

Bronchiolitis in Infants and Children: A Comprehensive Review

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Abstract:

Bronchiolitis is a leading cause of acute respiratory illness in children under 24 months, characterized by viral-induced inflammation of small airways. Respiratory syncytial virus (RSV) remains the predominant etiologic agent, though rhinovirus and other pathogens contribute. Pathogenesis involves epithelial damage, mucus plugging, and airway obstruction, with clinical manifestations including tachypnea, wheezing, and hypoxemia. Management focuses on supportive care, with severity stratification guiding interventions ranging from outpatient monitoring to intensive care. Despite its self-limited nature, severe disease disproportionately affects preterm infants and those with comorbidities. Emerging evidence highlights long-term associations with recurrent wheezing and asthma. Prevention strategies include RSV immunoprophylaxis (nirsevimab/palivizumab) and vaccination. This review synthesizes current evidence on pathogenesis, diagnosis, management, and outcomes, emphasizing evidence-based practices and unresolved controversies.

Keywords:

Bronchiolitis, Tachypnea, Wheezing, Hypoxemia, Preterm infants.

Introduction:

Bronchiolitis arises from viral pathogens targeting the respiratory epithelium of terminal bronchioles, inducing cytopathic injury and an inflammatory response within the small airways. Histopathologic alterations manifest within one day post-infection, including bronchiolar cell necrosis, ciliostasis, and peribronchiolar lymphocytic infiltrates. Accumulation of mucous hypersecretion, desquamated epithelial debris, and edema contributes to luminal occlusion of small airways, resulting in obstructive air trapping and regional atelectasis. Unlike asthma, bronchoconstriction of larger airways mediated by smooth muscle contraction plays a minimal role in disease pathophysiology [1-2].

Etiology:

Viral pathogens are the etiologic agents in bronchiolitis, with seasonal variability and annual fluctuations in prevalence influencing distribution patterns. Respiratory syncytial virus (RSV) remains the most frequently implicated pathogen, followed by rhinovirus. Less common etiologies include parainfluenza, human metapneumovirus, influenza, adenovirus, endemic coronaviruses (including SARS-CoV-2), and human bocavirus. Molecular diagnostic techniques identify a viral cause in >95% of cases, with approximately one-third of hospitalized pediatric patients exhibiting concomitant viral coinfections [1-5].

Respiratory Syncytial Virus (RSV): Globally endemic, RSV is the predominant mono-infectious agent in bronchiolitis. Epidemiologic patterns demonstrate seasonal outbreaks, with temperate climates experiencing epidemics during late autumn and winter, while tropical and semitropical regions correlate outbreaks with precipitation-driven seasonality. *Rhinovirus:* A primary etiologic agent of acute rhinopharyngitis, rhinovirus comprises over 130 distinct serotypes. It is associated with lower respiratory tract involvement in young children and immunocompromised individuals, frequently presented with concomitant viral coinfections. Seasonal peaks occur in spring and autumn. *Parainfluenza Virus:* Type 3 parainfluenza virus is linked to epidemics in spring and autumn, with types 1 and 2 more commonly associated with croup syndrome. *Human Metapneumovirus* may be present as a coinfection and is implicated in bronchiolitis and community-acquired pneumonia. Multicenter studies note peak incidence in March and April. *Influenza Virus:* Lower respiratory tract manifestations are clinically indistinguishable from RSV or parainfluenza virus-induced disease. *Adenovirus:* While more frequently associated with pharyngitis and rhinorrhea, adenovirus may cause bronchiolitis, bronchiolitis obliterans, or pneumonia, with the potential for systemic manifestations [1-5]. **Coronaviruses:** Endemic Coronaviruses: Etiologic agents of acute rhinopharyngitis and year-round lower respiratory tract disease, including bronchiolitis. Prior to SARS-CoV-2 emergence, most coronavirus-related bronchiolitis occurred in conjunction with concurrent RSV infections. **SARS-CoV-2:** Documented as an etiologic contributor to bronchiolitis and other respiratory syndromes. **SARS-CoV-1 and MERS-CoV:** Causative agents of severe acute and Middle East respiratory syndrome, respectively. *Human Bocavirus:* Human bocavirus 1 is associated with upper and lower respiratory tract infections during autumn and winter, manifesting as bronchiolitis or pertussis-spectrum presentations. Subtypes 2–4 are primarily implicated in enteric pathologies. Phenotypic overlap exists between bronchiolitis and atypical bacterial pneumonia (e.g., *Mycoplasma pneumoniae*) or pertussis infection; however, these represent less prevalent etiologies of respiratory distress in infants and young children [1-5].

