Croup Clinical Care Guideline Age 6 Mos – 3 Yrs*

*Always check intranet for latest version:

**Target Population**

Intended for patients with:
1. First or repeat episode
2. Age 6 mos – 3 yrs
3. Principal Diagnosis: Croup (Laryngotracheitis)

Exclude patients with:
1. Suspicion Tracheitis (laryngotracheal-bronchitis or –pneumonitis)
2. Uncommon or life threatening presentation
3. Chronic Lung Disease (BPD, CF, PAH) or known airway narrowing
4. Recent airway instrumentation
5. History of aspiration
6. Neurological impairment
7. Toxic Appearance
8. Suspicion SBI
9. Immunocompromise
10. Active Varicella or TB
11. Congenital or acquired heart disease

**Clinical Management**

1. **Prevention**
   - Droplet precautions for all care settings
   - Good hand washing
   - Protect high risk patients from exposure
   - Eliminate exposure to smoke

2. **Telephone Triage**
   - Activate EMS (911): Severe difficulty breathing (struggling for breath, grunting noises with each breath, unable to speak or cry), blue lips or reduced level of consciousness
   - ED Visit (immediate): Underlying heart or lung disease, breathing heard across room, poor fluid intake, T > 105, excessive drooling, inability to lie flat without distress
     - Age < 12 mos, RR > 60, unable to suck or sleep
     - Age > 12 mos, RR > 40, difficulty breathing, not interactive
   - Office Visit same day: Worsening cough, some difficulty breathing, poor fluid intake, chronic or underlying illness
   - Phone contact with PCP: barking cough, acting normally, good fluid intake

3. **Initial Triage**

Obtain brief history of presenting conditions and past medical history \ birth (hospitalization, intubation \ mechanical ventilation), sick contacts

Check Immunization Status: HIB, Pneumococcal, Tetanus. Important when considering Epiglottitis or Diphtherial Croup

Obtain all pertinent patient history, including onset and duration of symptoms including croup prodrome (rhinorrhea, sore throat, low grade fever, cough) and timing of evidence of upper airway obstruction (hoarse voice, barking cough, audible stridor) and subglottic involvement (aphonia)

Inquire regarding history of congenital or acquired heart disease, congenital or acquired subglottic stenosis, tracheomalacia, tracheal webs, choanal narrowing or atresia, micrognathia, macroglossia

Check current medications and time \ dose of last antipyretic

4. **Clinical Assessment**

Evaluation of presence of Noninvasive croup versus a more extensive or progressive process

Evaluate hydration status. Evaluate patient using Croup Score every 30 – 90 min based on severity (reference figure 1)
5. Knowledge Base

Croup is an acute inflammatory process expressed as laryngotracheitis. Infection begins in the nasopharynx and spreads to the respiratory epithelium of the larynx & trachea. Inflammation, erythema and edema of the vocal folds cause hoarseness.

Age: 6 mos - 3 yrs (Mean = 18 mos)
Duration: 3-7 days, symptoms maximal day 2-3
Morbidity: Highest first year of life
Epidemiology: Year round; most common fall and winter

While all medical care providers need to be aware of the potential for extension of the disease process to tracheitis (laryngotracheal-bronchitis or –pneumonitis), it is beyond the scope of this guideline.

Etiology of Croup

Table 1 Etiology of Croup (Laryngotracheitis)

<table>
<thead>
<tr>
<th>Parainfluenza type 1 (most common) 2, 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza A &amp; B</td>
</tr>
<tr>
<td>Human metapneumovirus (hMPV)</td>
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<tr>
<td>Measles virus</td>
</tr>
<tr>
<td>RSV</td>
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<tr>
<td>Adenovirus</td>
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<tr>
<td>Rhinovirus</td>
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<tr>
<td>Mycoplasma pneumoniae</td>
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<tr>
<td>Enteroviruses</td>
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<tr>
<td>Herpes Simplex viruses</td>
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<tr>
<td>ReoViruses</td>
</tr>
</tbody>
</table>

Table 2 Etiology of Tracheitis (laryngotracheal-bronchitis or –pneumonitis)

Bacterial

| Staphlococcus aureus                     |
| Streptococcus pneumoniae                 |
| Haemophilus influenzae                   |
| Moxarella catarrhalis                    |
| Streptococcus pyogenes                   |

Atypical

| Corynebacterium diptheriae               |
| Cryptosporidium                          |

