



Common Respiratory Infections in Children

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- Common cold
 - Pharyngitis
 - Croup

Common Cold

- Mild self-limiting acute upper respiratory viral infection (aka URTI)
- The average incidence is 6-8 episodes/year in preschool children
- Caused by over 200 subtypes of viruses
 - Rhinoviruses account for 30-50% with at least 100 serotypes
 - Coronaviruses
 - Influenza and parainfluenza viruses
 - RSV
 - Adenoviruses and enteroviruses


Seasonal Patterns

- Most common colds in children occur in the period between September and April.
- Rhinovirus and Parainfluenza virus cause outbreaks of infection in fall and late spring
- RSV, influenza virus and coronavirus produce epidemics in winter and spring.
- Enterovirus most often cause illness in the summer.
- Adenoviruses are usually not seasonal.

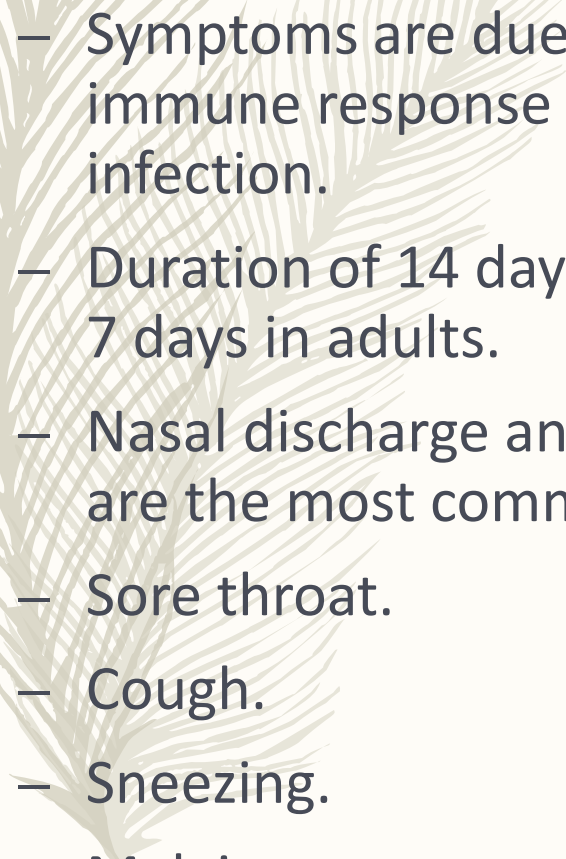


Transmission

- Hand contact (via direct contact with an infected person or via indirect contact with a contaminated environmental surface)
- Small particle droplets (droplet transmission) that become airborne from sneezing or coughing
- Large particle droplets that typically require close contact with an infected person.
- Incubation period 24-72 hr.

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- There is no scientific basis for the popular notion that a cold climate increases susceptibility to respiratory illness
 - Risk factors for increased severity :
 - Underlying chronic diseases
 - Congenital immunodeficiency disorders
 - Malnutrition
 - Cigarette smoking

Common Cold Symptoms

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- Symptoms are due to the effects of immune response to the viral infection.
 - Duration of 14 days in children and 5-7 days in adults.
 - Nasal discharge and nasal congestion are the most common.
 - Sore throat.
 - Cough.
 - Sneezing.
 - Malaise.
 - Fevermay be present in children. Be aware of late new onset or recurrence.
 - Conjunctivitis.
 - Headache.
 - The presence of purulence alone cannot distinguish between a cold or sinus infection.
 - The paranasal sinuses usually are involved during an uncomplicated cold.

