

Management of bronchiolitis in infants: key clinical questions

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Abstract

Bronchiolitis is the most common lower respiratory tract infection in infants. It is a seasonal illness and remains the leading cause of hospitalisation of infants worldwide. Respiratory syncytial virus (RSV) is responsible for approximately 70% of cases. Infants present with coryzal symptoms progressing to a cough and respiratory distress. A mild pyrexia and reduced feeding are common. Bronchiolitis is a clinical diagnosis and investigations are often of limited value. The management of bronchiolitis remains a contentious issue with a wide variation in practice. Recently there has been a significant shift in favour of minimally invasive, supportive therapy as the cornerstone of management. This typically involves minimal handling, nasopharyngeal suction, oxygen supplementation and optimising hydration. There is little evidence to support the use of pharmacological agents in managing of bronchiolitis. Palivizumab, a monoclonal antibody targeting RSV, can be administered to high risk patients in an attempt to reduce admission rates.

Keywords bronchiolitis; hypertonic saline; palivizumab; respiratory syncytial virus

Background

What is bronchiolitis?

Bronchiolitis is the most common lower respiratory tract infection in infants. Acute inflammation results in necrosis and sloughing of cells lining the airway, especially the bronchioles, bronchospasm and increased mucus production. Bronchiolitis shows a seasonal pattern with peak incidence in winter months. Respiratory syncytial virus (RSV) is responsible for approximately 70% of cases of bronchiolitis. Other causal agents include rhinovirus, human metapneumovirus, influenza, para-influenza, bocovirus and adenovirus.

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What is the epidemiology and economic burden of bronchiolitis?

Approximately one third of infants will develop bronchiolitis within the first year of life and 90% by the age of two. It remains the most common reason for admission of infants to hospital worldwide. Admission rates are highest in those aged less than 3 months. Bronchiolitis imposes a significant burden on healthcare services worldwide. It is responsible for approximately 128,000 hospital admissions each year in the United States of America (USA) at an estimated cost of US\$1.73 billion. In England there are an estimated 37,200 cases per year resulting in an annual burden of £83.8 million (£2254 per case).

How is bronchiolitis diagnosed?

Bronchiolitis is a clinical diagnosis. Infants typically present with a coryzal prodrome. Mild fever and reduced feeding are also common. Very young infants may present with apnoea. After one to two days lower respiratory signs, including a troublesome cough, are noted as a consequence of airway secretion retention and narrowing of the bronchi/bronchioles. Clinical examination will often reveal evidence of increased work of breathing. On auscultation there may be wheeze and/or crepitations throughout both lung fields. UK guidelines, published by the National Institute for Health and Care Excellence (NICE), suggest a positive diagnosis should be made in the presence of the following clinical features:

'Diagnose bronchiolitis if the child has a coryzal prodrome lasting one to three days, followed by:

- *Persistent cough and*
- *Tachypnoea and/or chest recession and*
- *Wheeze and/or crackles on chest auscultation'*

Are investigations useful in making the diagnosis?

Bronchiolitis is a clinical diagnosis and investigations should not be performed routinely. Nasopharyngeal aspirates are often sent for viral strip testing using molecular PCR. The results rarely influence management decisions. Theoretically knowledge of the causal agent may allow cohorting of patients. In practice this is not always feasible. There is emerging evidence to suggest that rhinovirus infection is a much stronger predictor of subsequent asthma than RSV bronchiolitis. Further research is needed but if rhinovirus infection does subsequently prove to be a good marker of future asthma risk there may be a need to consider possible interventions which could reduce the risk. Chest radiography should be avoided as changes on the film may mimic pneumonia and lead to inappropriate antibiotic prescribing. The NICE guidelines do suggest considering a chest X-ray if the fever is greater than 39 °C, chest signs are persistently focal or in severe cases. Blood sampling including blood cultures may be appropriate in severe cases or if there is a possibility of a concomitant serious bacterial infection. It is also essential to check electrolytes in any infant requiring intravenous fluids as hyponatraemia, secondary to inappropriate anti diuretic hormone (ADH) secretion, can occur.

What is the clinical course?

There is a spectrum of severity ranging from infants with very mild disease to those who develop respiratory failure. The illness typically reaches peak severity around days 5–7. The cough may persist for a period of weeks and parents should be made aware

of this. Risk factors for severe disease include prematurity, chronic lung disease, immunodeficiency, airway defects, congenital heart disease and parental smoking. Breast feeding reduces the risk of RSV related hospital admission.