Epidemiology:

Bronchiolitis primarily affects the pediatric population under 24 months of age, with seasonal prevalence observed in temperate regions from October to March in the Northern Hemisphere. It remains a leading cause of hospitalization for acute respiratory illness in infancy and early childhood, with hospitalization rates peaking in postnatal age 2–6 months [6, 7]. The epidemiologic profile parallels RSV seasonality; however, monoclonal antibody prophylaxis (nirsevimab) may alter the viral etiologic distribution in subsequent seasons. During the SARS-CoV-2 pandemic, non-pharmaceutical interventions (e.g., social distancing, mask use) significantly reduced RSV transmission during 2020–2021 [6, 7]. Subsequent seasons (2021–2022) demonstrated early-onset surges in RSV and other viral pathogens (rhinovirus, parainfluenza virus-3, human metapneumovirus), with normalization observed in 2023 to pre-pandemic patterns [7].

Risk factors for severe disease:

Predisposing factors for severe bronchiolitis include prematurity (gestational age ≤ 36 weeks), low birth weight, postnatal age < 12 weeks, chronic pulmonary disease (e.g., bronchopulmonary dysplasia), immunocompromised states, anatomical airway anomalies (e.g., laryngomalacia, tracheoesophageal fistula), hemodynamically significant congenital heart disease and neurological comorbidities. Environmental exposures, including secondhand tobacco smoke, household overcrowding, daycare attendance, sibling contact, high-altitude residence (> 2500 meters), and ambient particulate matter pollution, further exacerbate disease severity [8].

Clinical picture:

Bronchiolitis manifests as a biphasic syndrome in children < 24 months, initiated by a prodromal phase of rhinorrhea and pharyngitis, followed by lower airway involvement characterized by tachypnea, subcostal retractions, expiratory wheezing, and diffuse fine crackles. Hypoxemia may develop acutely during exertion (e.g., feeding, agitation) or sleep due to diaphragmatic fatigue and airway narrowing. While traditionally described as a self-limited illness with peak severity on days 3–5, previous studies highlight heterogeneity in disease progression influenced by age, comorbidities (e.g., prematurity, cardiopulmonary disease), and viral etiology [9].

Apnea:

Occurs in $\sim 5\%$ of hospitalized infants, particularly preterm infants and those < 8 weeks corrected age (postmenstrual age < 48 weeks). Hypoventilation may precede overt respiratory failure, necessitating close monitoring of respiratory rate (< 30 or > 70 breaths/minute) and oxygen saturation ($< 90\%$). Dehydration: Fluid homeostasis challenges arise from increased insensible losses (fever, tachypnea), reduced oral intake, and emesis. Clinical signs include tachycardia, mucosal dryness, fontanelle depression, and oliguria. Aspiration Pneumonitis: Risk heightened during active bronchiolitis due to ineffective airway clearance. Respiratory Insufficiency: Advanced support (noninvasive or invasive ventilation) is required in 5–10% of cases; intubation rates have declined with improved noninvasive strategies. Bacterial Superinfection: Occurs in $< 5\%$ of hospitalized cases, predominantly in intensive care units (22% incidence in ventilated RSV cohorts). Diagnostic uncertainty persists due to overlapping radiographic findings (e.g., consolidation in viral pneumonia vs. atelectasis) [10, 11].

Clinical Evaluation:

Diagnosis relies on clinical assessment, including history, physical examination, and pulse oximetry. Ancillary studies (e.g., laboratory tests, radiographs) are generally unnecessary for initial diagnosis. However, they may be utilized to evaluate complications (e.g., secondary bacterial infections), comorbidities (e.g., congenital heart disease), or differential diagnoses [1].

History: A prodromal phase of upper respiratory symptoms (e.g., rhinorrhea, mild cough) typically precedes bronchiolitis, followed by lower respiratory tract manifestations (e.g., tachypnea, retractions, wheezing). Key historical elements include hydration status, apnea episodes, hypoxemia indicators (e.g., cyanosis, lethargy), and risk factors for severe disease (e.g., prematurity, chronic lung disease) [1, 2].