Common Cold DDx

- Allergic rhinitis
 - Seasonal pattern of clear rhinorrhea, absence of associated fever, and family history of allergy. Possible associated conditions are asthma and eczema.
- Intranasal foreign body
- Vasomotor rhinitis
 - suggested by a chronic course without fever or sore throat.
- Sinusitis



Re-evaluation

- Persistent nasal symptoms for >10 days without improvement or is worsening
- Persistent cough for more than 2 weeks without improvement or is worsening
- If the symptoms worsen (eg, difficulty breathing or swallowing, high fever)

Worsening or persistent symptoms may indicate the development of complications or the need to consider a diagnosis other than the common cold

Complications

- **Acute bacterial rhinosinusitis**, may be indicated by any one of the following:
 - Persistent nasal symptoms without improvement for more than 10 days
 - Severe symptoms (temperature $\geq 39^{\circ}\text{C}$, ill-appearance, purulent nasal discharge) for 3-4days
 - Worsening symptoms (exacerbation of nasal discharge or cough, new onset fever, or recurrence of fever)



Complications, cont'd

- **Lower respiratory tract disease:**
 - RSV and parainfluenza virus can produce lower respiratory tract findings.
- **Asthma exacerbation:** at least 50% of asthma exacerbations in children are associated with viral infection
- **Acute Bacterial otitis media :**
 - Due to eustachian tube dysfunction
 - Occurs in 5-19% of common cold in young children (mainly 6-11 mo.)

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Treatment

- Supportive care
- Over-the-counter medications
- There is no role for antibiotics in the treatment of the common cold



Supportive care

- Maintaining adequate hydration.
- Ingestion of warm fluids
- Topical saline
 - Secretion removal and decongestion.
 - Applied with saline nose drops and a bulb syringe (infants), saline nasal spray or saline nasal irrigation (older children).
 - Can be prepared at home from sterile or bottled water by adding 1/2 teaspoon salt to 240 ml of warm (not hot) water. Stir to dissolve the salt, and store the solution for up to 1 week in a clean container with a cover.



OTC medications

- They include antihistamines, decongestants, antitussives, expectorants, mucolytics, antipyretics/analgesics, and combinations of these medications.
- For children <6 years : Except for antipyretics/analgesics, OTC medications for the common cold should be avoided.
- Children 6 to 12 years :
 - Except for antipyretics/analgesics, it is recommended not to use OTC medications for the common cold.
 - If parents choose to administer OTC medications to treat the common cold in these children, they should be advised to use **single-ingredient medications** for the most bothersome symptom and be provided with proper dosing, storage, and administration instructions to avoid potential toxicity
- Adolescents ≥ 12 years : OTC decongestants may provide symptomatic relief of nasal symptoms.



OTC medications

- Have not been proven to work any better than placebo in children and may have serious side effects.
 - Antihistamines can lead to sedation, paradoxical excitability, respiratory depression, and hallucinations.
 - Mucolytics can lead to bronchospasm, gastrointestinal disturbance, and fever
- OTC cough and cold medications have been associated with fatal overdose in children younger than two years.
- They have the potential for enhanced toxicity in young children because metabolism, clearance, and drug effects may vary according to age.
- Safe dosing recommendations have not been established for children



Treatment of nasal symptoms

- First-line therapy
 - Supportive care measures
- Second-line interventions for bothersome nasal symptoms that do not improve with supportive care :
 - Increase the frequency of nasal suction, sprays, or irrigation.
 - Ipratropium nasal spray 0.06%
 - *Two sprays are administered to each nostril three times per day for four days for children >5 years old*
 - Oral or topical decongestants in children >12 years old
 - *Topical decongestants (oxymetazoline, xylometazoline, and phenylephrine) should not be used for >2-3 days*
 - *Oral Pseudoephedrine is preferred to phenylephrine*

Treatment of cough

- The use of warm fluids
- Using honey in children >1 year (2.5 to 5 mL) has a modest beneficial effect on nocturnal cough. (*WHO, AAP*)
- Lozenges and hard candies in children >6 years (*AAP*)
- The AAP recommends against codeine and dextromethorphan-containing medications for the treatment of cough in children younger than 18 years because they have potential harms with no proven benefit
 - Codeine in children can lead to somnolence, respiratory depression, and even death
 - Dextromethorphan can lead to behavioral disturbances and respiratory depression .
- Neither expectorants nor mucolytics are of proven benefit in children
- Bronchodilators are not effective for acute cough in nonasthmatic children



Prevention

- Hygiene
 - Frequent Handwashing
 - Avoiding touching one's mouth, nose, and eyes.
 - Cough into a tissue or the crook of the elbow rather than into hands.
 - Used tissues should be discarded in a waste basket.
- Most children with the common cold need not be excluded from out-of-home child care or school. The risk of spread can be decreased through frequent hand washing and appropriate cough hygiene.



