

BRONCHIOLITIS

Facilitators Guide

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Duration **Up to 2 hrs**

Facilitator level **ST4+/ANP equivalent+**

Learner level **Most useful for those experience seeing paediatric patients regularly: FY1+,**

band 5+ nurses

Equipment required **None**

OUTLINE

- **Basics (10 mins)**
- **Main session: (2 x 15 minute)** case discussions covering the key points and evidence
- **Advanced session: (2 x 20 minutes)** case discussions covering grey areas, diagnostic dilemmas; advanced management and escalation
- **Quiz (10 mins)**
- **Infographic sharing (5 mins):** 5 take home learning points

We also recommend printing/sharing a copy of your local guideline for sharing admission criteria.

PRE-READING

Khan Academy pathophysiology video

OpenPaediatrics YouTube vid summarising pathophysiology

Khan Academy pathophysiology video

OpenPaediatrics YouTube vid summarising pathophysiology

Best practice: Bronchiolitis, Archives of Disease in Childhood E+P (2005)

McMaster Pathophysiology Review: Bronchiolitis (2004)

Also aim to listen to the PEM Playbook or EM Cases Podcast.

PEM Playbook (2016)

EM cases (2015)

BASICS (DOES NOT NEED TO BE INCLUDED BUT FOR INFORMATION IF IT COMES UP IN DISCUSSION)

PATHOPHYSIOLOGY (FROM PEM PLAYBOOK)

The classic clinical presentation of bronchiolitis starts just like any other upper respiratory tract infection: with nasal discharge and cough, for the first 1-2 days. Only about 1/3 of infants will have a low-grade fever, usually less than 39°C.

We may see the child in the ED at this point and not appreciate any respiratory distress – this is why precautionary advice is so important.

Then, lower respiratory symptoms come: increased work of breathing, persistent cough, tachypnea, retractions, belly breathing, grunting, and nasal flaring. Once lower respiratory symptoms are present, like increased work of breathing, they typically peak at day 4. This may help to make decisions or counsel parents depending on when the child presents and how symptomatic he/she is (bear in mind that the same severity on day 1 would be seen as more concerning than on day 4). You'll hear fine crackles and wheeze.

CAUSES

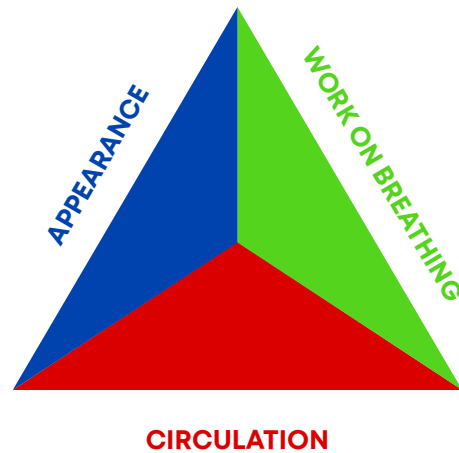
Respiratory syncytial virus is the culprit in up to 90% of cases of bronchiolitis. The reason RSV is so nasty is the immune response to the virus: it binds to epithelial cells, replicates, and the submucosa becomes edematous and hypersecretes mucus. RSV causes the host epithelia and lymphocytes to go into a frenzy – viral fusion proteins turn the membranes into a sticky goop – cells fuse into other cells, and you have a pile-on of multinucleated dysfunction. This mucosal chaos causes epithelial necrosis, destruction of cilia, mucus plugs, bronchiolar obstruction, air trapping, and lobar collapse.

ASSESSMENT (FROM EM CASES)

The ABCs of the Pediatric Assessment Triangle:

APPEARANCE

- Tone
- Interactiveness
- Consolability
- Look or gaze
- Speech or cry
- Also bear in mind there are some red flag features e.g. floppy, pale or blue episodes



BREATHING

- Upper limit of normal respiratory rate by age:
- Term newborn: 50bpm
- 6 month old: 40 bpm
- 12 month old: 30 bpm

- Signs of respiratory distress
- Abnormal breath sounds
- Tripod position (More relevant to viral wheeze and asthma)
- Recession
- Nasal flaring
- Bear in mind red flag features - head bobbing, grunting

CIRCULATION

- Pallor
- Mottling
- Cyanosis

CASE 1 (15 MINS)

A 7 month old infant presents on Day 4 of the illness. He has mild to moderate work of breathing. Sats 95% in air. He is taking around half his normal feeds.

What investigations and treatment options should you consider?

Why doesn't salbutamol work in this age group?

How do you know when to admit?