Physical Examination: Clinical signs include increased respiratory effort (intercostal/supraclavicular retractions, nasal flaring), expiratory wheezing, coarse/fine crackles, and hyperresonance on percussion.

Hypoxemia is detected via pulse oximetry. Severe cases may present with cyanosis, poor perfusion, or diminished breath sounds due to airway occlusion or exhaustion [1, 2].

Radiographic features and laboratory evaluation:

In pediatric patients with mild bronchiolitis, thoracic imaging is not routinely indicated due to its limited impact on therapeutic decisions and potential for inappropriate antimicrobial use. Imaging may be warranted in cases of moderate-to-severe respiratory distress (e.g., respiratory severity score ≥ 5) to exclude alternate diagnoses (e.g., pneumonia, congenital anomalies), particularly when focal physical findings (e.g., localized crackles), cardiac murmurs, or failure to improve are present [12].

Selective Laboratory/Imaging Use:

Neonates ≤ 28 days: Fever with bronchiolitis warrants evaluation for invasive bacterial infection (IBI), as the risk parallels that of febrile neonates without viral illness [13]. Infants 29–90 days: Testing is reserved for ill-appearing patients, those with risk factors for IBI, or atypical presentations [14]. Severe/unusual courses: Chest radiographs, complete blood counts (CBC), and inflammatory markers may assess secondary bacterial infections or alternative diagnoses (e.g., persistent wheezing, failure to improve) [14]. Respiratory failure: Arterial or capillary blood gas analysis may evaluate acid-base status and gas exchange impairment [14].

Viral Testing Indications:

Targeted testing (e.g., RSV, influenza, SARS-CoV-2) is indicated when results alter clinical decisions (e.g., antiviral therapy, isolation protocols). Due to superior sensitivity and broad viral detection, molecular assays (multiplex PCR) are preferred for hospitalized patients. Caution is advised in interpreting results, as prolonged viral shedding may yield false positives. Rapid antigen tests (70–90% sensitivity for RSV/influenza/SARS-CoV-2) are suitable for outpatient settings but unreliable for other pathogens [1].

Bronchiolitis must be differentiated from conditions such as:

Recurrent Viral-Triggered Wheezing/Asthma: History of episodic wheezing, atopic features (eczema, familial asthma), or response to bronchodilators favor asthma. Bacterial Pneumonia: Higher fever, systemic toxicity, or focal consolidation on imaging may suggest bacterial etiology. Pertussis: Afebrile paroxysmal cough with post-tussive emesis or apnea in infants; confirmed via PCR or culture. Airway Abnormalities: Congenital anomalies (e.g., laryngomalacia, vascular rings) present with stridor, monophonic wheezing, or recurrent infections. Foreign Body Aspiration: Acute choking history, unilateral decreased breath sounds, or focal wheezing warrant bronchoscopy. Congenital Heart Disease (CHD): Hepatomegaly, cardiomegaly, or pulmonary edema on radiography suggest CHD. Aspiration Syndromes: Coughing during feeds, swallowing dysfunction, or gastroesophageal reflux history support aspiration [15].

Severity assessment tools:

Severity classification in bronchiolitis relies on validated scoring systems integrating physiological parameters and clinical observations e.g., RSS: respiratory severity score (table 1) [16]. Key variables include respiratory rate, degree of accessory muscle use (retractions), lung auscultation findings (aeration, wheezing intensity) and neurobehavioral status (alertness, activity level, feeding tolerance)

Management of mild bronchiolitis (outpatient setting):

Clinical Context: Mild bronchiolitis (RSS <5) typically permits outpatient management absent social or medical contraindications (e.g., caregiver capacity, prematurity, cardiopulmonary comorbidities) [1, 3, 17-22].

1. Symptomatic Management:

Hydration: Address insensible fluid losses (tachypnea, fever) and impaired oral intake via frequent small-volume feeds or nasogastric supplementation if indicated. Nasal Clearance: Recommend bulb/mechanical suctioning with isotonic saline drops to alleviate obstructive rhinorrhea. Parent satisfaction may favor battery-powered suctioning, though cost implications warrant discussion. Avoidance of Pharmacotherapy: Pharmacologic agents (bronchodilators, corticosteroids, antibiotics) lack evidence in mild cases and are not indicated unless bacterial coinfection is suspected [see table 2].

Routine reevaluation is unnecessary for improving patients. Caregivers should monitor persistent symptoms (e.g., cough >4 weeks) or deviation from expected recovery, prompting reassessment for alternative diagnoses (e.g., pneumonia, foreign body aspiration) [1].