Prevention, cont'd

– Immunizations

- There is not an immunization to prevent the common cold.
- Yearly influenza immunization is recommended for all individuals older than 6 months to prevent influenza infection and its complications.
- Monthly injection of palivizumab (a monoclonal antibody preparation) is recommended to prevent RSV lower respiratory tract infection in high risk infants.



Pharyngitis

Infectious causes of acute pharyngitis in children:

- Bacterial
- Viral

Noninfectious causes:

- Gastroesophageal reflux disease
- PFAPA syndrome (Periodic fever, aphthous ulcers, adenitis)
- Allergic pharyngitis
- Kawasaki disease

Infectious Pharyngitis

Bacterial

- Group A streptococcus
- Groups C & G streptococcus
- Neisseria gonorrhoea
- Fusobacterium necrophorum (Lemierre syndrome)
- Arcanobacterium haemolyticum
- Corynebacterium diphtheriae
- Mycoplasma pneumoniae

Viral

- EBV, CMV
- HIV
- HSV 1&2
- Infl. A&B
- Enteroviruses
- Adenovirus
- Respiratory Viruses



Infectious Tonsillopharyngitis

- Most cases of tonsillopharyngitis in children and adolescents are caused by viruses and are benign and self-limited.
- Features suggesting viral cause: the presence of cough, coryza or conjunctivitis, diarrhea, viral exanthemes, hoarseness, myalgia
- Group A β -hemolytic Streptococcus (GAS) is the most common bacterial cause accounting for 15-30 % of all cases of pharyngitis in children 5-15 years old.
- Most cases of acute pharyngitis occur during the colder months of the year, when respiratory viruses are prevalent. The prevalence of GAS is highest in winter and early spring.



GAS pharyngitis

Clinical Features

- Sudden onset of sore throat with severe pain on swallowing
- Fever
- Headache
- Abdominal pain, nausea, and vomiting
- Enlarged erythematous tonsils with or without exudates
- Enlarged tender anterior cervical lymph nodes
- Palatal petechiae
- Scarlatiniform rash

Diagnosis

- The diagnosis is supported by a positive microbiologic test (throat culture or RADT) in a patient with symptoms of GAS pharyngitis and absence of signs and symptoms of viral infections.
- Throat culture has a sensitivity of 90-95%
- Clinical scoring systems are best aimed to identify individuals at such low risk of GAS infection that a throat culture or RADT usually is unnecessary.





The Modified Centor Score

- No Cough or other signs and symptoms associated with viral URTI (+1)
- Tender Enlarged Anterior Cervical lymph node(>1 cm)(+1)
- Temperature >38 (+1)
- Tonsillar exudates/swelling (+1)
- Age 3-15 years (+1)
- Age >45 years (-1)



Interpretation of the Modified Centor Score

Centor Score	Risk Level	Probability of strep pharyngitis	Recommendation
0-1	Low risk	1-10%	No culture or antibiotics necessary, return if worse
2-3	Moderate risk	10-28%	Culture all, treat if culture result positive
>4	High risk	38-63%	Culture all, treat if culture result positive

Choice of Test

- Throat culture is the gold standard.
- RADT is an alternative to throat culture :
 - For children with a streptococcal score of 5 or
 - When throat culture results will take >48 hours or
 - When the patient/family does not have reliable follow-up
- Antistreptococcal antibody titers have no value in the diagnosis of acute GAS pharyngitis, however they are valuable for confirmation of prior GAS infection in patients suspected of having acute rheumatic fever or other nonsuppurative complications.



