



Pediatric Emergency Medicine Practice Clinical Pathways: Evidence To Improve Patient Care In Emergency Medicine



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EM Practice Guidelines Update

The Lifelong Learning and Self-Assessment Study Guide

EM Critical Care

ED Overcrowding Solutions

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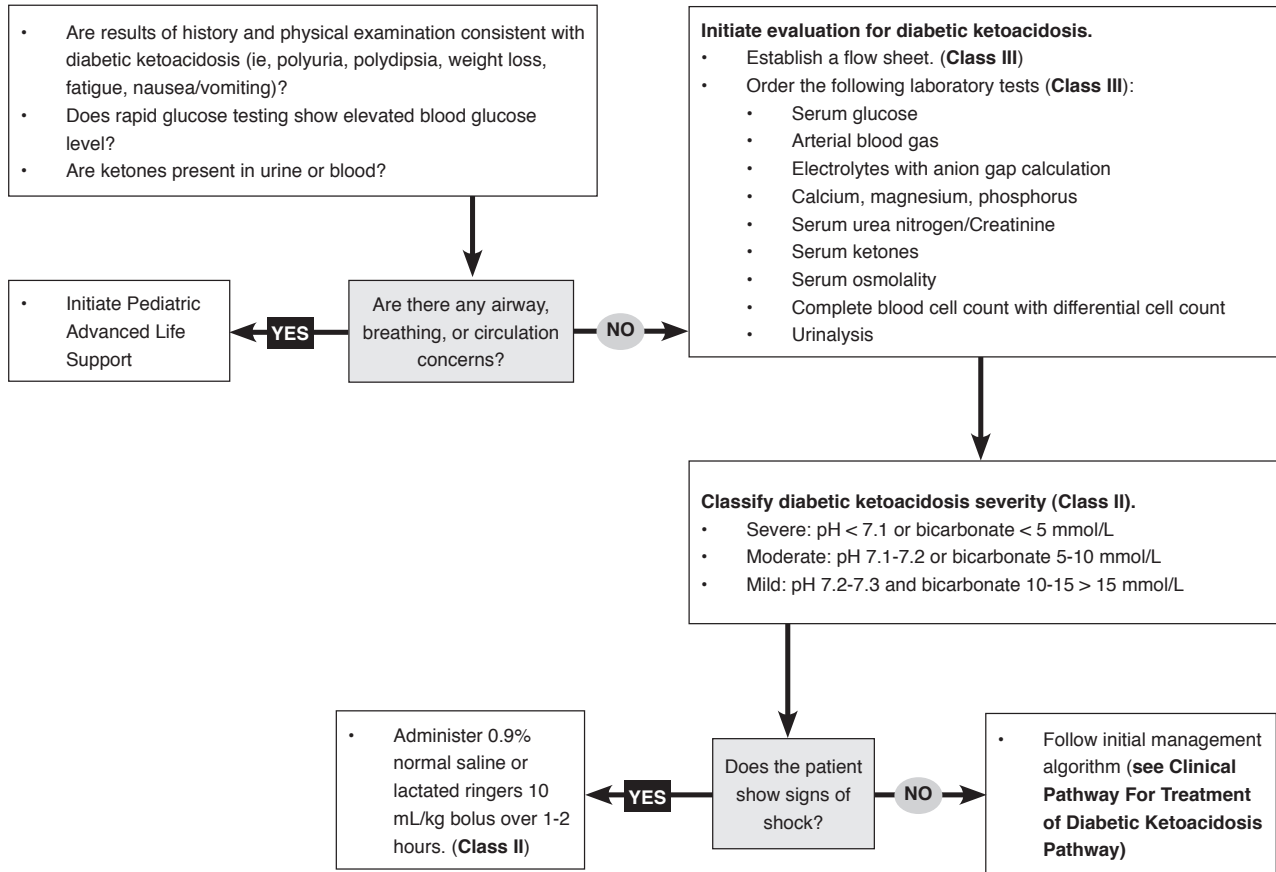
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Clinical Pathway For Initial Evaluation Of Diabetic Ketoacidosis



Class Of Evidence Definitions

Each action in the clinical pathways section of *Pediatric Emergency Medicine Practice* receives a score based on the following definitions.

Class I

- Always acceptable, safe
- Definitely useful
- Proven in both efficacy and effectiveness

Level of Evidence:

- One or more large prospective studies are present (with rare exceptions)
- High-quality meta-analyses
- Study results consistently positive and compelling

Class II

- Safe, acceptable
- Probably useful

Level of Evidence:

- Generally higher levels of evidence
- Non-randomized or retrospective studies: historic, cohort, or case control studies
- Less robust RCTs
- Results consistently positive

Class III

- May be acceptable
- Possibly useful
- Considered optional or alternative treatments

Level of Evidence:

- Generally lower or intermediate levels of evidence
- Case series, animal studies, consensus panels
- Occasionally positive results

Indeterminate

- Continuing area of research
- No recommendations until further research

Level of Evidence:

- Evidence not available
- Higher studies in progress
- Results inconsistent, contradictory
- Results not compelling

Significantly modified from: The Emergency Cardiovascular Care Committees of the American Heart Association and represen-

tatives from the resuscitation councils of ILCOR: How to Develop Evidence-Based Guidelines for Emergency Cardiac Care: Quality of Evidence and Classes of Recommendations; also: Anonymous. Guidelines for cardiopulmonary resuscitation and emergency cardiac care. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Part IX. Ensuring effectiveness of community-wide emergency cardiac care. *JAMA*. 1992;268(16):2289-2295.

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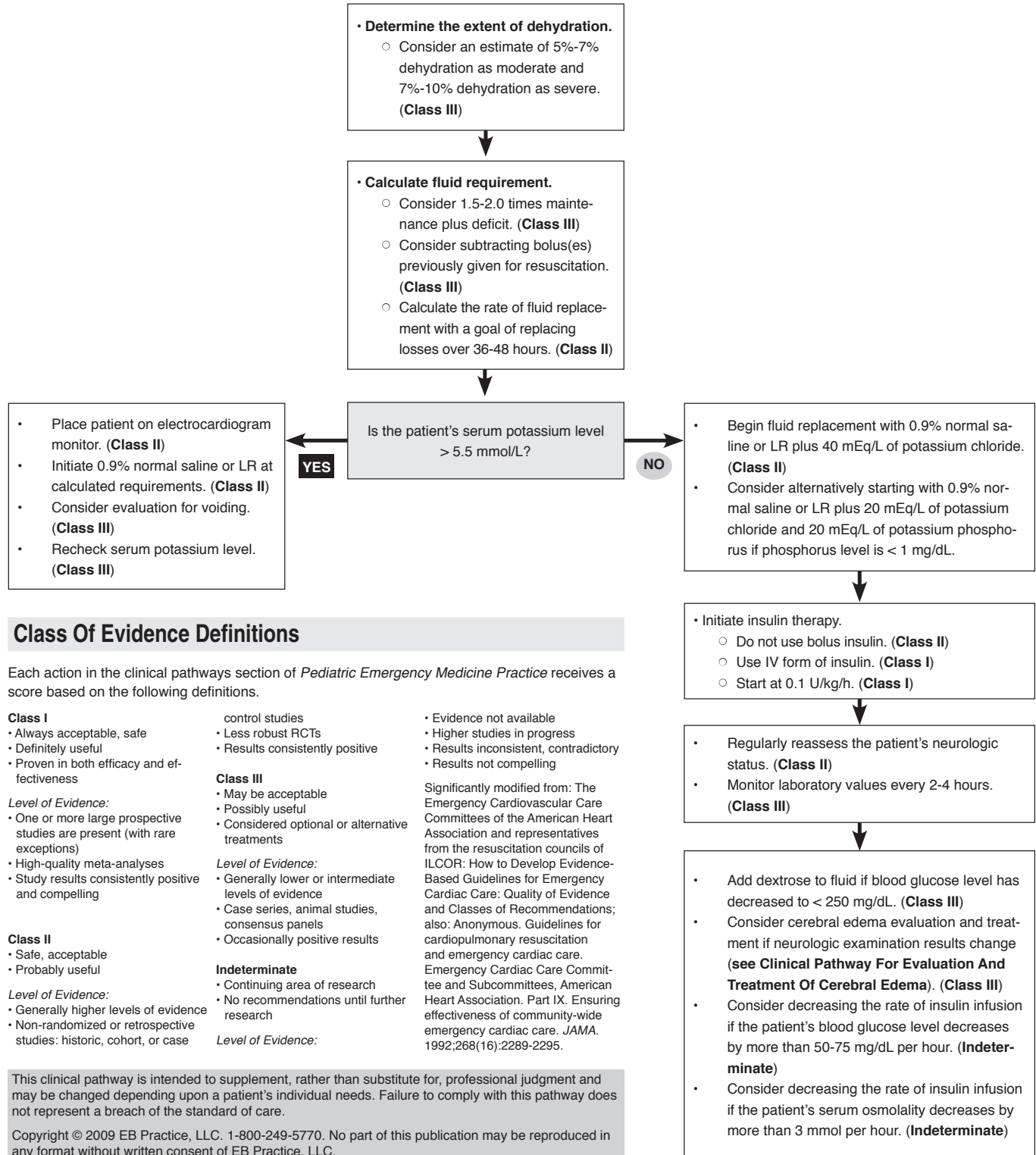
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Clinical Pathway For Treatment Of Diabetic Ketoacidosis



