Bronchiolitis

Bronchiolitis is an acute infectious disease of the lower respiratory tract that occurs primarily in the very young, most commonly infants between 2 and 6 months old. It is a clinical diagnosis based upon:[1]

- Breathing difficulties
- Cough
- Decreased feeding
- Irritability
- Apnoeas in the very young
- Wheeze or crepitations on auscultation

It is usually due to a viral infection of the bronchioles. Respiratory syncytial virus (RSV) is the most common pathogen, causing 50-90% of cases. A combination of increased production of mucus, cell debris and oedema produces narrowing and obstruction of small airways.

It is the most common cause of hospitalisation in infants and of acute respiratory failure in paediatric intensive care units (PICUs) in the UK. [2]

There is a significant discrepancy between the use of ‘bronchiolitis’ in the UK and in the USA and other parts of Europe. In the UK, the term describes an illness in infants, beginning as an upper respiratory tract infection (URTI) that evolves with signs of respiratory distress, cough, wheeze, air trapping and bilateral crepitations. In North America, bronchiolitis is used to describe a wheezing illness associated with an URTI in children up to the age of 2 (whilst this would be described as a ‘viral-induced wheeze’ in the UK). This causes difficulties in interpreting results of clinical trials, as the populations may display considerable heterogeneity.

Causes

- Respiratory syncytial virus (RSV)[3]
- Human metapneumovirus (hMPV) - causes a similar spectrum of illness to RSV and is thought to be the second most common cause [4]
- Adenovirus - occasionally causes a similar syndrome with a more virulent course
- Parainfluenza virus
- Other less common causes include:
  - *Mycoplasma pneumoniae*
  - Enterovirus
  - Influenza virus
  - Rhinovirus
  - *Chlamydia pneumoniae*

Epidemiology

- Peak incidence of RSV infections is in the winter months (November to March), although the size of the peak varies from winter to winter. [3]
- Prevalence may be higher in urban areas.
- By their first birthday over 60% of children have been infected and, by 2 years of age, over 80%. The antibodies that develop following early childhood infection do not prevent further RSV infections throughout life. [3]
- One study used Hospital Episode Statistics to identify all children aged below 2 years who were discharged from hospital with a primary code of bronchiolitis in England, between 1 April 2007 and 31 March 2010. This reported a total of 75,318 admissions during the study period. [9]
- Hospital admission rates have increased over a period of ten years. The cause for this is unknown but may in part be due to improved survival rates for preterm infants. [1]
An English study found that 88% of infants admitted with RSV bronchiolitis were born at term, with no risk factors for severe RSV infection. The study showed that admissions occurred at a much earlier age than previously reported and the majority were admitted for just one day.\textsuperscript{[8]}

**Risk factors\textsuperscript{[2]}**

Environmental and social risk factors:

- Older siblings
- Nursery attendance
- Passive smoke, particularly maternal
- Overcrowding

Breast-feeding is considered protective and should be encouraged for this and other reasons.

Risk factors for severe disease and/or complications:

- Prematurity (<37 weeks)
- Low birth weight
- Age less than 12 weeks
- Chronic lung disease (e.g., cystic fibrosis, bronchopulmonary dysplasia)
- Congenital heart disease\textsuperscript{[7]}
- Neurological disease with hypotonia and pharyngeal dis-co-ordination
- Epilepsy\textsuperscript{[8]}
- Insulin-dependent diabetes\textsuperscript{[8]}
- Immunocompromise
- Congenital defects of the airways
- Down’s syndrome\textsuperscript{[9]}

**Presentation**

**Symptoms**

- Early symptoms are those of a viral URTI, including mild rhinorrhoea, cough and fever. Fever >39°C is unusual and should prompt a thorough examination and further investigations to exclude other possible causes.
- Adults, older children and many infants do not progress to any further symptoms.
- For the 40% of infants and young children who progress to lower respiratory tract involvement, paroxysmal cough and dyspnoea develop within 1-2 days.
- Other common symptoms include the following: wheeze, cyanosis, vomiting, irritability and poor feeding.
- Apnoeas may occur, especially in young infants.