Emergency department management of bronchiolitis

Initial Stabilization:

Emergency department care for bronchiolitis prioritizes respiratory stabilization, hydration optimization, and disposition planning (outpatient, observation unit, inpatient, or pediatric intensive care unit [PICU]).

Severity-Based Interventions:

Mild Bronchiolitis (RSS <5):

Outpatient Management: Typically, feasible unless social determinants (caregiver capacity) or medical factors (comorbidities) preclude safe home care. Supportive Care: Includes nasal suctioning, hydration monitoring, and anticipatory guidance (e.g., warning signs for deterioration). Bronchodilators and corticosteroids are not routinely indicated.

Moderate/Severe Bronchiolitis (RSS ≥5):

Hospitalization Criteria: Toxic appearance, apnea, hypoxemia ($\text{SpO}_2 < 90\text{--}92\%$), dehydration, or inadequate caregiver support. Age <12 weeks alone is insufficient for admission but elevates risk. Respiratory Support: Supplemental Oxygen: Initiated for hypoxemia, targeting $\text{SpO}_2 \geq 90\%$ via nasal cannula or face mask. High-Flow Nasal Cannula (HFNC): Reserved for severe distress or impending respiratory failure. It avoids intubation by reducing the work of breathing. Noninvasive Ventilation (NIV): Considered for refractory hypoxemia or hypercapnia (e.g., CPAP for atelectasis, BPAP for hypoventilation). Hydration: Nasogastric or intravenous fluids for dehydrated patients. Avoid excessive isotonic fluids to prevent pulmonary congestion. Monitor for SIADH-related hyponatremia. Nasal Suctioning: Routine for mucus clearance to alleviate upper airway obstruction. Bronchodilators: Limited role; trialed only in severe cases with wheezing (e.g., albuterol). Discontinue if there is no clinical response. Antibiotics: Restricted to neonates ≤ 28 days (evaluate for invasive bacterial infection) or confirmed bacterial coinfections [1, 3, 17-22].

Inpatient Monitoring:

Continuous monitoring for severe cases (PICU), intermittent for stable patients. Prioritize pulse oximetry in those requiring oxygen/NIV. Fluid Balance: Track intake/output; adjust hydration to avoid fluid

overload. Blood Gas Analysis: Indicated for signs of fatigue or acidosis (elevated PaCO₂). Imaging: Chest radiographs are reserved for atypical courses, suspected pneumonia, or cardiac anomalies.

Clinical Considerations in Bronchiolitis Management:

1. Nebulized Hypertonic Saline:

- Use: Reserved for select cases (e.g., persistent moderate/severe distress despite suctioning or prolonged hospitalization). (See Table 2).

2. Bronchodilator Therapy:

- Role: Limited efficacy in bronchiolitis; not recommended for mild/moderate cases. A trial may be considered in severe wheezing, with careful response monitoring (e.g., improved aeration, reduced respiratory rate).
- Agents: Albuterol (preferred over epinephrine due to home-use feasibility) via nebulizer (0.15 mg/kg) or MDI (4–6 puffs with spacer). Discontinue if no response within 1 hour.
- Evidence: No significant impact on oxygenation, hospitalization rates, or length of stay. Potential for adverse effects (tachycardia, desaturation). (See Table 2).

3. Glucocorticoids

- Not recommended for first-time bronchiolitis (no benefit in reducing hospitalization or severity). Considered for recurrent wheezing/asthma overlap (e.g., history of atopy, response to bronchodilators).

4. Antibiotics

- Role: Reserved for neonates ≤ 28 days with fever (evaluate for invasive bacterial infection) or confirmed bacterial coinfections (e.g., pneumonia, otitis media). Overuse is discouraged due to the low incidence of bacterial pathogens ($<5\%$ in most studies).

Discharge Criteria:

Improved respiratory effort (respiratory rate: <60 bpm [<6 months], <55 bpm [6–11 months], <45 bpm [≥ 12 months]). Stable oxygenation on room air (SpO₂ $\geq 90\%$ for ≥ 6 –12 hours).

Adequate oral intake and caregiver competency in nasal suctioning. Follow-Up: Counsel caregivers on warning signs (apnea, dehydration, worsening respiratory distress) and prevention strategies (smoke avoidance, vaccinations).