RADT

- Based upon enzyme or acid extraction of antigen from throat swabs.
- Results are available at the point of care.
- Has a specificity of $\geq 95\%$ and a sensitivity of 70-90% .
- Given the high specificity and limited sensitivity of the available tests, a positive RADT is useful in establishing the diagnosis of GAS pharyngitis, but a negative RADT does not rule out GAS; back-up throat culture should be performed in children and adolescents with a negative RADT.



Specimen Collection

- Specimens should be obtained before initiation of antimicrobial therapy.
- If RADT is to be performed, take 2 throat swabs simultaneously. One is used for RADT; if RADT is positive, the second swab can be discarded. If RADT is negative, the second swab can be used for standard culture.
- Specimens should be obtained by vigorous swabbing of both tonsils (or tonsillar fossae in patients who have undergone tonsillectomy) and the posterior pharynx.
- The swab(s) should be moved into and out of the mouth without touching the tongue or the buccal mucosa.

Complications


- Most cases of GAS pharyngitis resolve without complications.
- **Nonsuppurative complications :**
 - Acute rheumatic fever,
 - PSGN
 - pediatric autoimmune neuropsychiatric disorders associated with streptococcus (PANDAS).

Suppurative complications :

- Necrotizing fasciitis
- Bacteremia
- Peritonsillar cellulitis or abscess
- Otitis media
- Sinusitis.

Treatment

- Antimicrobial therapy is indicated for individuals with symptomatic pharyngitis when GAS is confirmed by RADT or culture.
- Short delays in therapy (eg, while awaiting culture results) have not been associated with increased rates of complications such as acute rheumatic fever
- If clinical suspicion for GAS pharyngitis is high and testing results cannot be obtained rapidly, it is reasonable to start antibiotic treatment while test results are pending. If testing does not confirm the diagnosis, antibiotics should be discontinued.



The goals of antibiotic therapy for streptococcal pharyngitis:

- Reducing symptom severity and duration
- Prevention of acute complications, such as otitis media, peritonsillar abscesses, or other invasive infections
- Prevention of delayed complications or immune sequelae, particularly acute rheumatic fever
- Prevention of spread to others



Antibiotic Treatment

- For most children amoxicillin is the antibiotic of choice.
- The duration of therapy is 10 days
- Treating for 10 days appears to enhance the rate of GAS eradication from the oropharynx when compared with 5 or 7 days
- Penicillin hypersensitivity:
 - For patients with mild, non-IgE-mediated reactions (like maculopapular rash), a third-generation cephalosporin, such as cefpodoxime or cefdinir, is selected.
 - For patients with any possible IgE-mediated reactions (urticaria, angioedema or anaphylaxis), select a macrolide (3-5 day course of azithromycin) or clindamycin.

Croup

- Viral croup (laryngotracheitis) is the most common cause of infectious upper airway obstruction in young children.
- Parainfluenza virus types 1, 2 and 3 are the most common causative agents of croup, accounting for 50-80% of cases, followed by RSV and adenoviruses.
- Croup is common (the annual incidence is estimated to be as high as 7 cases per 1000 children younger than 6 years of age).
- The incidence typically peaks in late autumn and winter, and is highest among children between the ages of 6 months and 3 years

Clinical Manifestations

- The typical features of croup are inspiratory stridor, a barking cough, and hoarseness.
- Symptoms often start abruptly and typically worsen during the night.
- Nonspecific coryzal symptoms frequently precede the illness. Most patients have low or moderate-grade fever
- The diagnosis of croup is made primarily on clinical grounds.
- Airway or chest radiographs are not indicated
- Severity can be calculated according to the westley score. Calculators are available.

Spasmodic Croup

Typical croup is different from spasmodic croup which is characterized by:

- Recurrent nature, hence the descriptive term "frequently recurrent croup."
- Always occurs at night with abrupt onset and cessation of symptoms and short duration
- Fever is typically absent, but mild upper respiratory tract symptoms (eg, coryza) may be present.
- Episodes can recur within the same night and for 2-4 successive evenings .