**Signs**

Follow the National Institute for Health and Care Excellence (NICE) guidance for the assessment of feverish illness in children (in those aged under 5 years).\textsuperscript{[10]}

- Look for tachypnoea, tachycardia, fever, cyanosis and signs of dehydration. It is unusual for a child to appear ‘toxic’ (suggested by drowsiness, lethargy, pallor, mottled skin) and this should prompt urgent action in terms of the need for immediate treatment and exclusion of other potential causes.
- Mild conjunctivitis, pharyngitis.
- Evidence of increased respiratory work: intercostal, subcostal and supraclavicular recession, nasal flaring.
- Widespread fine inspiratory crackles are considered a key finding in the UK, whilst high-pitched expiratory wheezing is commonly present but not essential to a diagnosis. American definitions put more emphasis on the presence of wheeze.
- Liver and spleen may be palpable due to hyperinflation of the lungs.
Differential diagnosis

- Asthma and other causes of wheezing in childhood
- Bronchitis
- Pulmonary oedema
- Foreign body inhalation
- Pneumonia
- Oesophageal reflux
- Aspiration
- Cystic fibrosis
- Kartagener's syndrome
- Tracheomalacia/bronchomalacia
- Pneumothorax

Investigations

- Pulse oximetry.
- Nasopharyngeal aspirate for:
  - RSV rapid testing - to enable isolation or cohort arrangements and to prevent further, unnecessary testing.
  - Viral cultures for RSV, influenza A and B, parainfluenza and adenovirus can also be undertaken.

Other investigations that are not recommended for typical acute bronchiolitis include:[1]

- CXR: bronchiolitis produces:
  - Nonspecific hyperinflation and patchy infiltrates
  - Focal atelectasis
  - Air trapping
  - Flattened diaphragm
  - Increased anteroposterior diameter
  - Peribronchial cuffing

  CXR should only be performed if there is diagnostic uncertainty or an atypical course.
- FBC.
- Electrolytes and renal function: only perform if the child is dehydrated or on IV fluids.
- Blood and urine culture: consider if pyrexia >38.5°C or the child has a ‘toxic’ appearance.
- Arterial blood gases: may be required in the severely ill patients, especially in those who may need mechanical ventilation.

Management

Primary care

- Most infants with acute bronchiolitis will have mild, self-limiting illness and can be managed at home. Supportive measures are the mainstay of treatment, with attention to fluid input, nutrition and temperature control.
- Within general practice, a doctor's role is to assess current severity of illness and, for those with mild-to-moderate disease, to support and monitor. Consider whether the presentation is in the early stages of disease, when a child is more likely to get worse before improving. Careful safety netting is important, teaching parents to spot deterioration and to seek medical review should this occur.
- For the majority, bronchiolitis lasts 7-10 days, with 50% asymptomatic by two weeks and only a small subgroup still symptomatic at four weeks.

Referral

Hospital referral is suggested where there is:[1]

- Poor feeding (<50% usual intake over the previous 24 hours) which is inadequate to maintain hydration
- Lethargy
- History of apnoea
- Respiratory rate >70 breaths/minute
- Nasal flaring or grunting
- Severe chest wall recession
- Cyanosis
- Saturations ≤94%
- Uncertainty regarding diagnosis
- Where home care or rapid review cannot be assured

The threshold for admission should be lower in those with significant comorbidities, premature infants and those under 3 months old.