Outcomes:

Prognosis: Most infants recover fully, though 20–30% experience prolonged symptoms (>3 weeks). Hospitalization rates vary by age/comorbidities (e.g., BPD, prematurity).

Long-Term Risks: RSV/rhinovirus hospitalizations correlate with 3–4x increased asthma risk in childhood. Causal mechanisms (potential links to airway hyperresponsiveness and early viral-induced inflammation) remain unclear.

Conclusions:

Bronchiolitis remains a clinical diagnosis managed with supportive care. Severity stratification guides interventions, while prevention focuses on RSV immunoprophylaxis and vaccination. Long-term outcomes highlight the need for research into viral-induced airway remodeling and asthma pathogenesis.

References:

1. Dalziel SR, Haskell L, O'Brien S, et al. Bronchiolitis. *Lancet*. 2022;400(10349):392-406.
2. Ralston SL, Lieberthal AS, Meissner HC, et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics* 2014; 134:e1474.
3. O'Brien S, Borland ML, Cotterell E, et al. Australasian bronchiolitis guideline. *J Paediatr Child Health* 2019; 55: 42–53.
4. Meissner HC. Viral Bronchiolitis in Children. *N Engl J Med* 2016; 374:62.
5. Skjerven HO, Megremis S, Papadopoulos NG, et al. Virus Type and Genomic Load in Acute Bronchiolitis: Severity and Treatment Response With Inhaled Adrenaline. *J Infect Dis* 2016; 213:915.
6. Fujiogi M, Goto T, Yasunaga H, et al. Trends in Bronchiolitis Hospitalizations in the United States: 2000-2016. *Pediatrics* 2019; 144.
7. Pediatric Acute Respiratory Illness (ARI) Interactive Dashboard. Centers for Disease Control and Prevention. <https://www.cdc.gov/nvsn/php/ari-dashboard/index.html>.
8. Butler J, Gunnarsson R, Traves A, Marshall H. Severe Respiratory Syncytial Virus Infection in Hospitalized Children Less Than 3 Years of Age in a Temperate and Tropical Climate. *Pediatr Infect Dis J* 2019; 38:6.
9. Schroeder AR, Destino LA, Ip W, et al. Day of Illness and Outcomes in Bronchiolitis Hospitalizations. *Pediatrics* 2020; 146.
10. Mansbach JM, Geller RJ, Hasegawa K, et al. Association of Serum Albumin With Apnea in Infants With Bronchiolitis: A Secondary Analysis of Data From the MARC-35 Study. *JAMA Netw Open* 2019; 2:e197100.
11. Parikh K, Hall M, Teach SJ. Bronchiolitis management before and after the AAP guidelines. *Pediatrics* 2014; 133:e1.
12. Friedman JN, Davis T, Somaskanthan A, Ma A. Avoid doing chest x rays in infants with typical bronchiolitis. *BMJ* 2021; 375:e064132.
13. Pantell RH, Roberts KB, Adams WG, et al. Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old. *Pediatrics* 2021; 148.
14. Bordley WC, Viswanathan M, King VJ, et al. Diagnosis and testing in bronchiolitis: a systematic review. *Arch Pediatr Adolesc Med* 2004; 158:119.
15. Coffin SE. Bronchiolitis: in-patient focus. *Pediatr Clin North Am* 2005; 52:1047.
16. Rodriguez H, Hartert TV, Gebretsadik T, Carroll KN, Larkin EK. A simple respiratory severity score that may be used in evaluation of acute respiratory infection. *BMC Res Notes*. 2016;9:85.
17. National Institute for Health and Care Excellence. Guidelines. Bronchiolitis in children: diagnosis and management. London: National Collaborating Centre for Women's and Children's Health, 2015.
18. Brady MT, Byington CL, Davies HD, et al. Updated guidance for palivizumab prophylaxis among infants and young children at increased risk of hospitalization for respiratory syncytial virus infection. *Pediatrics* 2014; 134: 415–20.
19. Friedman JN, Rieder MJ, Walton JM. Bronchiolitis: recommendations for diagnosis, monitoring and management of children one to 24 months of age. *Paediatr Child Health* 2014; 19: 485–98.
20. Baraldi E, Lanari M, Manzoni P, et al. Inter-society consensus document on treatment and prevention of bronchiolitis in newborns and infants. *Ital J Pediatr* 2014; 40: 65.
21. Verstraete M, Cros P, Gouin M, et al. Update on the management of acute viral bronchiolitis: proposed guidelines of Grand Ouest University Hospitals. *Arch Pediatr* 2014; 21: 53–62.
22. Nebot MS, Teruel GC, Cubells CL, Sabadell MD, Fernandez JP. Acute bronchiolitis clinical practice guideline: recommendations for clinical practice. *An Pediatr (Barc)* 2010; 73: 208.