Management

The management of bronchiolitis is a contentious topic. Recently updated guidelines by NICE and the American Academy of Pediatrics (AAP) support a minimal intervention approach to management. However, there remains a wide variation in clinical practice.

Which patients require admission to hospital?

The majority of infants with bronchiolitis can be managed at home. The recent NICE guidelines, however, clearly outline clinical features which should trigger admission to hospital (Box 1).

It is also important, when deciding whether admission is required, to consider the presence of any underlying comorbidities and to be mindful of factors which may affect the parent's ability to look after a child at home such as social circumstances and their ability to identify deterioration. For infants admitted to hospital supportive care forms the mainstay of treatment.

What does supportive care involve?

Supportive care typically involves:

- **Minimal handling:** Infants with bronchiolitis are generally intolerant of interventions and minimal handling is recommended to avoid exhaustion.
- **Nasopharyngeal suction:** Bronchiolitis leads to increased nasopharyngeal secretions. This can interfere with the ability to feed orally. Traditionally nasopharyngeal suction has been used to clear secretions and facilitate feeding. NICE guidelines recommend considering upper airway suctioning in children who have respiratory distress or feeding difficulties secondary to upper airway secretions. A study published in 2013 revealed a significant association between increased length of stay (LOS) and percentage use of deep suctioning during the first 24 hours of admission, with an average difference of 0.6 days between groups with low and high exposure. It was proposed that this may result from deep suctioning causing oedema and irritation of the upper airway. As the trial was not randomised, however, it may be that these infants were more unwell

NICE recommendations for admission to hospital

When assessing children in the 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 into account risk factors and using clinical judgement
- Persisting severe respiratory distress e.g. grunting, marked recession or a respiratory rate of more than 70 breaths/minute

Box 1

initially explaining why they received increased suction and had a longer length of stay. If needed gentle, low pressure suction should be used.

- **Fluid management:** Infants with bronchiolitis may have decreased oral intake and increased insensible losses due to excess nasopharyngeal secretions and respiratory distress. An assessment of hydration is therefore essential. In mild cases oral fluid intake is often sufficient. In patients with reduced feeding and/or significant respiratory distress fluid replacement therapy may be required. In 2013 a randomised control trial (RCT) in infants with bronchiolitis aged 2–12 months revealed that intravenous fluid hydration and nasogastric hydration are equally efficacious and safe methods of administering fluid replacement therapy in bronchiolitis. A pilot study was published later that year which demonstrated that nasogastric hydration had comparable outcomes with IV fluid hydration in patients under 6 months with moderate bronchiolitis. In addition a recent retrospective cohort study considered infants under 2 months of age who received either nasogastric fluid replacement therapy or intravenous fluid and found similar rates of complications between the methods. If commencing intravenous fluids it is important to monitor urinary output, electrolytes and consider restricting fluid volumes.
- **Oxygen (acute phase):** The recent NICE guidelines suggest providing oxygen supplementation if oxygen saturations are persistently less than 92%. The AAP recommends a lower permissive hypoxaemic target for an oxygen saturation of 90% in children with bronchiolitis.

Other forms of respiratory support and pharmacological interventions have been trialled in the management of bronchiolitis.

What is the evidence regarding the use of other forms of respiratory support in bronchiolitis?

- **High-flow nasal cannula (HFNC) oxygen:** The use of heated and humidified HFNC therapy allows delivery of higher inspired gas flows of an air/oxygen blend and provides some level of continuous positive airway pressure. It is generally better tolerated than continuous positive airway pressure (CPAP), however, the level of pressure provided is less predictable. A Cochrane review in 2014 only identified one small randomised control trial and concluded that there was insufficient evidence to determine the effectiveness of HFNC therapy. The use of HFNC therapy does look promising and a large, multicentre, randomised paediatric acute respiratory intervention study (PARIS) is currently recruiting which it is hoped will provide further assessment of the efficacy of HFNC therapy.
- **Continuous positive airway pressure:** CPAP acts to prevent airway collapse and in theory should lead to improved work of breathing and gas exchange. The evidence supporting the use of CPAP in bronchiolitis is of low methodological quality and further research is needed.
- **Mechanical ventilation:** Early liaison with a paediatric intensive care unit is important in patients with impending respiratory failure. Mechanical ventilation may be required. In this situation there is little evidence to suggest that administration of surfactant is better than placebo at reducing mortality, duration of stay or respiratory deterioration.

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