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| | | |
|---|--|--|
| <p>Class I</p> <ul style="list-style-type: none"> • Always acceptable, safe • Definitely useful • Proven in both efficacy and effectiveness <p><i>Level of Evidence:</i></p> <ul style="list-style-type: none"> • One or more large prospective studies are present (with rare exceptions) • High-quality meta-analyses • Study results consistently positive and compelling | <p>control studies</p> <ul style="list-style-type: none"> • Less robust RCTs • Results consistently positive <p>Class III</p> <ul style="list-style-type: none"> • May be acceptable • Possibly useful • Considered optional or alternative treatments <p><i>Level of Evidence:</i></p> <ul style="list-style-type: none"> • Generally lower or intermediate levels of evidence • Case series, animal studies, consensus panels • Occasionally positive results | <ul style="list-style-type: none"> • Evidence not available • Higher studies in progress • Results inconsistent, contradictory • Results not compelling <p>Significantly modified from: The Emergency Cardiovascular Care Committees of the American Heart Association and representatives from the resuscitation councils of ILCOR: How to Develop Evidence-Based Guidelines for Emergency Cardiac Care: Quality of Evidence and Classes of Recommendations; also: Anonymous. Guidelines for cardiopulmonary resuscitation and emergency cardiac care. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Part IX. Ensuring effectiveness of community-wide emergency cardiac care. <i>JAMA.</i> 1992;268(16):2289-2295.</p> |
| <p>Class II</p> <ul style="list-style-type: none"> • Safe, acceptable • Probably useful <p><i>Level of Evidence:</i></p> <ul style="list-style-type: none"> • Generally higher levels of evidence • Non-randomized or retrospective studies: historic, cohort, or case | <p>Indeterminate</p> <ul style="list-style-type: none"> • Continuing area of research • No recommendations until further research <p><i>Level of Evidence:</i></p> | |

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Clinical Pathway For Emergency Care Of Patients With A Metabolic Disorder

Perform ABCDEs

- A** – Airway - Evaluate and protect airway as needed.
- B** – Breathing - Ensure adequate ventilation
- Non-invasive ventilatory support may be considered where appropriate.
 - Aggressive hyperventilation for cerebral edema should be avoided.
- C** – Circulation - Volume expansion should be provided when there is evidence of dehydration or volume depletion.
- D** – Disability - Bedside blood glucose testing:
- If below 60 mg/dL, obtain critical sample, IV access and provide glucose orally or via IV
 - Low osmolarity glucose solutions (D5W, D10W) are preferred where available
 - Critical sample: serum glucose, insulin, cortisol, and growth hormone
- E** – Exposure - Evaluate for exposure to infectious organisms, drugs, toxic substances, or new foods

Consider Additional Laboratory Testing

- Primary:** (most can be obtained with point of care testing devices)
- Arterial or venous blood gas
 - Electrolytes
 - Serum urea nitrogen and creatinine
 - Urine dipstick
- Secondary:**
- General – complete blood cell count with differential count
 - Hypoglycemia – insulin, cortisol, corticotropin, β -hydroxybutyrate
 - Encephalopathy – ammonia, aspartate aminotransferase, alanine aminotransferase, bilirubin
 - Suspected galactosemia – urine-reducing substances
- Tertiary:**
- Quantitative plasma organic acids
 - Quantitative urine organic acids
 - Plasma acylcarnitine
 - Tandem mass spectroscopy for disorders of fatty acid oxidation
 - Amino acids in the blood, urine, and cerebrospinal fluid
 - Orotic acid in the urine
 - Comprehensive newborn screen with tandem mass spectroscopy

Treatment

If the child has a diagnosed metabolic disorder, follow instructions provided by their Metabolic specialist.
Hydration – D10 1/2 NS at 1.5 times maintenance until needs for fluid, glucose, and electrolyte replacement have been determined.

Glucose

Medications (as directed by Metabolic specialist, except as noted)

- Fatty acid oxidation disorders – L-carnitine
- Hyperammonemia – sodium phenylacetate, sodium benzoate, arginine
- Neonatal seizures – pyridoxine (may be given empirically with concurrent EEG monitoring as available)
- Organic acid defects – biotin

Consider Consultations Or Referrals To:

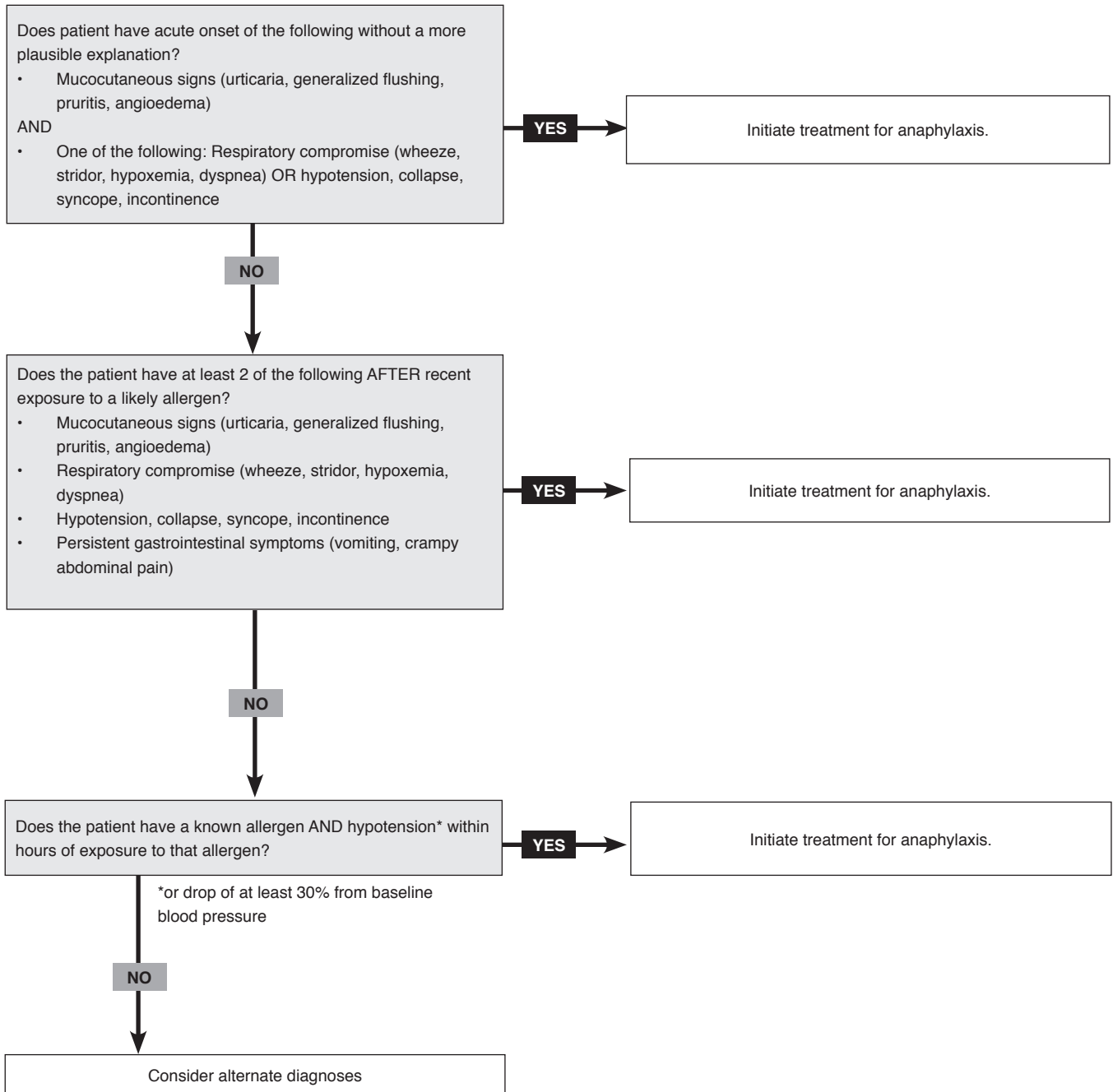
- Critical Care
- Genetics/Metabolism
- Nephrology– as indicated for renal replacement therapy for hyperammonemia

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Clinical Pathway For The Diagnosis Of Anaphylaxis



Adapted from Sampson HA, Munoz-Furlong A, Campbell RL, et al. Second symposium of the definition and management of anaphylaxis: Summary report—Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network symposium. *J Allergy Clin Immunol.* 2006;117:391-397.