DISCUSSION POINTS:

PREDICT systematic review of all treatments (from DFTB)

- Salbutamol – there is no benefit in using salbutamol in infants with bronchiolitis (and some evidence of adverse effects)
- Nebulised adrenaline – no clinically useful benefit (there is evidence for temporary effect but not for improvement in outcome)
- Nebulised hypertonic saline – there is weak evidence of a reduction in length of stay of 0.45 days. However when two studies were removed, both of which used a different discharge criteria than most hospitals, there was no benefit. This is not recommended routinely, although the authors suggest that it should be used only as part of an RCT
- Antibiotics – not recommended (The risk of a secondary bacterial infection is very low, and there is potential harm from giving antibiotics)
- Oxygen – no evidence of benefit in infants with no hypoxia, and low level evidence that maintaining the sats over 91% with oxygen actually prolongs the length of stay. There are no reports of long-term adverse neurodevelopmental outcomes in infants with bronchiolitis, however there is also no data on the safety of targeting sats <92%. Commence oxygen therapy to maintain sats over 91%.
- Glucocorticoids – no benefit
- Sats monitoring – there is moderate evidence suggesting that continuous sats monitoring increases the length of stay in stable infants
- High flow – there is low to very-low level evidence of benefit with high flow
- Chest physiotherapy – not recommended
- Saline drops – routine saline drops are not recommended but a trial with feeds may help
- Feeds – both NG and IV are acceptable routes for hydration

Beta receptor mythbusting (from gppaedstips.blogspot.com)

This myth comes from early studies that failed to find evidence of beta-receptors in infants. Since then, (as early as 1987) research of better methodology has proven that these receptors are there from birth.

The myth persists because (just as the news reports plenty of crises but not so many resolutions) we are often told things, but rarely does anyone untell us something.

Perversely, the beta-receptor folklore has done us no favours when it comes to trying to understand bronchiolitis and viral wheeze.

The uncertainty created by this myth makes clinicians think that a lack of beta receptors has caused the lack of response to salbutamol. In fact, the child would respond just fine if only they had bronchospasm.

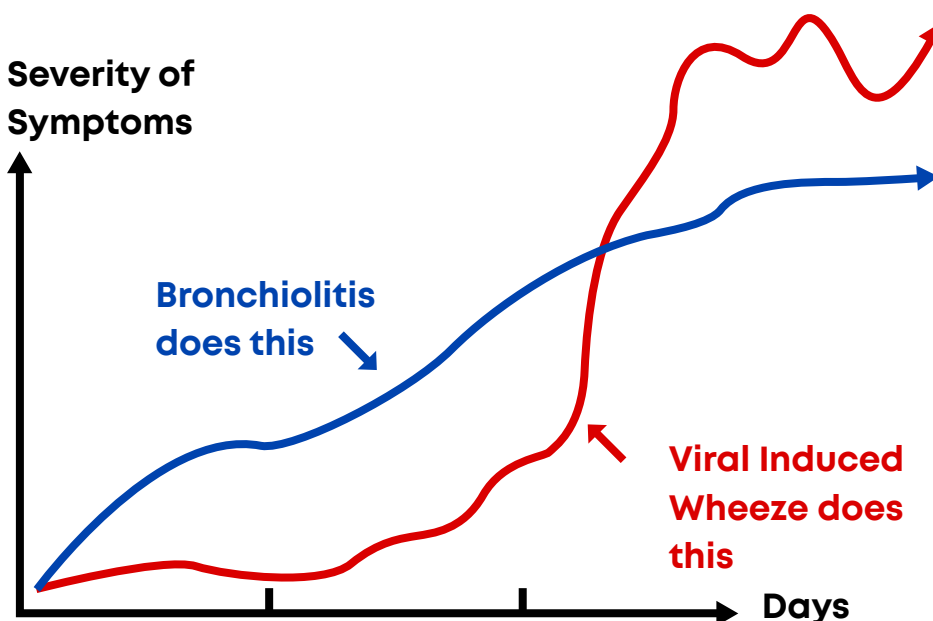
In bronchiolitis, there is no bronchospasm so salbutamol does not help.

In viral wheeze, ipratropium is a poor treatment and the old myth about ipratropium leads some to believe that ipratropium is the first line treatment for this age group when what they really need is plenty of salbutamol if they really do have bronchospasm.

When discussing the management of wheeze in infants, I often get the impression that people believe that bronchiolitis is just what you call viral wheeze in a child under the age of 12 months. In fact this is not true.