Viral

| Parainfluenza type 1, 2, 3               |

Clinical Symptoms Croup

Symptoms increase at night and improve during day
Hoarse Voice
Barking Cough (often described as a “barking seal”)
Stridor (variable, usually inspiratory)
Respiratory Distress (variable):

- Retractions (suprasternal, intercostal, abdominal)
- Tachypnea
- Tachycardia

Clinical Progress Croup

Day 1-3
- Rhinorrhea
- Sore throat
- Low grade fever
- Mild cough

Day 3-7 inflammation
- Onset symptoms of upper airway
- Hoarseness
- Barking Cough
- Stridor (variable)
- Respiratory Distress (variable)

Differential Diagnosis Croup

Table 3 Differential Diagnosis Croup

- Allergic Reaction
- Bacterial Tracheitis
- Epiglottitis
- Foreign Body Aspiration
- Hemangioma (Subglottic)
- Infectious Mononucleosis
- Laryngeal Diphtheria
- Laryngeal nerve compression
- Parapharyngeal Abscess
- Retropharyngeal Abscess
- Spasmodic croup
- Subglottic Stenosis
- Trauma
- Tumor – intracranial process (rare)

Clinical Symptoms Tracheitis

Sudden worsening of symptoms airway is indicative of more severe or invasive disease and warrants immediate specialty consultation.

- Aphonia
- Cyanosis
- Prolonged disease process
- Acute onset high fever
- Toxic appearance
- Increased work of breathing with retractions
- Severe stridor
- Tripodding
6. Monitoring:

Figure 1 CROUP SCORE (Modified Westley) [B]
Possible Score 0–17:
<4=mild croup, 4–6=moderate croup, >6=severe croup

<table>
<thead>
<tr>
<th>Indicators of Disease Severity</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspiratory stridor</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Only with agitation or activity</td>
<td>1</td>
</tr>
<tr>
<td>At rest</td>
<td>2</td>
</tr>
<tr>
<td>Intercostal Retractions</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Mild</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>2</td>
</tr>
<tr>
<td>Severe</td>
<td>3</td>
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<tr>
<td>Air Entry</td>
<td></td>
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<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Mildly decreased</td>
<td>1</td>
</tr>
<tr>
<td>Severely decreased</td>
<td>2</td>
</tr>
<tr>
<td>Cyanosis</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>With agitation / activity</td>
<td>4</td>
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<tr>
<td>At rest</td>
<td>5</td>
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<tr>
<td>Level of Consciousness</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
</tr>
<tr>
<td>Altered</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 2 Severity Classification

<p>| SEVERITY CLASSIFICATION: Follow croup score classification to guide therapy and management: |
|-----------------------------------------------|---------------|</p>
<table>
<thead>
<tr>
<th>Score</th>
<th>Severity</th>
<th>Management</th>
<th>Treatment Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4</td>
<td>Mild</td>
<td>Outpatient</td>
<td>Supportive ; Consider Corticosteroids</td>
</tr>
<tr>
<td>4-6</td>
<td>Moderate</td>
<td>Inpatient / Observation</td>
<td>Corticosteroids Oxygen (for hypoxia) Epinephrine</td>
</tr>
<tr>
<td>&gt; 6</td>
<td>Severe</td>
<td>Inpatient, Consider ICU</td>
<td>Corticosteroids Oxygen (for hypoxia) Epinephrine Consider Helium oxygen Consider intubation</td>
</tr>
</tbody>
</table>

Clinical Severity Reassessment Schedule
Mild: Reassess every 4 h, consider discharge
Moderate: Reassess every 2 h, consider admission
Severe: Reassess every 1 h, consider ICU admission

Monitoring
- SaO2 usually normal in croup unless tracheitis present
- Continuous cardiac/pulse oximetry monitoring only recommended for unstable patient or receiving repeat nebulized Epinephrine

7. Laboratory and Radiology Studies

Diagnostic tests only indicated if they will change outcome. Croup is a clinical diagnosis and usually no testing needed

<table>
<thead>
<tr>
<th>CBC</th>
<th>If concerns SBI or bacterial super-infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABG</td>
<td>Suspected/ impending respiratory failure</td>
</tr>
<tr>
<td>CXR</td>
<td>Indicated only in atypical illness</td>
</tr>
</tbody>
</table>

