Bronchiolitis SOP

***Definition**:* Bronchiolitis is a clinically diagnosed respiratory condition presenting with breathing difficulties, cough, poor feeding, irritability and apnoea. The clinical features together with wheeze and or crepitations on auscultation combine to make the diagnosis.

Risk factors for severe disease(1)

- Age – Less than six weeks at age of presentation
- Prematurity
- Congenital heart disease
- Chronic lung disease

Differential diagnosis

Bronchiolitis is a clinical diagnosis with seasonal variation. However, it is important to consider alternate diagnoses.

Symptoms and Signs	Differential diagnosis
Tachypnoea with chest x-ray (CXR) changes	Bacterial bronchopneumonia Aspiration pneumonia Total/ partial anomalous pulmonary venous connection Heart Failure
Isolated tachypnoea/recessions	Primary airway abnormalities e.g. tracheobronchomalacia
Tachypnoea, poor perfusion +/- murmur	cardiac disorders e.g. critical aortic stenosis
Apnoea	Pertussis Sepsis NAI Metabolic disorders
Older children	Viral induced wheeze Asthma Anaphylaxis

Assessment

Moderate disease

- FiO2 <0.5 to maintain saturations >92%
- RR >50
- Nasal flaring, use of accessory muscles
- Unable to feed

Severe disease

- FiO2 >0.5 to maintain saturations >92%
- Frequent apnoea but not requiring bag and mask intervention.
- RR>70

Life-threatening disease

- Hypoxia (saturations <88% despite maximal oxygen therapy)
- Exhaustion
- Apnoea requiring bag and mask intervention.

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Investigations

Acute bronchiolitis is a **clinical** diagnosis and there is no evidence for routine investigations. However, if considering enhanced respiratory support or need for PICU support a number of investigations may be helpful. (2)

CXR
FBC (differential of pertussis if lymphocytosis)
U&E (monitoring of serum sodium – risk of hyponatraemia) – necessary at least once daily if on fluids. Watch sugars particularly in the neonate.
Secretions for respiratory strip

Management in severe disease

Treatment for bronchiolitis even for severe disease is largely supportive. Time is required.

1. Ensure adequate monitoring – continuous pulse oximetry and heart rate measurements and regular respiratory rate and blood pressure monitoring

2. Ensure airway patency – patent nares.

3. Suction secretions if required (not routine).

4. Ensure oxygen to maintain saturations >92%

5. Commence enhanced respiratory support via high flow nasal cannula at 2L/kg/min for infants <10kg.

6. Very occasionally it may be appropriate to use chloral hydrate 30mg/kg NG/PR to ensure good compliance with therapy. This should be on a case by case basis and be Consultant led.

7. Keep nil by mouth if severe respiratory distress or FiO2 >0.5 (in anticipation of possible need to intubate). As babe improves institute NG feeds early. A fed baby is a happy baby.

8. Restrict intravenous fluids to 2/3 maintenance (or 100ml/kg in a neonate). Monitor blood sugar and electrolytes.

9. Insert nasogastric tube (NGT) to prevent abdominal distension.

10. Consider antibiotics if bacterial infection is suspected.

11. There is no evidence for routine use of nebulised beta 2 agonist bronchodilators, ipratropium bromide, adrenaline, hypertonic saline or steroids. (3,4)There is no evidence that caffeine prevents intubation in apnoeic babes. (5,6)

12. Consider trial of prone position if babe is unsettled. (7)

At any time contact PICU for help and support

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High Flow Nasal Cannula

High flow nasal cannula (HFNC) therapy is generally well tolerated and should make a clinical difference in the first few hours of therapy. (8-10)

Bronchiolitis	Settings
Infants and neonates (weight <10Kg)	2L/kg/ min (minimum of 3L/min) Target sats 92-94%. Adjust oxygen as required.