Bronchiolitis is a separate entity, with different histopathology and a unique clinical pattern of illness. There is a gradual onset of symptoms, peaking at day 3-4 and beginning to resolve at day 7-10.

Doesn't sound very spasmy does it?



Of course the confusion arises from the fact that both bronchiolitis and viral wheeze are caused by a viral illness. They can both occur in a child around the age of 12 months old and they cause similar symptoms. There is however a subtle but helpful difference in the way that they present.

The reason for this difference is a difference in mechanism.

While bronchiolitis and viral wheeze share a cause, the pathology is different because the effects on the airways are different.

I suppose that since it is unrealistic to think that all uncertainty can be removed, the question remains, what is the harm in trying a bronchodilator in every case, just in case? Here are a few possible reasons why it is going to make things worse if it isn't going to make things better:

Possible adverse effects of giving unnecessary Inhalers to a baby with bronchiolitis:

- Tiring the baby out by upsetting them
- Increasing airway resistance (crying at least doubles resistance)
- Driving Tachycardia
- Ipratropium and salbutamol may rarely cause arrhythmias

Source GPpaedsTips.blogspot.co.uk

SEND HOME V ADMIT. (PEM PLAYBOOK)

Watch out especially for young infants, so those less than 3 months of age. Apnea may be the presenting symptom of RSV. Premature infants, especially those less than 32 weeks' gestation are at high risk for deterioration. The critical time is 48 weeks post-conceptual age. Other populations at high-risk for deterioration: congenital heart disease, pulmonary disease, neuromuscular disorders, metabolic disorders.

Neonates less than one month of age are at highest risk for apnoea — they should be admitted. Generally speaking — in the full term child, greater than three months of age, and otherwise healthy (no cardiac, pulmonary, neuromuscular, or metabolic disease), we can look to three simple criteria for home discharge. If the otherwise healthy child three months and older is: euvolemic; not hypoxic; and well appearing... they can likely go home.

NICE ADMISSION GUIDANCE

- Measure oxygen saturation using pulse oximetry in every child presenting to secondary care with clinical evidence of bronchiolitis.
- When assessing a child in a secondary care setting, admit them to hospital if they have any of the following:
 - apnoea (observed or reported)
 - persistent oxygen saturation of less than 92% when breathing air;
 - inadequate oral fluid intake (50–75% of usual volume, taking account of risk factors and using clinical judgement);
 - persisting severe respiratory distress, for example grunting, marked chest recession, or a respiratory rate of over 70 breaths/minute.
- When deciding whether to admit a child with bronchiolitis, take account of any known risk factors for more severe bronchiolitis such as: chronic lung disease (including bronchopulmonary dysplasia); haemodynamically significant congenital heart disease age in young infants (under 3 months); premature birth, particularly under 32 weeks; neuromuscular disorders; immunodeficiency.
- When deciding whether to admit a child, take into account factors that might affect a carer's ability to look after a child with bronchiolitis, for example: social circumstances; the skill and confidence of the carer in looking after a child with bronchiolitis at home; confidence in being able to spot red flag symptoms; distance to healthcare in case of deterioration.

CASE 2 (15 MINS)

A 6 month old infant presents on Day 3 of the illness. She has moderate to severe work of breathing. Sats are 91% in air. She is struggling to feed at home.

What management options would you consider?

Discussion around high flow. PARIS Paper. (DFTB)

Inclusion Criteria

Infants <12 months with a diagnosis of bronchiolitis (AAP criteria) requiring oxygen to maintain saturations
Data collected from 17 hospitals in Australia over a three year period

High Flow

Humidified high flow oxygen (2L/kg) via Optiflow.
FiO2 adjusted to maintain saturations.
Wean as tolerated.
High flow was ceased after four hours of an FiO2 of 0.21

Exclusion Criteria

Critically ill, cyanotic heart disease; basal skull fracture; upper airway obstruction; craniofacial malformations; or on home oxygen

Oxygen

Oxygen via nasal cannula up to 2L/min to maintain saturations
FiO2 adjusted to maintain saturations.
Wean as tolerated.

Primary Outcome

Escalation of care (increased respiratory support or ICU admission) due to meeting three out of the four criteria:

The Numbers

1472
Included

733
Standard Oxygen

739
High Flow

167
Escalated

87
Escalated

The Stats

<0.001
ESCALATION p value

9
NNT

Some caution must be used around the potential for erroneous use of the high-flow circuits themselves and the interpretation of early warning scores in the context of high-flow use.