Classic “Steeple sign” reflects narrowed subglottic space
Patchy infiltrate seen in laryngotracheal-bronchitis or – pneumonitis
Lateral Neck Soft Tissue XR: Only if atypical clinical presentation
Epiglottitis: classic “thumb” sign reflects swollen epiglottis
Retropharyngeal abscess: widened pre-vertebral space

8. Therapeutics – “Prove it or don't use it”

Indicated therapies

Corticosteroids [A]
Dosing: Single Dose
Mechanism of action: Long lasting anti-inflammatory agent
Decrease edema in laryngeal mucosa
Adverse Effects: Risk of progressive viral infection
Risk of secondary bacterial infection
Exacerbate active Varicella or TB
Mask steroid dependant upper airway lesions (hemangioma)

Dexamethasone [A]
Dose: 0.15 – 0.6 mg/kg PO (preferred), IV, IM
Frequency: Once
Maximum Dose: 10 mg
Peak serum levels: Oral: Within 1 – 2 h IM: within 8 h
Duration of action: 24 – 72 h

- Note, the taste of oral dexamethasone may not be well tolerated thus the preferred method of administration may be a crushed dexamethasone tablet mixed with vehicle of choice

Nebulized Budesonide [C]
Equal efficacy to Dexamethasone; expensive
Consider in children with emesis or sever respiratory distress

Prednisolone [C]
Dose: 1 mg/kg

Prednisone [C]
Dose: 4 mg/kg/ (equivalent 0.6 mg/kg Dexamethasone)
2 mg/kg/ (equivalent 0.3 mg/kg Dexamethasone)
1 mg/kg/ (equivalent 0.15 mg/kg Dexamethasone)
Nebulized Epinephrine for Croup Score >3, stridor  [A]
Mechanism of Action: Stimulation $\alpha$-adrenergic receptors
Constrict capillary arterioles causing fluid resorption from interstitial space and decreases interstitial edema
Duration of action: $<2$ h
Efficacy: Racemic & L-epinephrine are equally efficacious  [A]

Adverse effects: Myocardial Infarction (rare)

Racemic Epinephrine (1:1 mixture of $\delta$ & $\varpi$-isomers epinephrine)
Dose: $0.05$ mL/kg/dose of $2.25\%$ solution in $2.5$ mL normal saline via nebulizer over $15$ min
- $< 5$ kg = $0.25$ mL
- $\geq 5$ kg = $0.5$ mL
Frequency: Repeat every $20$ min as indicated
Maximum Dose: $0.5$ mL

L-epinephrine (use if racemic epinephrine unavailable)
Dose: $0.5$ mL/kg/dose of $1:1000$ L-epinephrine in $2.5$ mL of NS via nebulizer over $15$ min repeated every $15-20$ min as indicated
Frequency: Repeat every $20$ min as indicated
Maximum Dose: $5$ mL

The term 'rebound phenomenon' is a misnomer. Epinephrine doesn't change the duration of croup and benefits lasts $\leq 2$ h

It is safe to send children home from the ED after receiving racemic epinephrine if they have been observed for a minimum of $3$ h post therapy

Antipyretics Indicated for T $> 38.3^\circ$
Acetaminophen
Dose = $15$ mg/kg po q $4^\circ$
Repeat if home treatment sub therapeutic & TDD $< 140$ mg/kg
Ibuprofen
Dose = $10$ mg/kg po q $6^\circ$

Oxygen Utilize supplemental oxygen to treat hypoxia

Other therapies
Mist Humidified air with or without oxygen  [C]
Controversial therapy without supporting evidence
- May moisten airway secretions
- May decreases airway inflammation
- May decreases viscosity of tracheal mucus secretions enabling patient to remove them by coughing
- May increase wheezing in laryngotracheitis-bronchitis\ pneumonitis

Anti-tussive or decongestant  [C]

Antibiotics  [A]
No role in uncomplicated croup
Indicated only for bacterial component (tracheitis)

Helium-Oxygen Mixture  [B]
Not shown to be more effective than nebulized epinephrine or mist
May be efficacious in patient with severe croup with impending respiratory failure.