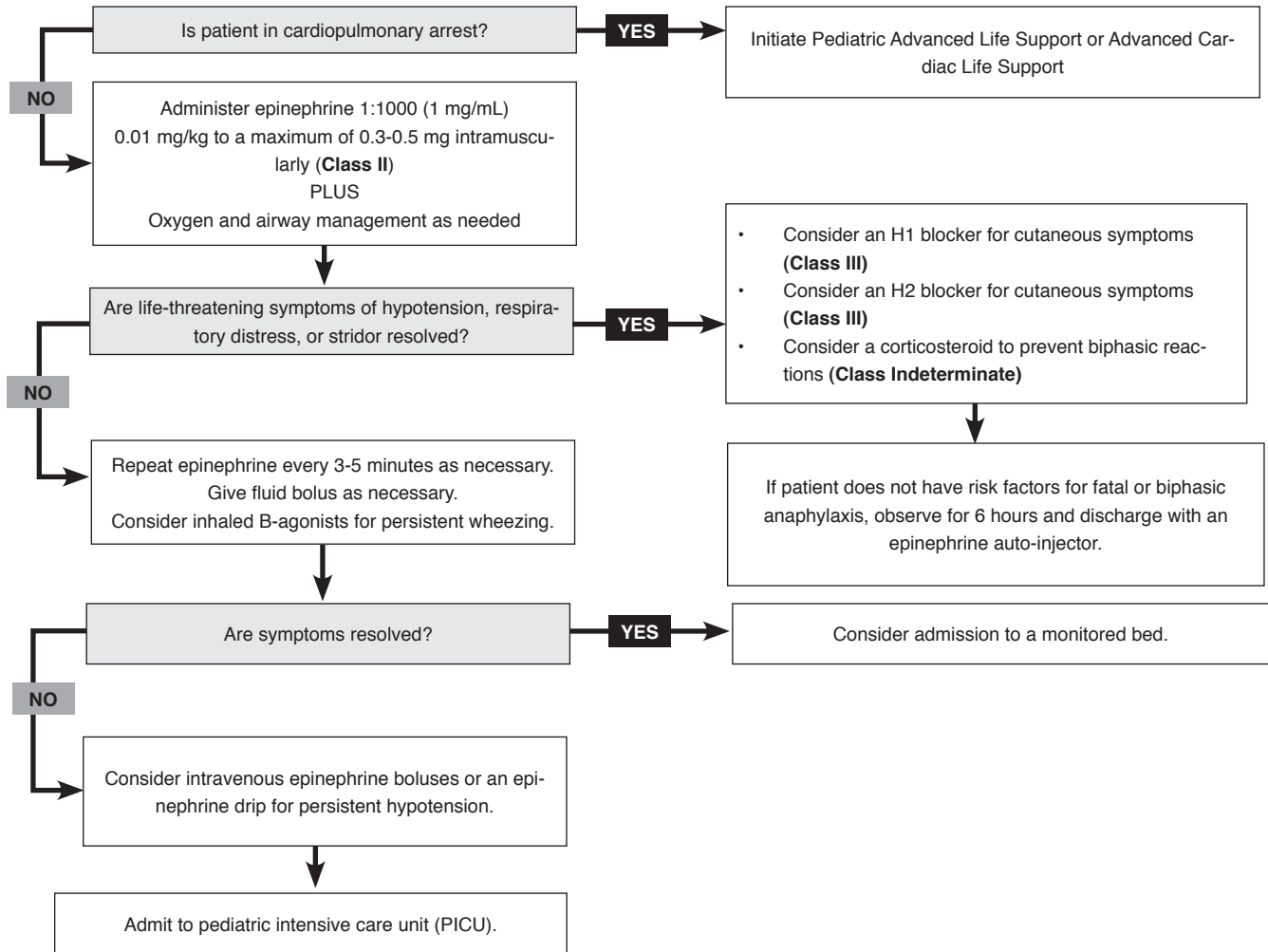
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Clinical Pathway For The Treatment Of Anaphylaxis



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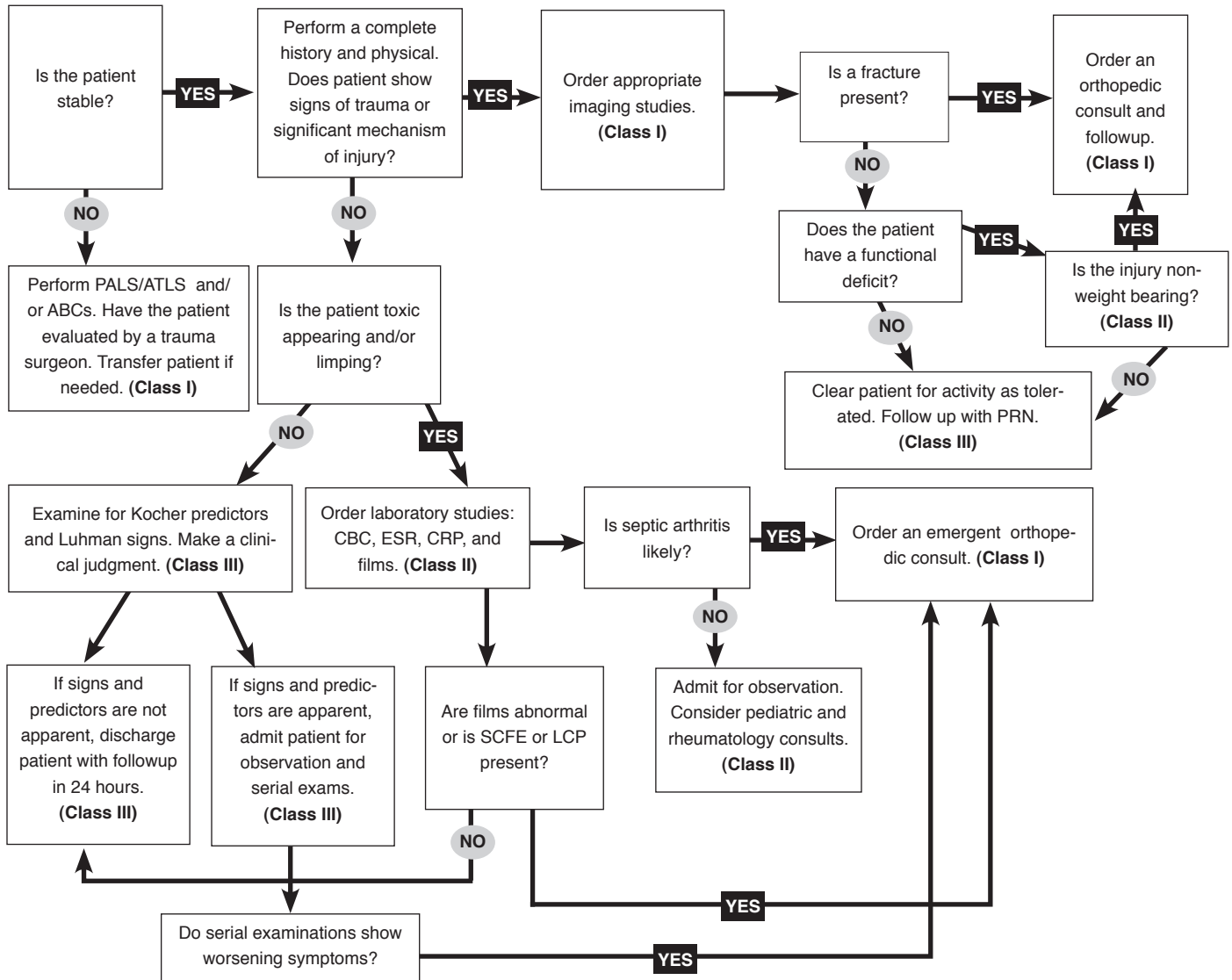
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Clinical Pathway: The Evaluation Of The Lower Extremity