Spasmodic Croup, cont'd

- There may be a familial predisposition, and it may be more common in children with a family history of allergies.
- Sometimes referred to as "allergic croup", because there is some clinical overlap with atopic diseases
- Early in the clinical course, spasmodic croup may be difficult to distinguish from viral croup. As the course progresses, the episodic nature of symptoms and relative wellness of the child between attacks differentiate spasmodic croup from viral croup, in which the symptoms are continuous.
- Although the initial presentation can be dramatic, the clinical course is usually benign. Symptoms are almost always relieved by comforting the anxious child and administering humidified air.

Croup Severity

- **Mild** (score ≤ 2):
 - Occasional barky cough, no stridor at rest, mild or no retractions
- **Moderate** (score 3-7):
 - Frequent barky cough, stridor at rest, and mild to moderate retractions, but no or little distress or agitation
- **Severe** (score 8-11):
 - Frequent barky cough, stridor at rest, marked retractions, **significant distress and agitation**
- **Impending respiratory failure** (score ≥ 12):
 - **Depressed level of consciousness**, stridor at rest, severe retractions, **poor air entry, cyanosis or pallor**



Westley croup severity score

Clinical feature	Assigned score
Level of consciousness	Normal, including sleep = 0 Disoriented = 5
Cyanosis	None = 0 With agitation = 4 At rest = 5
Stridor	None = 0 With agitation = 1 At rest = 2
Air entry	Normal = 0 Decreased = 1 Markedly decreased = 2
Retractions	None = 0 Mild = 1 Moderate = 2 Severe = 3

Complications

- **Laryngotracheobronchitis:**

- occurs when inflammation extends into the bronchi, resulting in lower airway signs (eg, wheezing, crackles, air trapping, increased tachypnea) and sometimes more severe illness than laryngotracheitis alone

- **Laryngotracheobronchopneumonitis:**

- with the extension of inflammation further into the lower airways which can be complicated by bacterial pneumonia.

- **Bacterial tracheitis** (sometimes called "bacterial croup") is an invasive exudative bacterial infection of the soft tissues of the trachea.

- It may occur as a primary infection or as a complication of viral croup.
- With secondary infection, patients typically present with symptoms of viral croup and then have marked worsening with high fevers, toxic appearance, and severe respiratory distress.

Differential Diagnosis

- **Acute Epiglottitis** : rare in the era of vaccination against HiB, no barking cough. Rapid onset of symptoms. the child is highly febrile, pale, toxic, and ill-appearing. The child will have difficulty swallowing and is often drooling. Children usually prefer to sit up and seldom have observed cough
- **Deep neck abscesses** (peritonsillar, parapharyngeal, or retropharyngeal): may present with fever, drooling, neck stiffness, lymphadenopathy, and varying degrees of toxicity. Barking cough is usually absent.
- **Foreign body aspiration**: history of the sudden onset of choking and symptoms of upper airway obstruction in a previously healthy child. Can produce hoarseness and stridor if it is inhaled and lodges in the larynx. Can produce barking cough and stridor if large object is swallowed and lodged in the upper esophagus, resulting in distortion of the adjacent soft extrathoracic trachea.

Differential Diagnosis, cont'd

- **Allergic reaction** (angioedema): has rapid onset without antecedent cold symptoms or fever. The primary manifestations are swelling of the lips and tongue, urticarial rash, dysphagia without hoarseness, and sometimes inspiratory stridor .
- **Anomalies of the airway** : can lead to hoarseness and stridor but have a more chronic course with absence of fever and symptoms of upper respiratory tract illness, unless the presentation is due to exacerbation of airway narrowing from the impact of a concomitant viral infection. Often these infants will respond temporarily to the usual treatment for croup (steroids and nebulized epinephrine) however the symptoms will recur within a few days of completion of treatment.

Management

Mild Croup:

- Antipyretics, oral fluids and humidified air.
- Corticosteroids

Moderate-to-severe Croup:

- Administration of corticosteroids and nebulized epinephrine.
- Antipyretics, oral fluids and humidified air.
- Should be observed for 3-4 hours after initial treatment.