9. Parent Education (see Parent Education Attachment)
- Expected clinical course $< ten$ days
- Signs of worsening clinical status and when to notify PCP
- Smoking cessation counseling
- Provide Parent with Patient Education Materials

10. Discharge Criteria
Begin discharge planning at time of initial presentation
✓ Assess caretaker ability to provide home care
✓ Assess home resources adequate to support care
✓ Confirm transportation and telephone
✓ Confirm follow-up PCP/designee in specified time frame
✓ Complete croup teaching
✓ Provide verbal and written instructions to caretakers
✓ Assure family awareness indications return
✓ Provide $24$-h contact number for PCP or designee
✓ Assure chart faxed to PCP or designee

Discharge Home
✓ Vital signs baseline
✓ No hypoxia
✓ Able to maintain adequate hydration
✓ Patient at baseline level of functioning
✓ Presenting condition stabilized or improves
✓ Croup score $< 4$

Patients who have received nebulized epinephrine may be discharged home after a minimum of $3$ h if no stridor at rest

Admit Inpatient/ Observation
✓ Croup score 4 - 6
✓ Continued stridor at rest despite therapy
✓ Inadequate hydration
✓ Moderate retractions
✓ Require supplemental oxygen
✓ Vital signs do not return to baseline
✓ Condition deteriorates or does not improve

Admit ICU
✓ Consider for croup score $> 6$
✓ Escalating stridor at rest despite therapy
✓ Patient benefiting from ICU monitoring, treatment, or environment
✓ Any patient with impending respiratory failure:
  - $\text{SaO}_2 < 90\%$ in $40\%$ $\text{FiO}_2$
  - Cyanosis with supplemental oxygen
  - Bradypnea or tachypnea outside normal limits for age
  - Severe retractions
  - Hypercarbia

11. Follow-up
- With PCP or designee as scheduled
- Evaluate severity of croup
- Evaluate vital signs and oxygen saturation
- Evaluate respiratory status
- Evaluate hydration status
### 12. Clinical Care Guideline Measures & Targets

<table>
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<th>Measures</th>
<th>Target 2009</th>
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<tr>
<td><strong>Inpatient or Observation</strong></td>
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<tr>
<td>1. Antibiotics (without coded rationale)</td>
<td>&lt; 25%</td>
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<td>2. Radiographs (CXR or Lateral Neck)</td>
<td>&lt; 25%</td>
</tr>
<tr>
<td>3. Single Dose Steroid</td>
<td>&gt; 75%</td>
</tr>
<tr>
<td>4. Viral Testing</td>
<td>&lt; 25%</td>
</tr>
<tr>
<td>5. Laboratory studies</td>
<td>&lt; 25%</td>
</tr>
<tr>
<td>6. Readmission within 7 days</td>
<td>&lt; 25%</td>
</tr>
<tr>
<td>7. Average Length of Stay (&lt; 48 h)</td>
<td>&gt; 75%</td>
</tr>
</tbody>
</table>

| **Outpatients**                             |             |
| 1. Antibiotics (without coded rationale)    | < 25%       |
| 2. Radiographs (CXR or Lateral Neck)        | < 25%       |
| 3. Single Dose Steroid                      | > 75%       |
| 4. Viral testing                            | < 25%       |
| 5. Laboratory studies                       | < 25%       |
| 6. Anti-tussive or decongestant             | < 25%       |
Figure 3 Algorithm Croup

**CROUP SCORE:** Modified Westley

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<tr>
<td>Possible Score</td>
<td>0-17</td>
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<tr>
<td>&lt; 4</td>
<td>Mild Croup</td>
</tr>
<tr>
<td>4-6</td>
<td>Moderate Croup</td>
</tr>
<tr>
<td>&gt;6</td>
<td>Severe Croup</td>
</tr>
</tbody>
</table>

**TREATMENT Croup Score ≥ 4**

Corticosteroids: Single dose only!

Dexamethasone

- **Dose:** PO, IM, IV:
  - 0.15 – 0.6 mg/kg
- **Max Dose:** 10 mg
- **Onset of action:** 6 hours
- **Duration of action:** 24-72 h

Nebulized Epinephrine:

- **Observe 3 h**
- **Racemic Epinephrine**
  - **Dose:** 0.05 ml/kg/dose of 2.25% in 2.5mL NS
  - 0.25 ml (wt < 5 kg)
  - 0.5 ml (wt ≥ 5 kg)
- **Maximum Dose:** 0.5 mL
- **Frequency:** every 20 min as indicated

L-epinephrine

- **Dose:** 0.5 mL/kg/dose of 1:1000 in 2.5 mL NS
- **Max dose:** 5 mL
- **Frequency:** every 20 min as indicated