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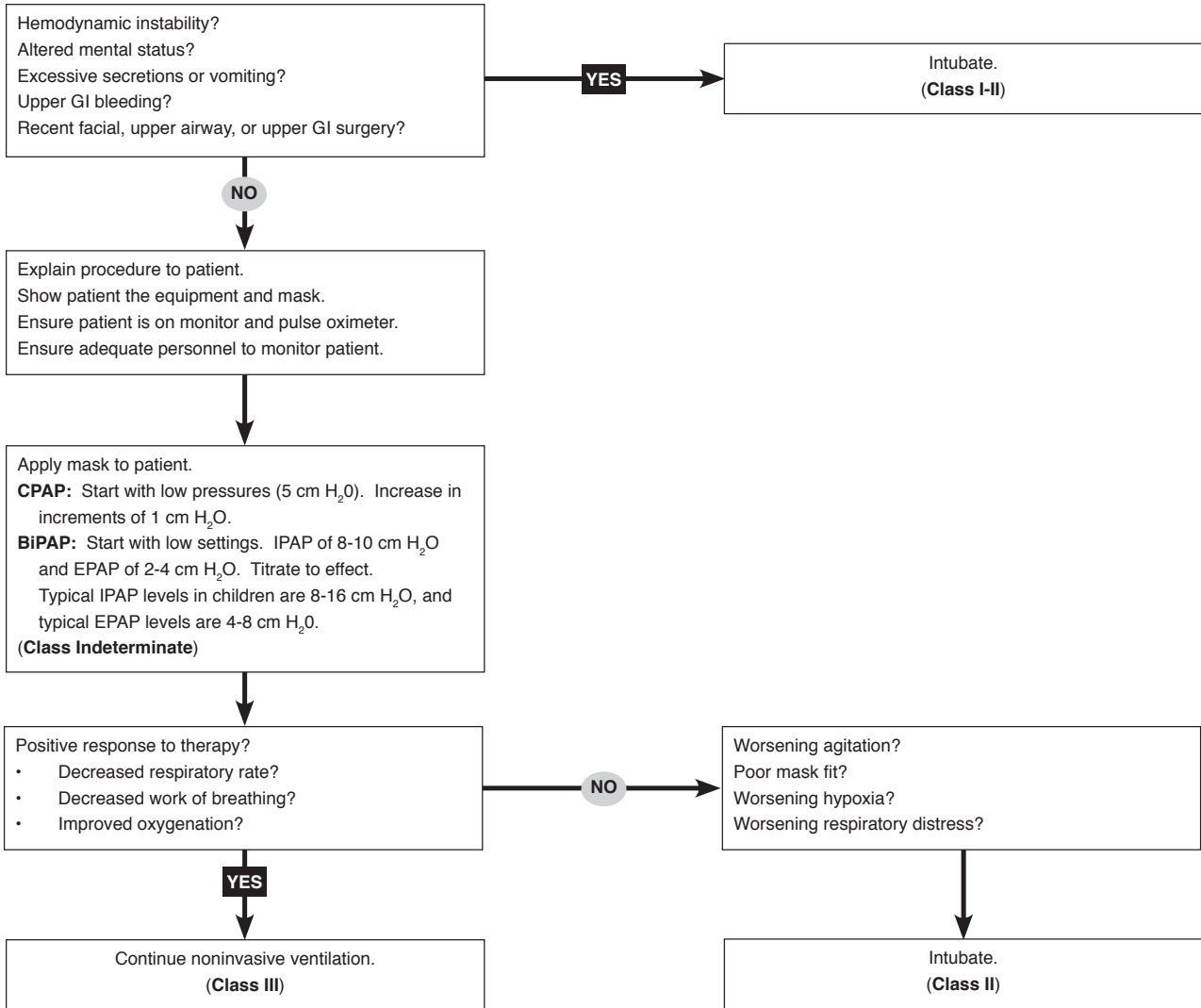
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Clinical Pathway: Noninvasive Ventilation In Children



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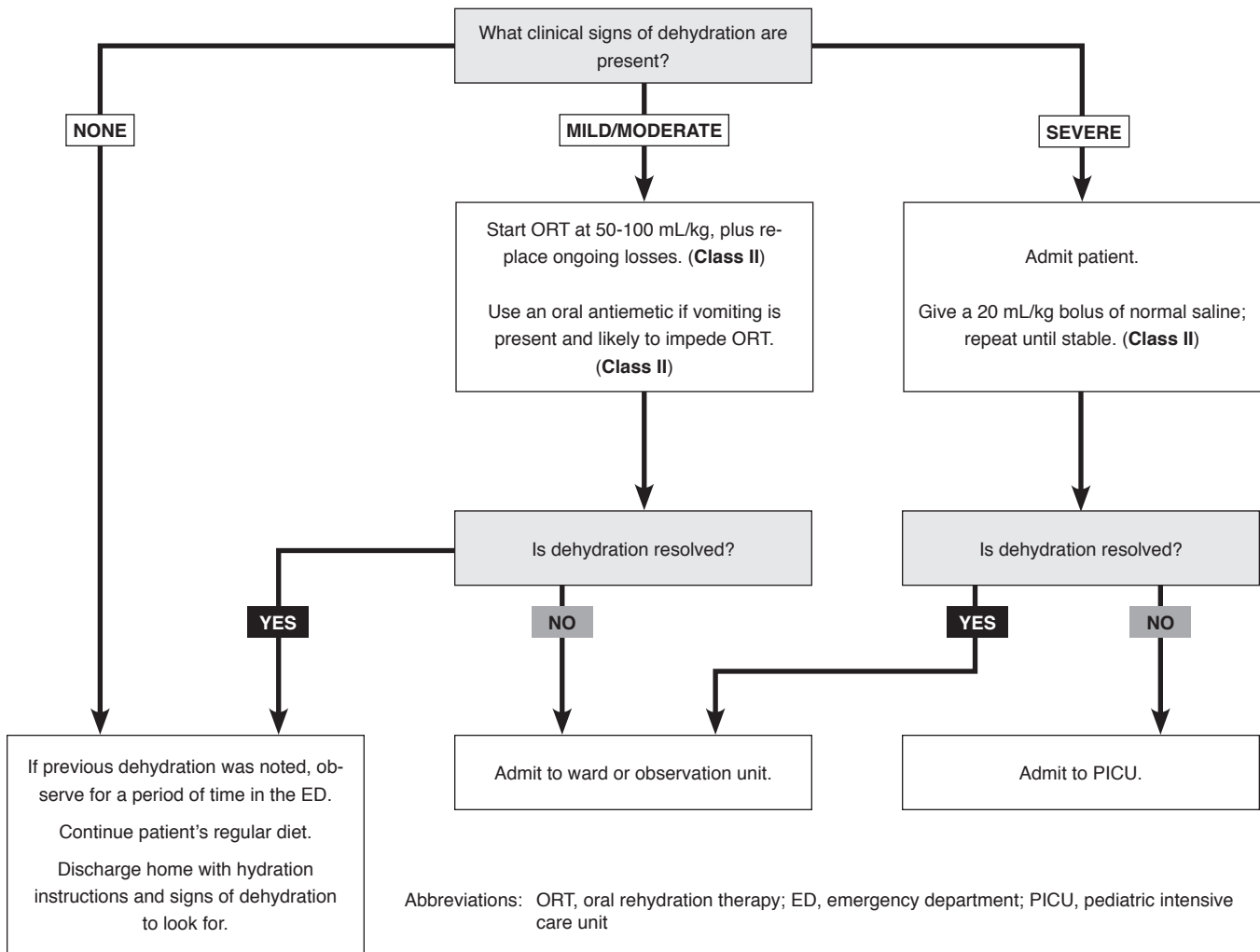
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Clinical Pathway: Management Of Dehydration In Pediatric Gastroenteritis



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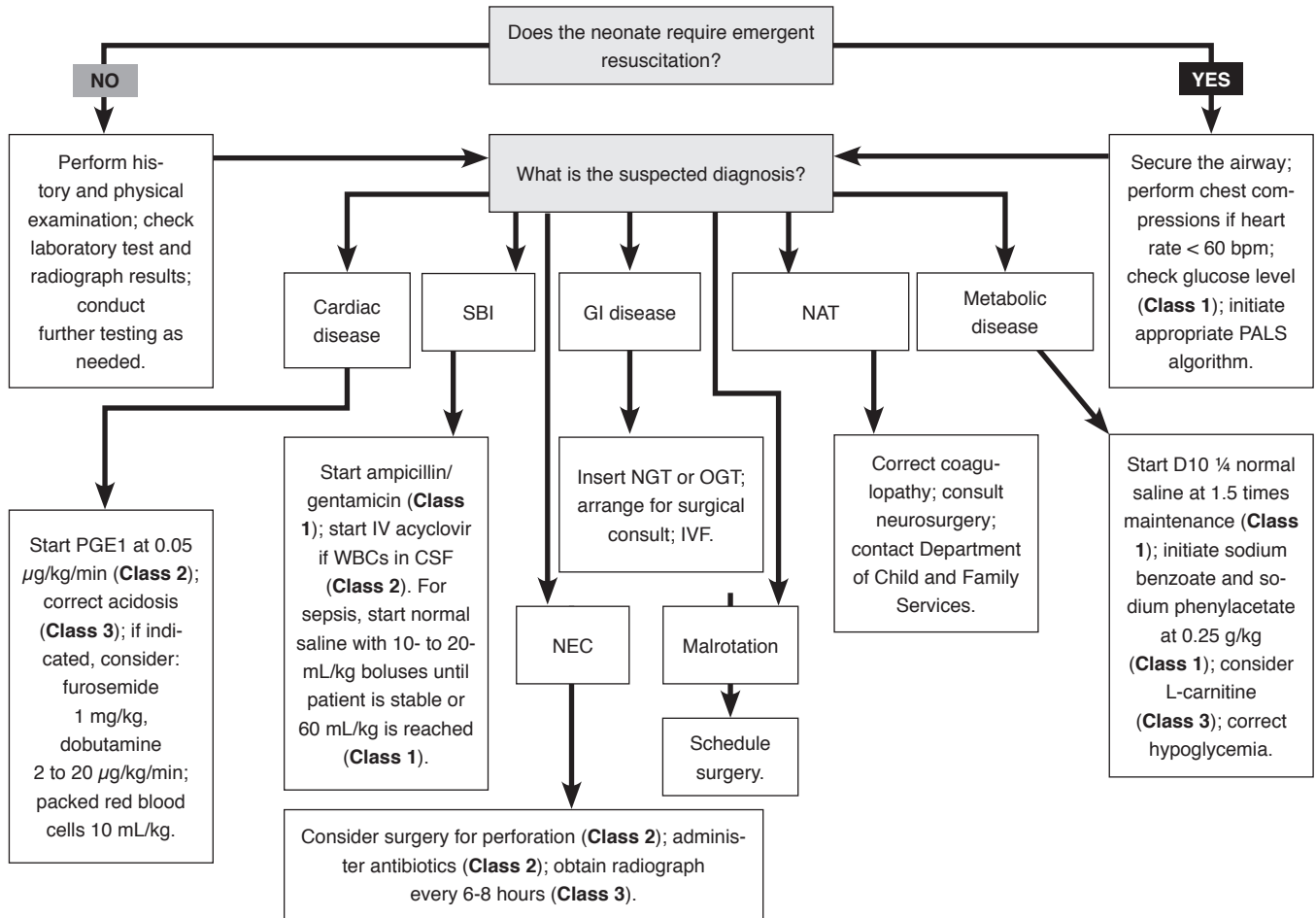
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Clinical Pathway: Management Of The Critically Ill Neonate



Abbreviations: BPM, beats per minute; CSF, cerebrospinal fluid; D10, dextrose 10%; GI, gastrointestinal; IV, intravenous; IVF, intravascular fluids; NAT, nonaccidental trauma; NEC, necrotizing enterocolitis; NGT, nasogastric tube; OGT, orogastric tube; PALS, pediatric advanced life support; PGE1, prostaglandin E1; WBC, white blood cells; SBI, serious bacterial infection.