There is currently no evidence to support increasing flow beyond 2ml/kg in this age group for this diagnosis. Increase in flow may lead to agitation. (11)

Weaning High Flow

Clinical improvement is usually indicated by a decrease in respiratory rate, heart rate and/or oxygen requirements. If the child is noted to be improving on this therapy consideration should be given to re-commencing NG feeds at this point to reduce distress.
The FiO_2 is the first thing to wean on HFNC and should be weaned to target saturations of >92%

Flow can usually be weaned if evidence of respiratory distress is settling and the oxygen requirement has fallen to <0.4. At this stage you could consider weaning by 1- 2L every 6- 12 hours until you reach 3L when oxygen could be converted to low flow. If at any time there is increasing evidence of respiratory distress (e.g. RR>60, FiO2 >40) the flow could be increased to the previously tolerated value and then weaned again when possible. HNFC can be weaned more rapidly as per clinical picture and there is good evidence that discontinuation can occur safely if babe has been in 21% oxygen for more than 4 hours. (9)

PICU are happy to discuss HFNC strategy at any time.

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Indications and management of intubation

Intubation is likely to be required if features of life-threatening disease (see pg1) despite HFNC.

Ensure senior paediatric review and involve the local anaesthetic team early.
PICU are happy to be contacted for advice as well as for referral for admission
Please do not delay intubation waiting for the transport team.

Ketamine is a useful induction agent (1-2mg/kg IV bolus) in view of its bronchodilator properties and cardiovascular stability. Increased respiratory secretions are not a major problem experientially in this patient population. Use a paralysis agent that you are familiar with.

1. Optimise pre-oxygenation
2. Ensure access to emergency drugs for treatment of hypotension and/or bradycardia.
3. Prepare a fluid bolus (10ml/kg) prior to anaesthesia although this is rarely required.
4. Decompress stomach by NGT aspiration.
5. Anticipate non-compliant chest once anaesthetised and muscle-relaxed. Mask ventilate with a slow respiratory rate to achieve good chest movement. Aspirate NG to ensure chest movement not compromised by abdominal splinting (common problem in neonatal group).
6. Choose appropriate endotracheal tube (ETT) to minimise leak e.g. microcuff size 3
7. Ensure end-tidal CO_2 ($ETCO_2$) monitoring available.
8. Routinely perform ETT suction post-intubation when ETT secured.
9. Initial ventilation settings
    a. I:E ratio 1:2 to start
    b. RR 20-30
    c. PEEP at least 5 cmH_2O (up to 10 depending on oxygenation)
    d. PIP to move chest (ideally <30cmH20).
    e. If volume mode target tidal volume 5-7ml/kg
10. CXR to confirm ETT position.
    a. If the ETT does need adjusted please repeat CXR as in this age group even a small change can result in a sub-optimal tube position
11. Review ventilator setting regularly and target
    a. Saturations >88% if FiO2 >0.6 or >92% if FiO2 <0.6
    b. $ETCO_2$ 5-10kPa
    c. Allow permissive hypercarbia and aim pH >7.25 if no contraindications such as pulmonary hypertension. Discuss with PICU if unsure.
12. Repeat suctioning of ETT may be helpful – problems with ventilation may well be secretion related
13. Consider physiotherapy

Other tips

- Ensure there are 2 working cannulas.
- An arterial line is only necessary if there are high oxygen requirements or high ventilator pressures. Capillary gases are completely acceptable.
- Sedate with morphine +/- midazolam. (The PICU drug calculator can be consulted to confirm infusion strength and dosage)
- A urinary catheter is useful
- If not already on antibiotics these should be commenced at this stage as per local antibiotic protocols.

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- Continue fluids at 2/3 maintenance (or 100ml/kg neonates). Check sugars.
- The transfer team are likely to bolus paralysis for transfer.

Troubleshooting

This is intended as a guide only – do not hesitate to contact PICU to discuss specific cases/problems

Struggling to settle on ventilator – high pressures, desaturation

- Ensure optimal endotracheal tube position. Very easy to slide into right main bronchus.
- Check DOPE
- *Good suction +/- physiotherapy as the most common reason for this in a bronchiolitis patient is secretion related.*

DOPE
Displacement **–** check the ETT for displacement or dislodgement
Obstruction **–** check the ETT for obstruction (mucus plug or kinked tubing)
Pneumothorax **–** check with CXR or USS
Equipment failure – disconnect the patient from the ventilator and bag manually

High CO_2

- Ensure ventilation settings optimised
- This may be secondary to mucous plugging which can respond to
    - Saline suction
    - Chest physiotherapy
- Optimise sedation
- Muscle relax
- As always consider DOPE
- In smaller patients dead space can be an issue – watch large filters etc.