PARIS was supported with significant nursing education resources potentially reducing errors to a level that were below what could be expected with the standard resourcing of mixed EDs and other environments where high-flow use in children may be infrequent. As with many grey areas in medicine protocols as to how we use high-flow vary by institution with little more than opinion to guide them.

Though neither the intention nor the conclusion of this paper in showing the progress of such a large number of children on high-flow, this trial also provides a basis for more robust decision making around how we use high-flow itself.

Do you know how to set up high flow?

(watch video or demonstrate)
(8 minutes)

How to set up Airvo 2 (Optiflow)

(3.5mins)

How to use Airvo 2

(6 mins)

DISCUSSION AROUND NG V IV FLUIDS

NICE feeding guidance

- Give fluids by nasogastric or orogastric tube in children with bronchiolitis if they cannot take enough fluid by mouth.
- Give intravenous isotonic fluids (see the NICE guideline on intravenous fluids therapy in children) to children who: do not tolerate nasogastric or orogastric fluids; or have impending respiratory failure.

ADVANCED DISCUSSION (20 MINS PER CASE)

This is an opportunity to cover grey areas, diagnostic dilemmas and advanced management and escalation if there are more experienced trainees or senior registrars in your group.

ADVANCED CASE 1

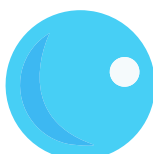
You have a 12 month old, with two days of coryza and one day of increased work of breathing symptoms. How do you manage them? How do you figure out whether they have bronchiolitis or VIW?

Practically speaking, we know that bronchiolitis and viral induced wheeze have two quite different management pathways, but it is not as if a child moves from being 12 months old to 13 months old and therefore cannot have bronchiolitis (or vice versa for viral induced wheeze). These conditions as previously mentioned, exist on a spectrum.

Some questions to further discussion:

What would you look for on history and examination to help you decide?

- What has been the onset of symptoms? Progressive over days is most consistent with bronchiolitis. Onset of wheeze and respiratory distress over hours is most consistent with bronchospasm (viral induced wheeze).
- What has been the pattern of their work of breathing?
- How significant is the work of breathing?
- What are the auscultation findings - is there presence of focal findings? Wheeze? Crackles?
- Is this affecting the child functionally with feeding or sleeping difficulties?
- If auscultation is suggestive of possible viral induced wheeze or at least, a component of wheeze that may be responsive to bronchodilators (If wheeze is present and no crackles or focal findings) and presuming the child has more than just mild work of breathing -then we suggest this may be a possible candidate for viral induced wheeze.



At what age would be appropriate to consider a trial of ventolin for potential viral induced wheeze vs bronchiolitis?

- (Note - This is a good opportunity to survey your team and colleagues to see what the practice is at your local department).

- Regarding this grey area question, in Australian practice, some clinicians will trial salbutamol for potential viral induced wheeze if the child is 12 months or older. Other doctors may wish to trial if the child is slightly younger (e.g. from 10 months) if they have a strong family history of asthma and atopy or if they have had previous ventolin use reported by their family with good effect. The younger the child is, the less likely that the story and case is to fit viral induced wheeze.

If you have decided to trial ventolin - would you give only an initial 6 puffs and reassess or would you give a burst (x puffs x 20 minutely x 3) ?

- It would be prudent to give 6 puffs (or do you use another number?) and reassess following to see if there is any improvement or change.

ADVANCED CASE 2

You've started high flow 2L/kg for a four month old with bronchiolitis, moderate work of breathing and saturations of 88% and titrated FiO₂ up to 30% to maintain saturations.

However they are still intermittently desaturating so you titrate them up to 40% FiO₂.

**They have ongoing work of breathing with a respiratory rate of 60-70?
What are your next steps?**

Some issues to consider:

Ensuring you have appropriately assessed and optimised their condition

How would you reassess the patient?

- Consider revisiting history, respiratory examination and consider adjuncts to assessment such as a capillary or venous blood gas.

Is their nutrition optimised to minimise work of breathing?

- For example, Do they have an NG tube on free drainage, are they nil by mouth and on IV fluid support at $\frac{2}{3}$ maintenance
- Are they working harder to breathe because they are getting “hangry” and might actually tolerate a continuous NG or comfort feed?
- Are their family actually compliant with this or have also been feeding them via a bottle?

Have you accurately assessed the effect of the intervention (HFNP)?

- Consider whether the HFNP has led to no change, improvement and then deterioration or simple worsening of symptoms due to patient distress.
- If no improvement was observed on commencement - it may be worth de-escalating them - ie. lower flow rates or low flow nasal prongs

What could be missing?