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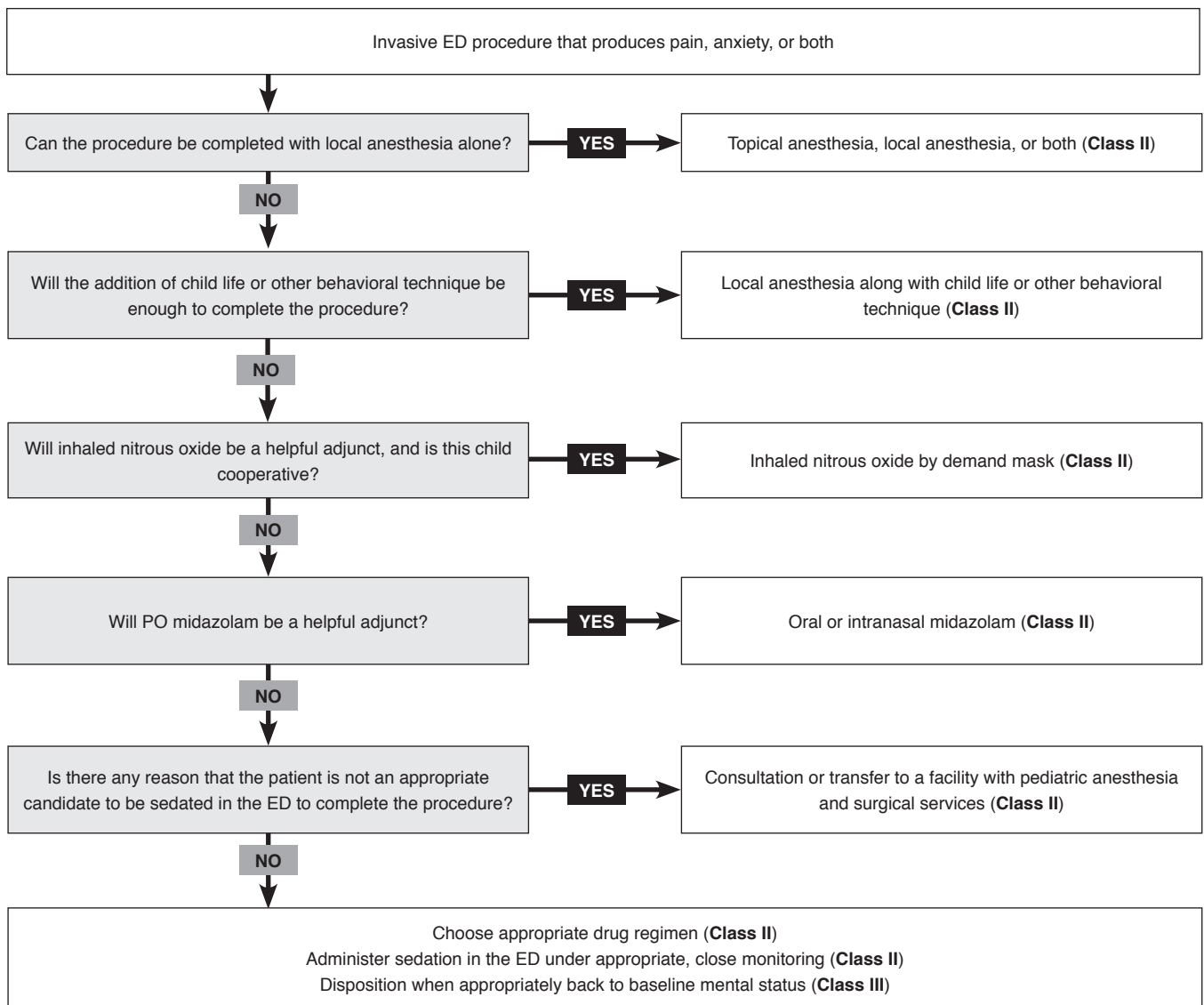
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Clinical Pathway: Pediatric Pain And Anxiety In The ED



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Reprinted from: Matsuno WE, Ota FS. Managing Pediatric Procedural Pain And Anxiety In The Emergency Department. *Pediatric Emergency Medicine Practice* 2006; 3(5):1-28. (Review, Evidence-based)

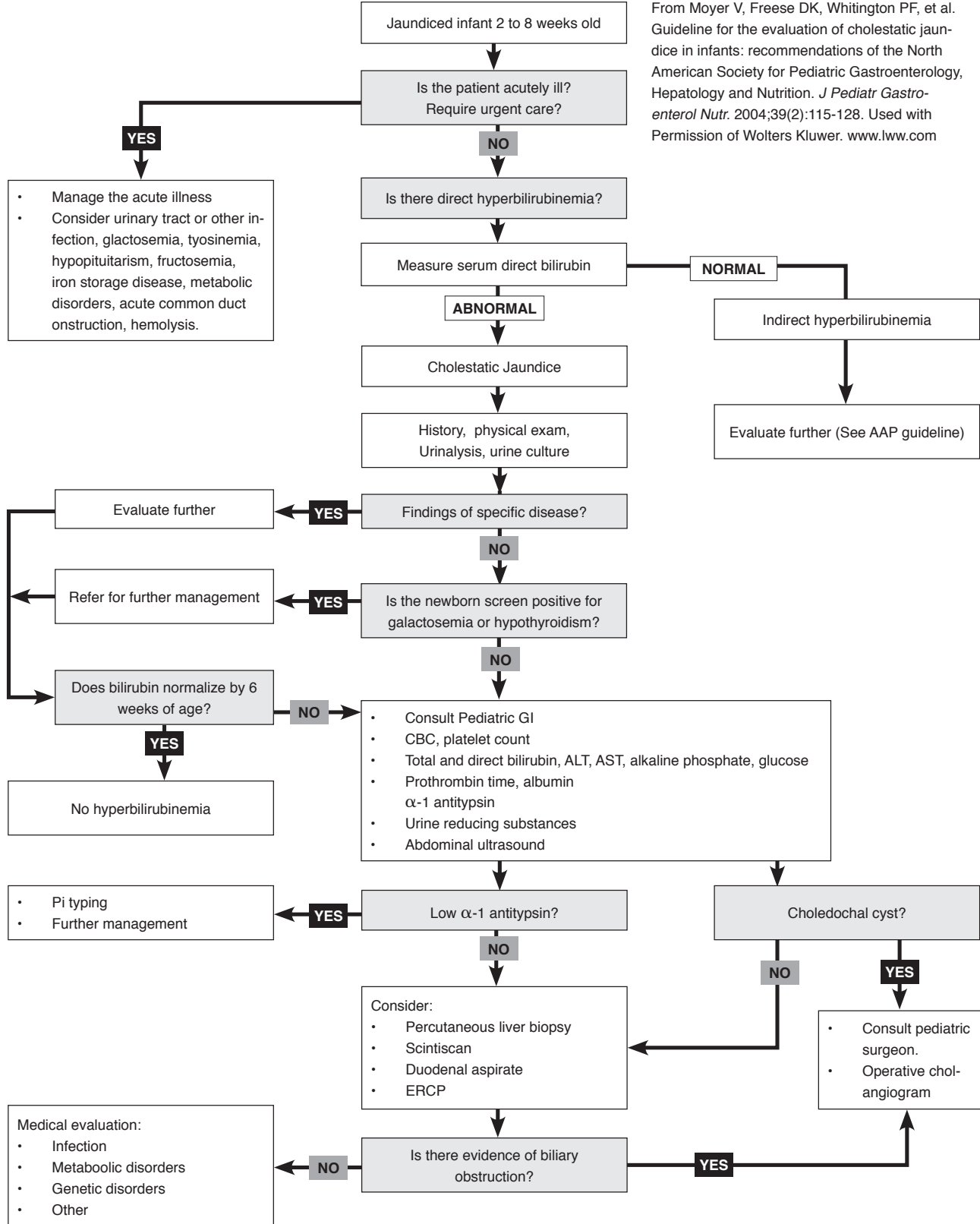
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Clinical Pathway For The Treatment Of Jaundice In 2- To 8-Week Old Infants