Oxygen

- Supplemental oxygen for hypoxia

Antipyretic

- for T > 38.3
  - Acetaminophen: **Dose** = 15 mg/kg po q4h
  - Ibuprofen: **Dose** = 10 mg/kg po q6h

**Indications for Admission**

≥ 3 Nebulized Epinephrine treatments in 3 h

- Stridor at rest despite therapy
- Continued symptoms 4 h post steroids
- Inadequate hydration
- Moderate – severe retractions
- Requires supplemental oxygen
- Condition deteriorates or does not improve
- Croup score ≥ 6

- Cystosis
- Hypercarbia
- Aphonía – consider alternative diagnosis + start antibiotics

**Indications for Specialty Consultation**

- Any Concern for Invasive Disease, including:
  - Aphonía
  - Cystosis
  - Prolonged disease process
  - Acute onset high fever
  - Toxic appearance
  - Increased WOB with retractions
  - Symptoms > 7 days

**Additional Workup as Indicated**

- Clinical Dehydration: BMP
- Concern Pneumonia: CXR
- Concern Epiglottitis: Lateral Neck XR
- Concern SBI? BC (> 0.5 ml)
- CBC + automated diff
- Respiratory Compromise: ABG
Admitting Orders

Date: ____________  Time: ____________  Weight: ____________  kg

1) Admit  □ Inpatient  □ Observation
2) Diagnosis: CROUP
3) Condition: □ Good  □ Fair  □ Serious
4) Nursing
   VS  □ T, BP on admission then per routine
       □ Every 4 h
       □ Other ____________
   I/O  □ Strict
       □ Routine
       □ Other ____________
   Monitoring  □ Continuous pulse oximetry
               □ Spot check pulse oximetry every shift
               □ Cardio Respiratory monitor
5) Isolation Precautions  □ Droplet
                           □ Other ____________
6) Allergies  □ No known medication or food allergies
               □ No known drug allergies
               □ No known food allergies
               □ ____________
7) IV  □ None
       □ ____________ IVF at ____________ cc/hr
       □ ____________ IV bolus; ____________ cc over ____________ hr(s)
8) Labs/Radiology  □ None
                    □ ____________
9) Medications  □ Oxygen – NC or Blow-by for hypoxia
               □ Racemic Epinephrine 0.25mL (<5kg) for stridor at rest; alert physician prior to dose
               □ Racemic Epinephrine; 0.5mL (>5kg) for stridor at rest; alert physician prior to dose
               □ Dexamethasone (0.15 - 0.6mg/kg) ____________ PO (preferred), IV, IM once (Max 10 mg)
               □ Tylenol (15mg/kg) ____________ orally, every 4 h for fever/irritability
               □ Ibuprofen (10mg/kg) ____________ orally, every 6 h for fever/irritability
               □ Other ____________
### GLOSSARY

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>&lt;</td>
<td>Less than</td>
</tr>
<tr>
<td>≤</td>
<td>Less Than or equal to</td>
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<tr>
<td>&gt;</td>
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<td>&amp;</td>
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<tr>
<td>ABG</td>
<td>Arterial blood gas</td>
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<tr>
<td>BP</td>
<td>Blood Pressure</td>
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<tr>
<td>BPD</td>
<td>Bronchopulmonary dysplasia</td>
</tr>
<tr>
<td>CBC</td>
<td>Complete Blood Count</td>
</tr>
<tr>
<td>CF</td>
<td>Cystic Fibrosis</td>
</tr>
<tr>
<td>CXR</td>
<td>Chest radiograph</td>
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<tr>
<td>D</td>
<td>Day</td>
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<td>ED</td>
<td>Emergency Department</td>
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<tr>
<td>EMS</td>
<td>Emergency Medical Services</td>
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<td>(911)</td>
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<tr>
<td>FiO2</td>
<td>Fraction of Inspired Oxygen</td>
</tr>
<tr>
<td>h</td>
<td>Hour</td>
</tr>
<tr>
<td>HR</td>
<td>Heart Rate</td>
</tr>
<tr>
<td>HIB</td>
<td>Haemophilus influenza type b</td>
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<td>Human metapneumo virus</td>
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<td>I/O</td>
<td>Intake and Output</td>
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REFERENCES

General

Epinephrine
**Heliox**


**Humidified Air**


**Steroids**


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