Indications for Hospital admission:

- Severe croup with poor air entry, altered consciousness, or impending respiratory failure
- Moderate/severe croup with persistent or deteriorating respiratory distress after treatment with nebulized epinephrine and corticosteroids
- "Toxic" appearance or clinical picture suggesting serious secondary bacterial infection
- Need for supplemental oxygen
- Severe dehydration

Management

- Corticosteroids:
 - Shorter duration of stay in the emergency department or hospital
 - Fewer admissions, and fewer return visits.
 - Can be administered as oral or IM dexamethasone (0.6 mg/kg) or nebulized budesonide (2mg).
 - Repeat doses of corticosteroids are not necessary on a routine basis as moderate to severe symptoms that persist for more than a few days should prompt investigation for other causes of airway obstruction.
- Nebulized epinephrine can be repeated every 15-20 minutes in those with severe croup (with close cardiac monitoring)
- Children with oxygen saturation below 92% on room air should be given supplemental oxygen



Management

- The use of antitussive and decongestant agents is not recommended.
- Treatment with antibiotics is not indicated unless clinical features indicate a secondary bacterial infection
- Symptoms largely resolve within 48-72 hours in most patients

Fever in children

Age	Site of measurement	Fever	Fever of concern
0-1 months	Rectal	$\geq 38.0^{\circ}\text{C}$	$\geq 38.0^{\circ}\text{C}$
1-3 months	Rectal	$\geq 38.0^{\circ}\text{C}$	$\geq 38.6^{\circ}\text{C}$
3-36 months	Rectal	$\geq 38.0^{\circ}\text{C}$	$\geq 39.0^{\circ}\text{C}$
Older children and adults	Oral	$\geq 37.8^{\circ}\text{C}$	$\geq 39.5^{\circ}\text{C}$

Management of Fever

- Antipyretic agents
- External cooling



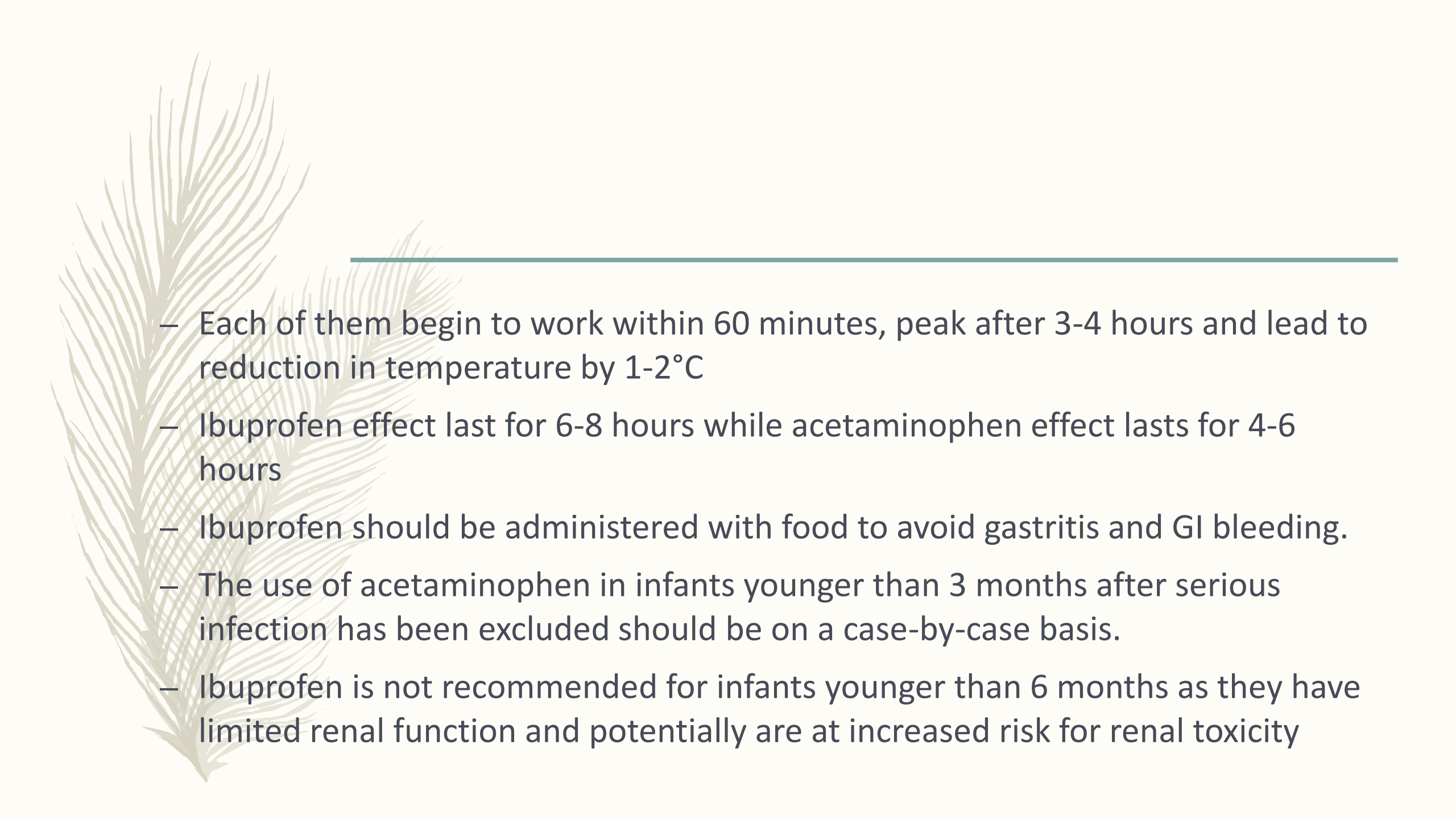
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Antipyretic Agents