From Moyer V, Freese DK, Whittington PF, et al. Guideline for the evaluation of cholestatic jaundice in infants: recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. *J Pediatr Gastroenterol Nutr.* 2004;39(2):115-128. Used with Permission of Wolters Kluwer. www.lww.com

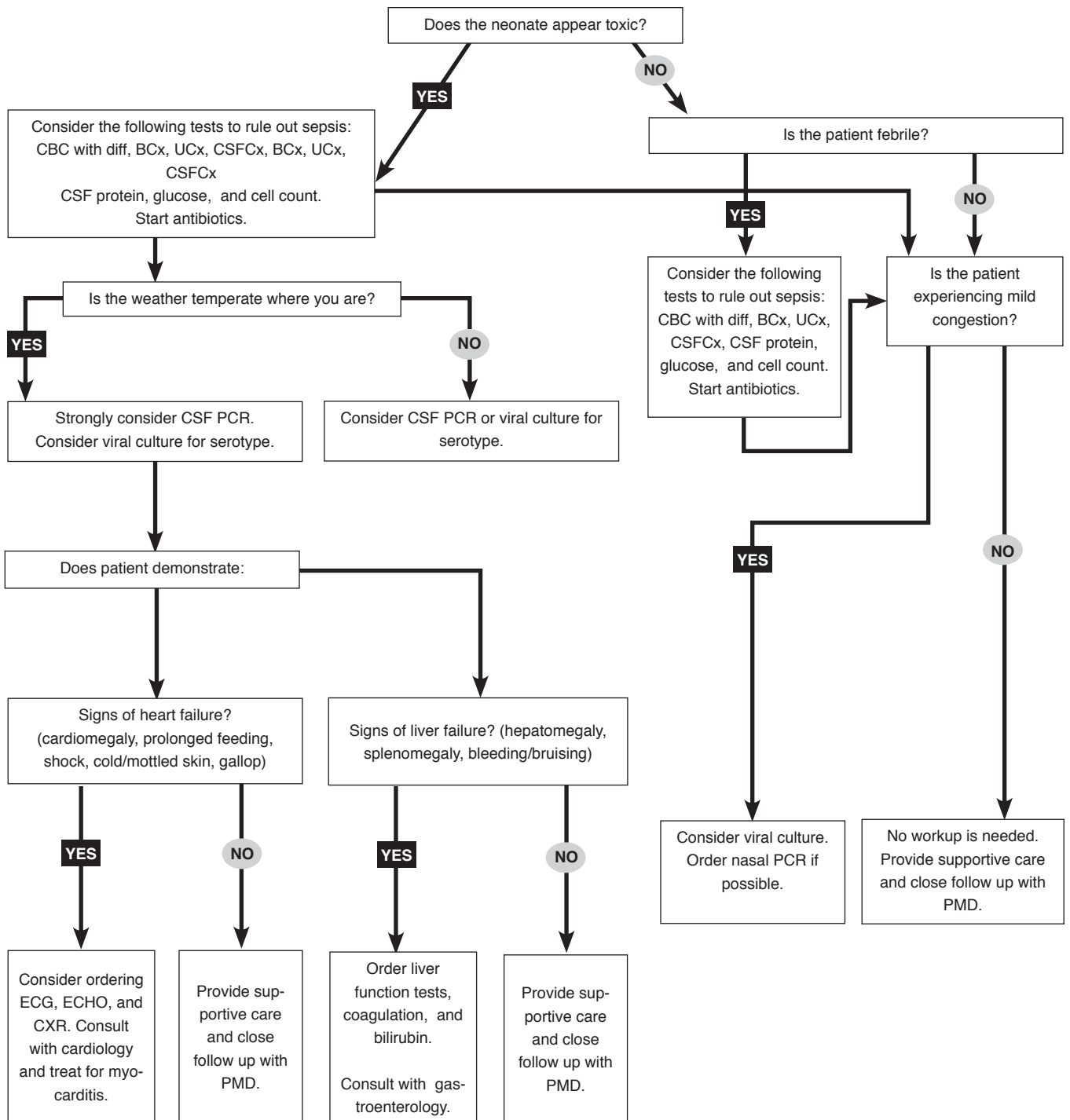


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Clinical Pathway For Treatment Of *Enterovirus* In The Neonate

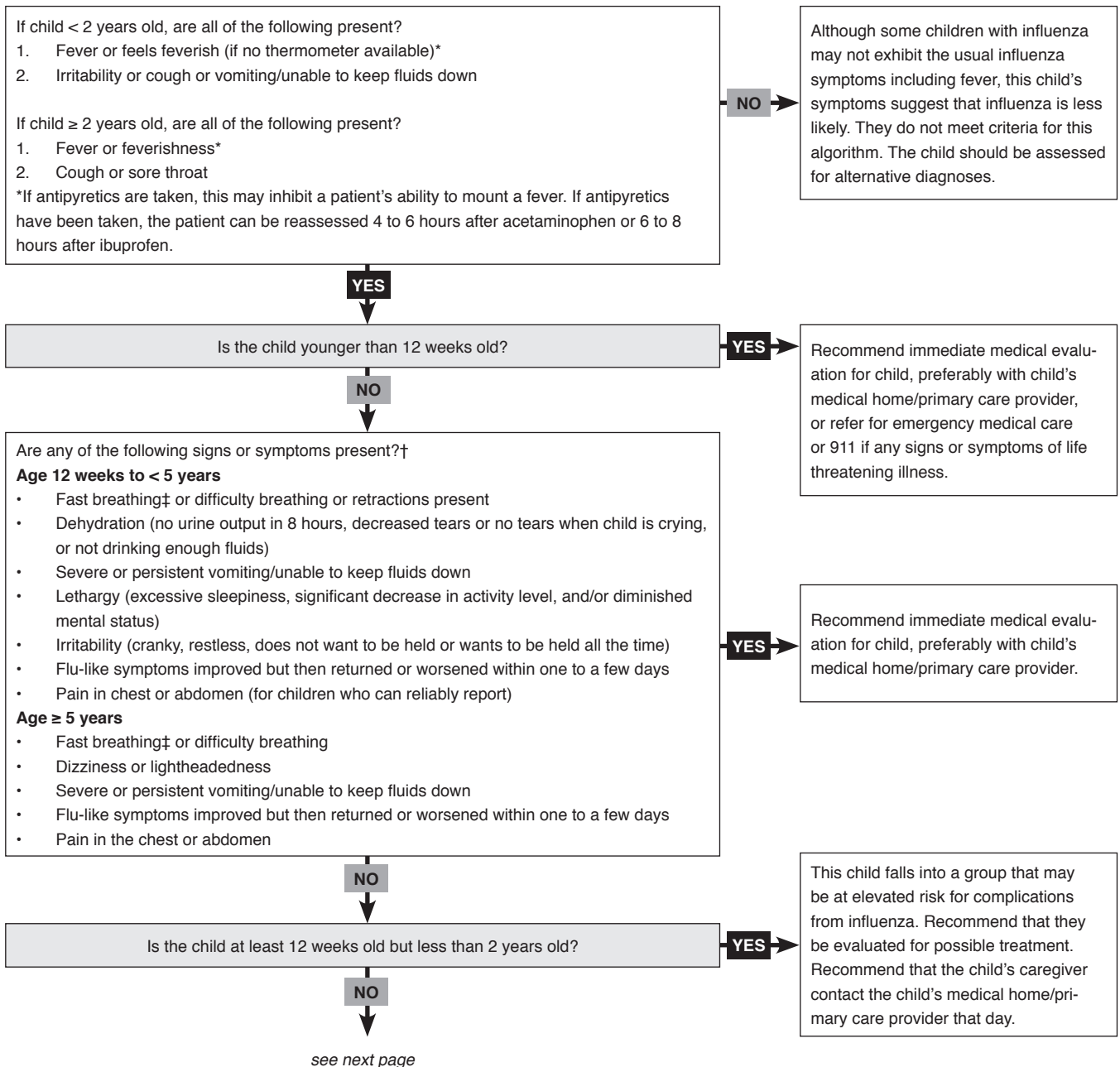


CBC: complete blood count; BCx: blood culture; UCx: urine culture; CSF: cerebral spinal fluid; CSFCx: cerebral spinal fluid culture; EV: Enterovirus; PCR: polymerase chain reaction; ECG: electrocardiogram, ECHO: echocardiogram; CXR: chest x-ray; PMD: primary medical doctor

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2009-2010 Influenza Season Triage Algorithm for Children (≤ 18 years) With Influenza-Like Illness



† These symptoms are purposely broad to minimize the possibility of misclassifying people who truly have severe symptoms. The person attempting to triage the patient should take into account the severity and duration of the symptoms when deciding whether or not patients should be advised to seek evaluation immediately