Low Sats

- Increase FiO_2
- Check sats monitor
- Suction
- Optimise sedation
- Think DOPE
- Increase PEEP (max 10 unless consultant direction)
- Muscle relax

Bronchospasm (infrequent)

- Optimise sedation
- Muscle relax (avoid atracurium)
- Suction to ensure no secretions

Management in PICU

Bronchiolitis is a common cause for admission to PICU. Using a standardised approach (ABCD BFF DAISY) we will consider admission and management in PICU.
Average duration of intubation for a child with bronchiolitis with no associated underlying disease is 3 -5 days generally. Certain viruses are more likely to lead to a more prolonged course e.g. metapneumovirus.
Therapy is entirely supportive. Treatment is time.

A: On arrival to PICU consideration will be given to changing to a nasal ETT. This should not be attempted if it was felt to be a difficult intubation and there is evidence of vocal cord oedema.

On the daily ward review consideration should be given to how secure the tapes are.

B: In a straightforward bronchiolitic patient the ventilator strategy should allow permissive hypercarbia by targeting.

a. Saturations >88% if FiO_2 >0.6 or >92% if FiO_2 <0.6
b. $ETCO_2$ 5-10kPa
c. Allow permissive hypercarbia and aim pH >7.25 (unless known pulmonary hypertension)

If the patient has complex underlying disease check the ventilator strategy with the consultant.

Depending on stability gases should be performed 6 hourly.

If there are problems clearing CO_2 – see troubleshooting section initially. If the problems do not improve with these measures may need to consider paralysis and high frequency oscillator ventilation. See separate guideline.
If continued problems with oxygenation consider iNO or high PEEP strategy.

CXR is not a daily requirement unless on oscillation. Consider if deterioration.

C: Cardiovascular stability should be ensured. It is unusual to need extra fluid or inotropic support in bronchiolitis. If required review diagnosis, consider sepsis or underlying cardiac condition.

However if oscillation is required some cardiovascular support may be necessary.

D: Ensure BMs are stable whilst on IV fluids

B: Ensure blood trends are reviewed daily. Initially once daily FBC, UE and CRP required.

F: Fluids should be 2/3 maintenance initially due to risk of hyponatraemia. Positive balance in the first 24 hours of PICU admission may be associated with worse prognosis. (12)

F: NG feeds should be commenced as soon as possible to ensure nutrition – ideally within 12 hours of admission.

D: Pre-admission drugs should be prescribed. If NG feeds are not expected to be quickly introduced and built up then PPI cover should be provided.

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A: These children may be less than 5kg which should be highlighted and requires special Care with prescribing and ensure routine neonatal care and immunisations are not missed.
If they are paralysed this is another alert to be aware of to ensure that appropriate eye care is prescribed and that a daily paralysis holiday is considered.

I: All babies should have Point of care respiratory viruses test and BBAL in the first hours of admission. Apnoeic babies and those with most severe disease should have a septic screen. If antibiotic cover has not been commenced prior to admission it should be commenced at this stage as per local policy. There is no evidence that antibiotics work in bronchiolitis but it is pragmatic to start them and reconsider with more clinical information. Most stop in the next 48 hours.

S: Sedation is often commenced with morphine and midazolam initially aiming for the lowest effective dose. In younger neonates consideration should be given as to whether midazolam is necessary.
Once the enteral route is available this should also be considered for sedation e.g. chloral hydrate and promethazine
If the child remains sedated for more than a week consideration should be given to cycling the sedation

Y: It is always the aim to have children in PICU for the shortest time safely possible and the reason for their ongoing interventions should be reviewed daily with the aim of stepping down treatments as soon as possible. In terms of lines and tubes: Central lines and arterial lines are reserved for the sickest cohort. All invasively ventilated must have working access in the form of a cannula or mid-line.

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