Table 1: Respiratory severity score for infants and young children with bronchiolitis (16)

Parameter*	Points	Score
Respiratory rate		
Age ≤ 2 months: <60 breaths per minute Age 3 to <12 months: <50 breaths per minute Age 12 to 24 months: <40 breaths per minute	1	
Age ≤ 2 months: 60 to 69 breaths per minute Age 2 to <12 months: 50 to 59 breaths per minute Age ≤ 2 months: 12 to 24 months: 40 to 49 breaths per minute	2	
Age <2 months of age: ≥ 70 breaths per minute Age 2 to <12 months: ≥ 60 breaths per minute Age 12 to 24 months: ≥ 50 breaths per minute	3	
Respiratory effort		
Normal	0	
Mild subcostal or intercostal retractions	1	
Moderate subcostal, intercostal, and/or substernal retractions, $\pm$ nasal flaring but no grunting or head bobbing	2	
Severe subcostal, intercostal, and/or suprasternal retractions; grunting and flaring; head bobbing	3	
Lung examination		
Good aeration, normal breath sounds	0	
Scattered wheezes and/or rhonchi, good lung aeration	1	
Diffuse wheezes and/or rhonchi, prolonged exhalation, decreased aeration	2	
Poor lung aeration	3	
Activity level and feeding		
Normal activity, feeding, and vocalization	0	

Some fussiness and difficulty feeding, but consoles easily	1	
Agitated, poor feeding, decreased vocalization	2	
Lethargic, not able to feed, not vocalizing	3	
Total (maximum score 12)		
Interpretation		
Mild	1 to 4	
Moderate	5 to 8	
Severe	9 to 12	

Table 2: Comparisons between bronchiolitis clinical practice guidelines

	Australia and New Zealand, 2016 [3]	NICE (UK), 2015 [17]	AAP (USA), 2014 [18]	CPS (Canada), 2014 [19]	Italy, 2014 [20]	France, 2013 [21]	Spain, 2010 [22]
Age	Infants aged <12 months (can be used in those aged 12–24 months)	Children with bronchiolitis	Children aged 1–23 months	Children aged ≤2 years	Infants and children aged <12 months	Infants aged <12 months	Children aged <24 months
Diagnostic testing							
Chest x-ray	It is not routinely recommended to consider diagnostic uncertainty, atypical presentation, severe disease, or progressive disease course.						
CBC	Not routinely recommended					Obtain if undergoing investigations for a septic work-up	Not recommended
Blood culture	Has no role in management	Not routinely recommended	No mention	Not routinely recommended	Not routinely recommended	Obtain if undergoing investigations for a septic work-up	Not routinely recommended

	Australia and New Zealand, 2016 [3]	NICE (UK), 2015 [17]	AAP (USA), 2014 [18]	CPS (Canada), 2014 [19]	Italy, 2014 [20]	France, 2013 [21]	Spain, 2010 [22]
Blood gas	No mention	Not recommended; only with severe respiratory distress or respiratory failure	No mention	Not recommended; only with severe respiratory distress or respiratory failure	Not routinely recommended	No mention	Not recommended; only with severe respiratory distress or respiratory failure
Virological testing	No role in the management of individual patients	No mention	Not routinely recommended	Not routinely recommended	RSV antigen recommended in hospital setting	Not routinely recommended	Not routinely recommended
Urine microscopy or culture	Can be considered if temperature >38 °C in an infant aged <2 months with bronchiolitis	No mention	Not recommended	Not routinely recommended	No mention	No mention	Routine urine test not indicated; only in patients aged <3 months with bronchiolitis and fever
Treatments							
β 2 agonists	Not recommended (only in a personal or family history of atopy)	Not recommended				Not recommended (only in a personal or family history of atopy)	Not recommended; if used, must undergo carefully monitored trial
Corticosteroids	Not recommended						
Adrenaline	Not recommended						
Hypertonic saline	Not recommended	Not recommended in ER; weak recommendation for inpatients with average length of stay > 3 days	It is not recommended in the ER; it might be beneficial in inpatients with long stays.	Recommended	Recommended for inpatients who have moderate to severe bronchiolitis	Recommended for inpatients	