‡ Suggested respiratory rates indicative of "fast breathing" included in Box

Adapted from <http://www.cdc.gov/h1n1flu/clinicians/pdf/childalgorithm.pdf>

Box 1: Definition of "Fast Breathing"

| Age | Respiratory rate |
|-----------------------|------------------|
| Birth up to 3 months | > 60/min |
| 3 months up to 1 year | > 50/min |
| 1 to < 3 years | > 40/min |
| 3 to < 6 years | > 35/min |
| 6 to < 12 years | > 30/min |
| 12 to 18 years | > 20/min |

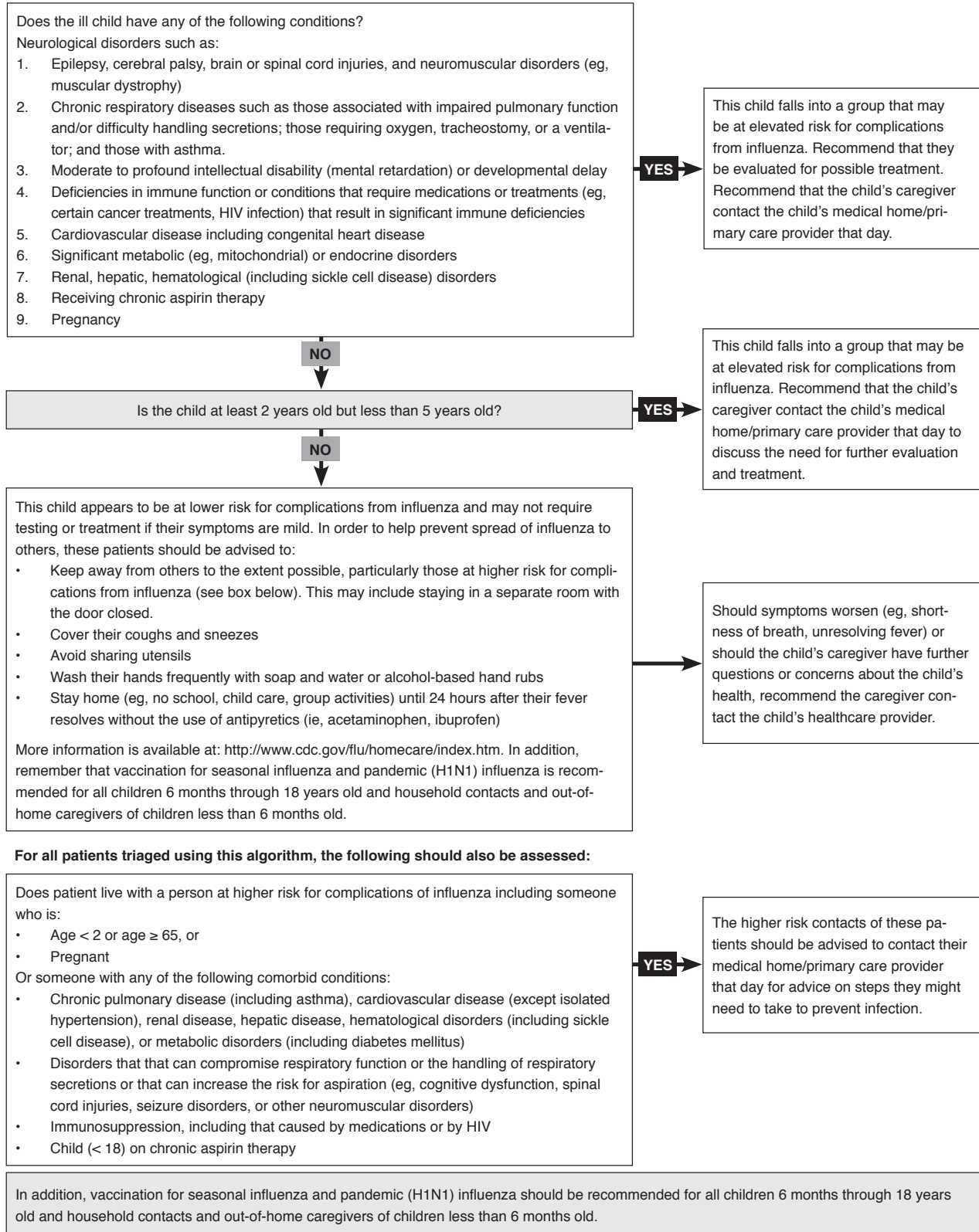
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2009-2010 Influenza Season Triage Algorithm for Children (≤ 18 years) With Influenza-Like Illness (continued)

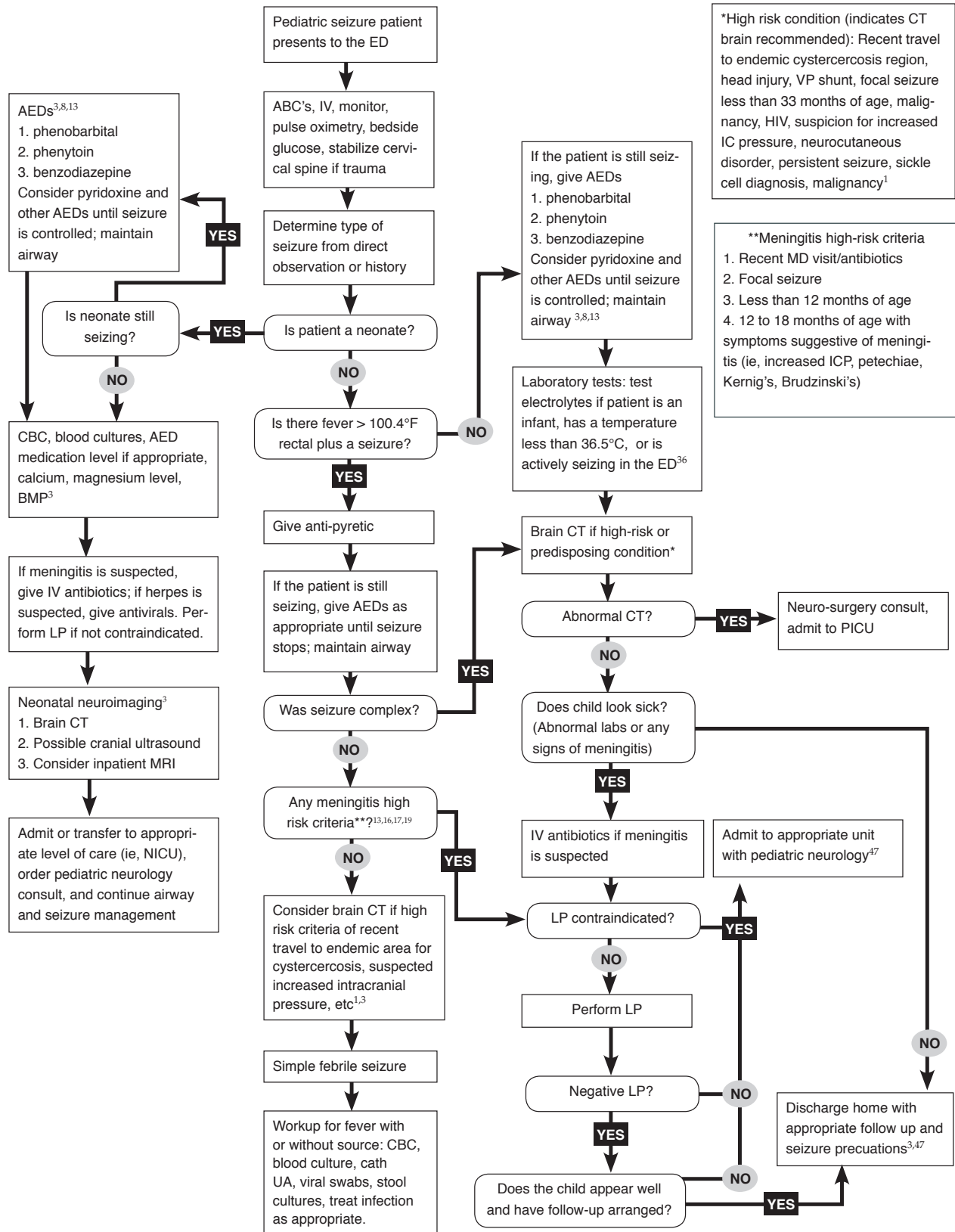


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Clinical Pathway For The Management Of Pediatric Seizures



*High risk condition (indicates CT brain recommended): Recent travel to endemic cystercercosis region, head injury, VP shunt, focal seizure less than 33 months of age, malignancy, HIV, suspicion for increased IC pressure, neurocutaneous disorder, persistent seizure, sickle cell diagnosis, malignancy¹

