- Day 9-10: 0.5 mg/kg/dose q24 hours

2. Rescue

If steroids are to be used for rescue therapy, **methylprednisolone is recommended** because of its apparently superior risk: benefit ratio compared to other steroids. Either dexamethasone or hydrocortisone is also acceptable:

Methylprednisolone

Methylprednisolone for RESCUE

- Day 1-5: 2 mg/kg/dose q 24 hours
- Day 6-10: 1 mg/kg/dose q 24 hours
- Day 11-14: 1 mg/kg/dose q48 hours for two doses (skip day 11, **give dose on day 12**, skip day 13 and **give dose on day 14**).

For longer term use, consider continuing to decrease dose to 0.5 mg/kg every other day then let child outgrow dose.

Dexamethasone

Dexamethasone for RESCUE (based on DART*)

- Day1-3: 0.15 mg/kg/dose q 24hours
- Day 4-6: 0.1 mg/kg/dose q24 hours
- Day 7-8: 0.05 mg/kg/dose q24 hours
- Day 9-10: 0.02 mg/kg/dose q24 hours

*DART: Dexamethasone A Randomized Controlled Trial

Hydrocortisone

- Day 1-2: 1 mg/kg/dose q6 hours
- Day 3-5: 0.5 mg/kg/dose q6 hours
- Day 6-8: 0.5 mg/kg/dose q12 hours
- Day 9-10: 0.5 mg/kg/dose q24 hours

If patient arrives from OSH on a steroid taper, include pharmacy in discussion regarding if taper should continue as planned or be adjusted.

Evaluation

Evaluate effectiveness of the medication and discontinue after 72 hour trial if no improvement.

Documentation

Complete ***patient care documentation*** as described in the Standards and Guidelines.

Resources

Hydrocortisone for BPD Weaning Tool

Methylprednisolone/ Prednisolone for BPD Rescue Weaning Tool

Dexamethasone for BPD Rescue Weaning Tool

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Document Attributes

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