PICU admission is necessary if the child has increasing severe respiratory distress with desaturation or apnoea whilst receiving 50% oxygen. Continuous positive airway pressure (CPAP) or intubation may be required in these cases, although one study found that the majority of children could be managed with non-invasive ventilation outside the PICU setting.[11]

### Secondary care

- Even amongst hospitalised children, supportive care is the mainstay of treatment, including oxygen and nasogastric feeding where necessary.
- Other treatments have shown inconsistent or little evidence of benefit:
  - Bronchodilators: modest short-term improvement in clinical scores but no reduction in the rate or duration of hospitalisation.[12]
  - Corticosteroids: trials have consistently failed to provide evidence of benefit.[13] A large multicentre randomised controlled trial (RCT), comparing the use of a single dose of oral dexamethasone with placebo in children diagnosed with bronchiolitis in Emergency Departments, failed to show any significant differences in the rates of hospital admission, respiratory status after four hours or longer-term outcomes.[14]
  - Racemic adrenaline (epinephrine) - racemic = 1:1 mixture of the dextrorotatory and levorotatory isomers: one study reported that inhaled racemic adrenaline (epinephrine) was no better than inhaled saline.[15]
  - Hypertonic (3%) saline: thought to act by unblocking mucous plugs and reducing airways obstruction. A Cochrane Review concluded that there was evidence its use did reduce length of hospital stay and clinical severity scores.[16] A later study found no difference in clinical outcome between 3% and 0.9% saline.[17]
  - Antibiotics: there is minimal evidence to support their use, except in a small subset of patients with respiratory failure.[18]
  - Ribavirin: may reduce the need for mechanical ventilatory support and the number of days in hospital but there is no clear evidence of clinically relevant benefits (eg, preventing respiratory deterioration or mortality).[19]

- Chest physiotherapy does not improve the severity of the disease, respiratory parameters, or reduce length of hospital stay or oxygen requirements in hospitalised infants with acute bronchiolitis not on mechanical ventilation.[20]

### Prognosis

- Most children with bronchiolitis make a full recovery.
- Mechanical ventilation is required for some patients but one study found that the majority can be managed without.[11]
- In the UK, RSV-related mortality rate in those aged under 1 year is 8.4/100,000 population.[1]
- Most deaths occur in infants younger than 6 months or in those with underlying cardiac or pulmonary disease.
- There is an association between bronchiolitis and subsequent reactive airways disease - approximately 34-50% wheeze following bronchiolitis.[2] The underlying mechanism by which RSV or other agents, such as rhinovirus, cause reactive airways disease is unknown.
Prevention

Vaccine

A vaccine is available for babies most at risk of developing severe, and occasionally fatal, RSV infection. These will be very young infants born prematurely who have predisposing conditions such as chronic lung disease, congenital heart disease or children who are immunodeficient. It is usually given in secondary care.\[21\]

Immunoprophylaxis

Recent years have seen the development of agents which provide passive immunity to RSV: RSV immunoglobulin (RSV-Ig) which has been superseded by palivizumab, a monoclonal antibody. It has been shown to reduce RSV-related hospitalisation and intensive care admissions significantly. The Joint Committee on Vaccination and Immunisation recommends that it should be used by those at high risk of severe RSV disease: [22]

- Children aged under 2 years with chronic lung disease, who have required at least 28 days of supplemental oxygen from birth or who are receiving home oxygen.
- Infants less than 6 months old with a left-to-right shunt, haemodynamically significant congenital heart disease or pulmonary hypertension.
- Children aged under 2 years with severe congenital immunodeficiency.

The first dose should be administered before the start of the RSV season.

Infection control

Disease transmission should be limited by: [1]

- Hand washing
- Use of gloves, aprons or gowns when in direct contact with the patient
- Isolation of infected patients or nursing in cohorts, based on laboratory confirmation of RSV status

Further reading & references

- Bronchiolitis in children; NICE Guideline (May 2015)
- Bronchiolitis in children; NICE Quality Standard, June 2016
- Bronchiolitis in children; Scottish Intercollegiate Guidelines Network - SIGN (2006)
- Respiratory Syncytial Virus (RSV), Public Health England
- Feverish illness in children - Assessment and initial management in children younger than 5 years; NICE Guideline (Updated August 2017)


21. Respiratory syncytial virus (RSV) immunisation programme; Service specification No.3, Public health functions to be exercised by the NHS Commissioning Board, November 2012

22. Respiratory syncytial virus: the green book, chapter 27a; Public Health England (March 2013)

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