- They treat fever by restoring the thermoregulatory set-point to normal.
- The most commonly used antipyretic agents in children and adolescents are acetaminophen and ibuprofen
- Aspirin should not be used because of its association with Reye syndrome

Antipyretic Choice

- In otherwise healthy child begin treatment with oral acetaminophen.
- Oral ibuprofen is an alternative to acetaminophen, particularly if anti-inflammatory effect is desired in addition to antipyresis.
- It is not advised to combine or alternate acetaminophen with ibuprofen because of:
 - The potential for dosing confusion
 - Increased toxicity
 - Contribution to fever phobia
- If the temperature remains elevated and the child's discomfort is not improved 3-4 hours after administration of acetaminophen or ibuprofen, it is reasonable to switch from acetaminophen to ibuprofen or ibuprofen to acetaminophen.

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- Each of them begin to work within 60 minutes, peak after 3-4 hours and lead to reduction in temperature by 1-2°C
 - Ibuprofen effect last for 6-8 hours while acetaminophen effect lasts for 4-6 hours
 - Ibuprofen should be administered with food to avoid gastritis and GI bleeding.
 - The use of acetaminophen in infants younger than 3 months after serious infection has been excluded should be on a case-by-case basis.
 - Ibuprofen is not recommended for infants younger than 6 months as they have limited renal function and potentially are at increased risk for renal toxicity

External Cooling

- May be used as an adjunct to antipyretic therapy for children in whom more rapid and greater reduction of body temperature is warranted.
- Antipyretic agents should be administered at least 30 minutes before external cooling to reset the thermoregulatory set-point, without which external cooling will result in an increase in heat production
- Achieved by sponging with comfortably warm or tepid water (generally around 30°C). Sponging is more effective than immersion because evaporation from the skin augments heat loss.

External Cooling, cont'd

Indications for concomitant antipyretic administration and mechanical cooling in children :

- Uncertainty about the cause of elevated temperature (heat illness versus fever)
- Fever combined with a component of heat illness (eg, from over-wrapping, hypovolemia, or drugs such as atropine)
- Underlying neurologic disorder, in which the child may have abnormal temperature control and poor response to antipyretic agents

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