- Consider your confidence of whether you have the right diagnosis or if there is need to assess for a secondary pathology such as pneumonia, foreign body, cardiac contribution? Do you need to further investigate with bloods, CXR? Do you need to append your management and provide antibiotic coverage? Do you need to assess for a complication from treatment e.g. pneumothorax.

Escalation options

- Have you sought a senior review/notified the admitting paediatrician?
- Do you need an ICU consult, NETS consult or retrieval to a tertiary centre?
- How long are you comfortable to wait to see if there is a response to high flow?

Non invasive ventilation - Switching to CPAP

- What settings would you start on?
- Where could you move up to (in terms of peep, FiO₂)
- How soon would you reassess - what are you looking for?

Does this child need to be intubated?

- How would you determine this?
- Who should be involved in the conversation?
Who should perform the intubation?
- What sedation would you use?
- What equipment would you use?
- What settings would you use?

SIMULATION (30-60 MINS)

See the optimus bonus sim scenario:



QUIZ QUESTIONS (10 MINS)

Question 1.

In bronchiolitis, children do not respond to salbutamol because:

- | | | | |
|--|--|--|--|
| A
They don't have beta receptors until they are older. | B
The beta receptors are immature and do not begin functioning correctly until the child is older. | C
The large amount of secretions interfere with it and prevent it binding to the receptors | D
There is no bronchospasm for the salbutamol to act on. |
|--|--|--|--|

Question 2.

A 3 month old baby presents to ED with coryza, cough, and poor feeding. Breastfeeding is going ok, but the baby is feeding for shorter periods, more frequently than usual. She is having wet nappies as normal. Saturations are 93% on room air, RR is 62, and there is moderate subcostal recession with some nasal flaring.

Which of the following is an indication to admit this baby to hospital?

- | | | | |
|---------------------------------------|-----------------------------|-----------------------------------|---------------------------------|
| A
The reduced breastfeeding | B
The oxygen sats | C
The work of breathing | D
The age of the baby |
|---------------------------------------|-----------------------------|-----------------------------------|---------------------------------|

The criteria for admission usually are:

- | | | | |
|--|------------------------------------|-----------------|--------------------|
| • feeding less than half of usual, or less wet nappies | • saturations less than 92% on air | • increased WOB | • apnoeic episodes |
|--|------------------------------------|-----------------|--------------------|

Risk factors such as:

- Ex-prem
- Age less than 12 weeks or less than 37 weeks CGA
- history of lung disease or congenital heart disease or neurological problems
- smoke exposure

In clinical practice, you would use your judgement to assess if hospitalisation was necessary. Social concerns should always be considered.

In this case, the baby is maintaining good urine output and the feeds, although shorter, are more frequent. The age alone is not an indication for admission. Obviously, an O₂ requirement would be an indication for admission but most units would consider sats of 92% or less as reduced.

There is significantly increased work of breathing with recession and nasal flaring, however, so this would be the main indication for admission.

Question 3.

You have a 10 month old baby with bronchiolitis who is to be commenced on high flow. Which of the following is false?

- | | | | |
|---|---|--|--|
| A
Nasal prongs size should be estimated based on the width of the patient's nostrils. | B
Patients can be NG fed immediately once on high flow. | C
High flow improves the functional residual capacity. | D
The humidified oxygen help clearing mucous secretions. |
|---|---|--|--|

Patients on high flow will likely need an NG inserted due to abdominal distention, but should usually not be fed for the first couple of hours on high flow.

The aim of high flow is to provide humidified, high flow to improve clearance of secretions and to increase the functional residual capacity. Together this should reduce the work of breathing.

Finish - infographic of the take home tips (5 mins)

- 1 Do not trial salbutamol (and understand why it doesn't work)
- 2 Consider NG fluids as an option for feeding
- 3 Understand there is likely to be no role for investigations
- 4 Consider starting high flow and know how to set it up
- 5 Know when to admit v discharge

REFERENCES

Khan Academy pathophysiology video

OpenPaediatrics YouTube vid summarising pathophysiology

Best practice: Bronchiolitis, Archives of Disease in Childhood E+P (2005)

McMaster Pathophysiology Review: Bronchiolitis (2004)

PEM Playbook - Bronchiolitis (2016)

EM cases - Bronchiolitis (2015)

Why bronchiolitis doesn't get better with inhalers and how understanding "why?" is better than "do that!", GPPaedstips (2016)

NICE: Bronchiolitis in children - diagnosis and management (2015)

DFTB - PARIS in the autumn (2018)

DFTB - Bronchiolitis guidelines (2018)

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