	Australia and New Zealand, 2016 [3]	NICE (UK), 2015 [17]	AAP (USA), 2014 [18]	CPS (Canada), 2014 [19]	Italy, 2014 [20]	France, 2013 [21]	Spain, 2010 [22]
Antibiotics	Not recommended unless there is clear and documented evidence of secondary bacterial infection						
Antivirals	Not indicated	No mention	No mention	Not recommended	Not recommended	No mention	It is not recommended; it might play a role in ribavirin in severely immunocompromised patients.
Suctioning	It is not routinely recommended that superficial nasal suction be considered in individuals with moderate disease to assist feeding; nasal saline drops can be considered when feeding.	Do not routinely perform; consider upper airway suctioning in individuals with respiratory distress or feeding difficulties due to upper airway secretions; use if apnea is present.	Insufficient data: routine use of deep suctioning might not be beneficial	Superficial nasal suctioning at frequent intervals; avoid deep suctioning and long intervals between suctioning	Superficial nasal suctioning is recommended; deep suctioning is not recommended	Superficial nasal suctioning is recommended if nasal congestion	Superficial nasal suctioning is recommended before feeding, sleeping, and assessment
Chest physiotherapy	Not indicated	Not recommended					
Supplemental oxygen	Use if PO ₂ is persistently <92%	Use if PO ₂ is persistently <92%	Not recommended if PO ₂ >90% without acidosis	Use if PO ₂ <90% to maintain saturations ≥90%	Use if PO ₂ is persistently <90–92%	Use if PO ₂ <92% or oxygen saturation <95% and with severe respiratory distress.	Use if severe respiratory distress or oxygen saturation <92%

	Australia and New Zealand, 2016 [3]	NICE (UK), 2015 [17]	AAP (USA), 2014 [18]	CPS (Canada), 2014 [19]	Italy, 2014 [20]	France, 2013 [21]	Spain, 2010 [22]
Heated, humidified high-flow oxygen or air via nasal cannula	Can be considered in the presence of hypoxia (oxygen saturation <92%) and moderate to severe recessions; use without hypoxia should be limited to RCT setting only	Use is becoming widespread without demonstration of additional efficacy; multicentre RCT and weaning strategies would be of benefit	Future research required	There is insufficient evidence to recommend	No recommendation (studies currently ongoing to assess efficacy)	No mention	No mention
CPAP	In severe bronchiolitis	In impending respiratory failure	No mention	No mention	For respiratory failure	No mention	In severe respiratory distress, hypercapnia, or recurrent apnea
Monitoring or pulse oximetry	Continuous oximetry should not be routinely used to dictate medical management unless the disease is severe.	Intermittent pulse oximetry monitoring should be measured and monitored at all secondary and primary care centers if available.	Not recommended if supplemental oxygen is not required or if Po ₂ >90%	Not recommended unless patients are high-risk and in the acute phase of the disease; intermittent checks are appropriate	No mention	No mention	Intermittent pulse oximetry; no clear recommendation for continuous monitoring

	Australia and New Zealand, 2016 [3]	NICE (UK), 2015 [17]	AAP (USA), 2014 [18]	CPS (Canada), 2014 [19]	Italy, 2014 [20]	France, 2013 [21]	Spain, 2010 [22]
Hydration or nutrition	When non-oral hydration is required, either intravenous or nasogastric hydration are appropriate; if intravenous fluid is used, it should be isotonic (0.9% sodium chloride with similar); the ideal volume of intravenous or nasogastric fluids required to maintain hydration remains unknown (60–100% of maintenance fluid is an appropriate volume to initiate)	Nasogastric or orogastric fluids first in infants who cannot maintain oral hydration; isotonic intravenous fluids in individuals who cannot tolerate nasogastric or orogastric fluids or with impending respiratory failure	Nasogastric or intravenous fluids for infants who cannot maintain hydration	Nasogastric or intravenous fluids for infants who cannot maintain hydration	Nasogastric or intravenous fluids for infants who cannot maintain hydration	Nasogastric or intravenous fluids for infants who cannot maintain hydration; consider restricting fluid intake to 66% of normal maintenance in severe bronchiolitis due to the risk of SIADH	Nasogastric or intravenous fluids for infants who cannot maintain hydration