**Meningitis high-risk criteria

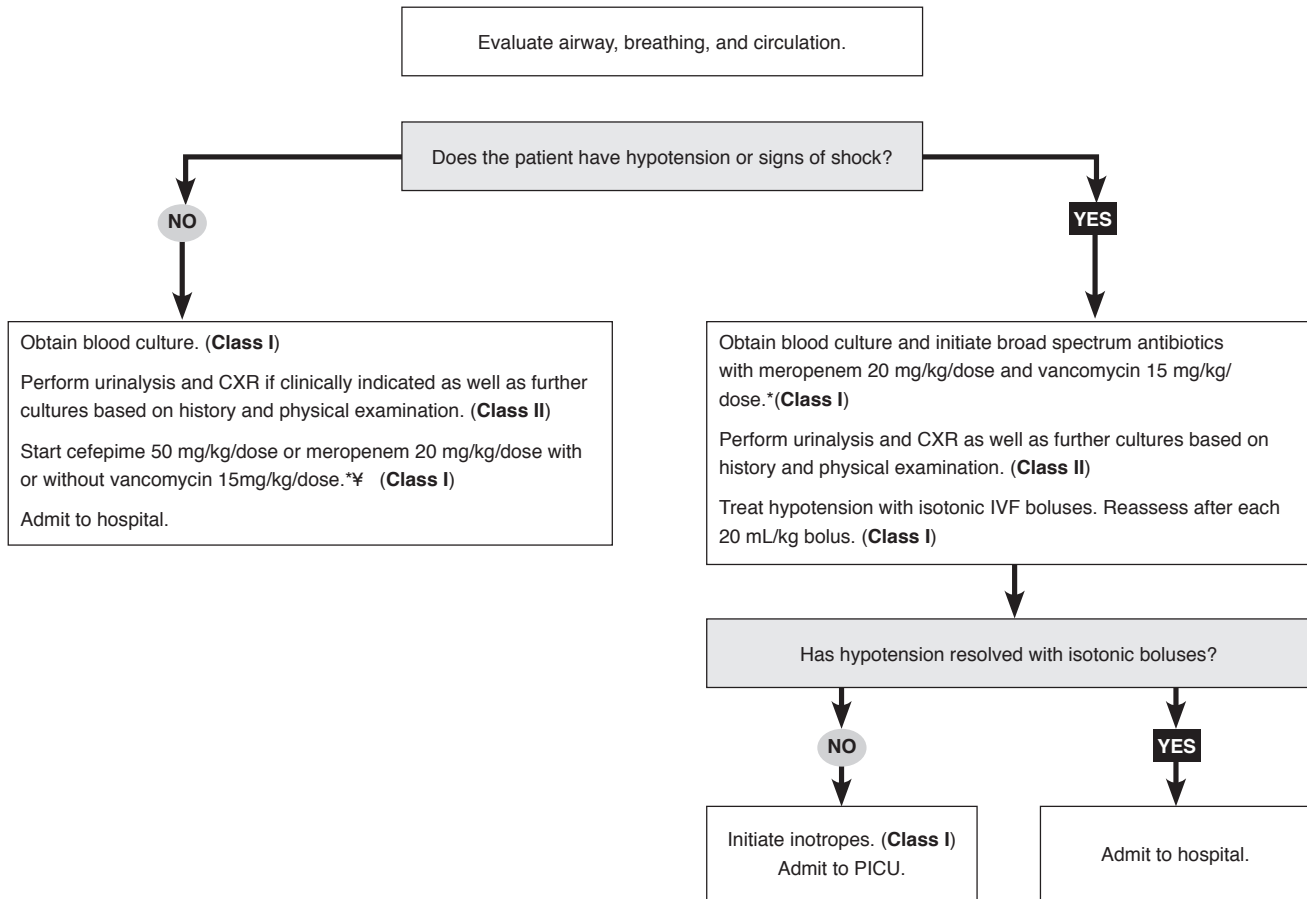
1. Recent MD visit/antibiotics
2. Focal seizure
3. Less than 12 months of age
4. 12 to 18 months of age with symptoms suggestive of meningitis (ie, increased ICP, petechiae, Kernig's, Brudzinski's)

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Clinical Pathway: Patient With ANC < 500 Or Chemotherapy-Induced Neutropenia



*The practitioner should choose antibiotics based on hospital policy and local bacterial resistance patterns.

¥ Maximum doses of medications are not listed here. Please refer to a database for complete dosing recommendations.

Class Of Evidence Definitions

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Class I

- Always acceptable, safe
- Definitely useful
- Proven in both efficacy and effectiveness

Level of Evidence:

- One or more large prospective studies are present (with rare exceptions)
- High-quality meta-analyses
- Study results consistently positive and compelling

Class II

- Safe, acceptable
- Probably useful

Level of Evidence:

- Generally higher levels of evidence
- Non-randomized or retrospective studies: historic, cohort, or case control studies
- Less robust RCTs
- Results consistently positive

Class III

- May be acceptable
- Possibly useful
- Considered optional or alternative treatments

Level of Evidence:

- Generally lower or intermediate levels of evidence
- Case series, animal studies, consensus panels
- Occasionally positive results

Indeterminate

- Continuing area of research
- No recommendations until further research

Level of Evidence:

- Evidence not available
- Higher studies in progress
- Results inconsistent, contradictory
- Results not compelling

Significantly modified from: The Emergency Cardiovascular Care Committees of the American Heart Association and representatives from the resuscitation councils of ILCOR: How to Develop Evidence-Based Guidelines for Emergency Cardiac Care: Quality of Evidence and Classes of Recommendations; also: Anonymous. Guidelines for cardiopulmonary resuscitation and emergency cardiac care. Emergency Cardiac Care Committee and Subcommittees, American Heart Association. Part IX. Ensuring effectiveness of community-wide emergency cardiac care. *JAMA*. 1992;268(16):2289-2295.

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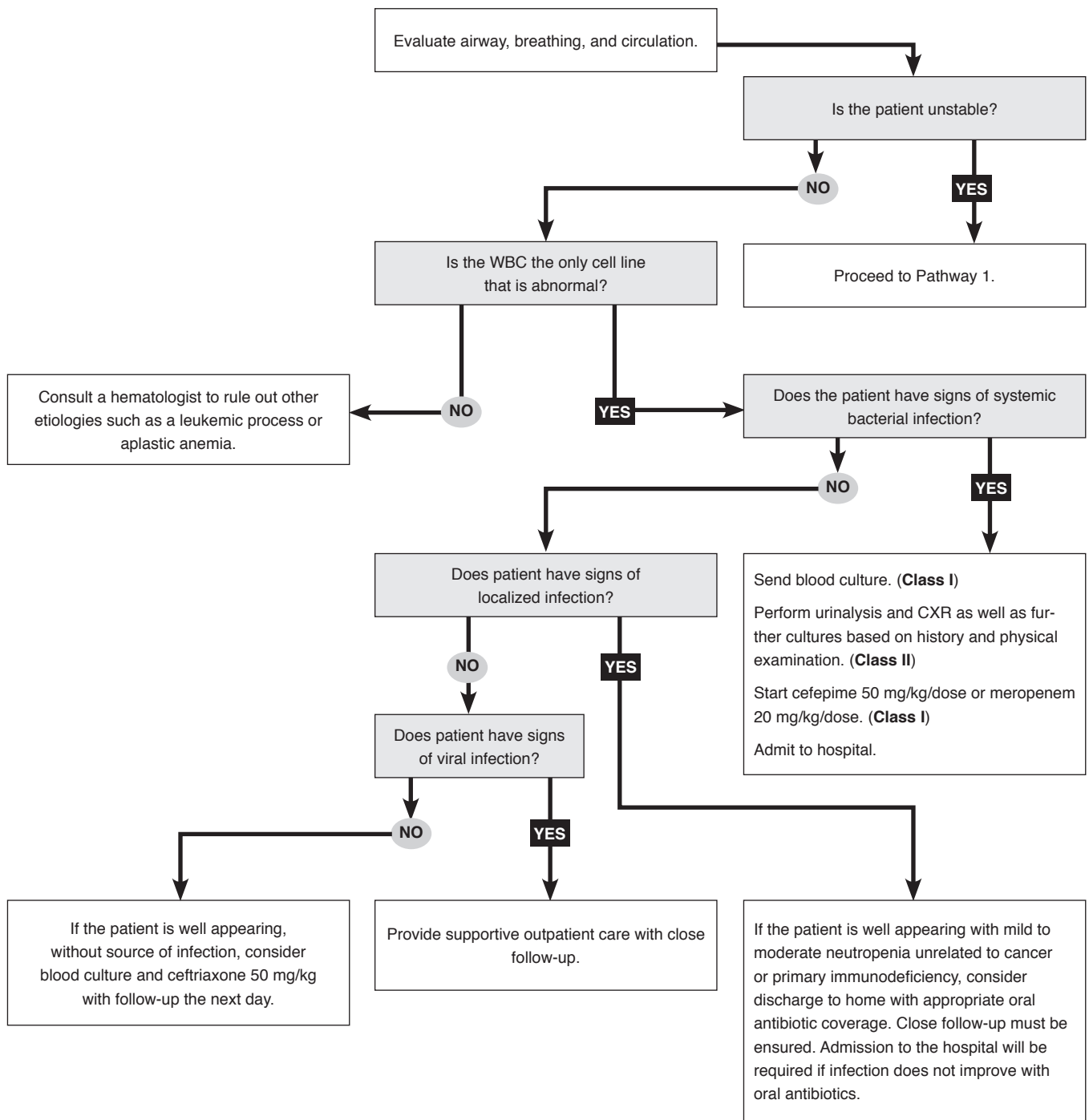
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Clinical Pathway: Patient With Mild To Moderate Neutropenia*



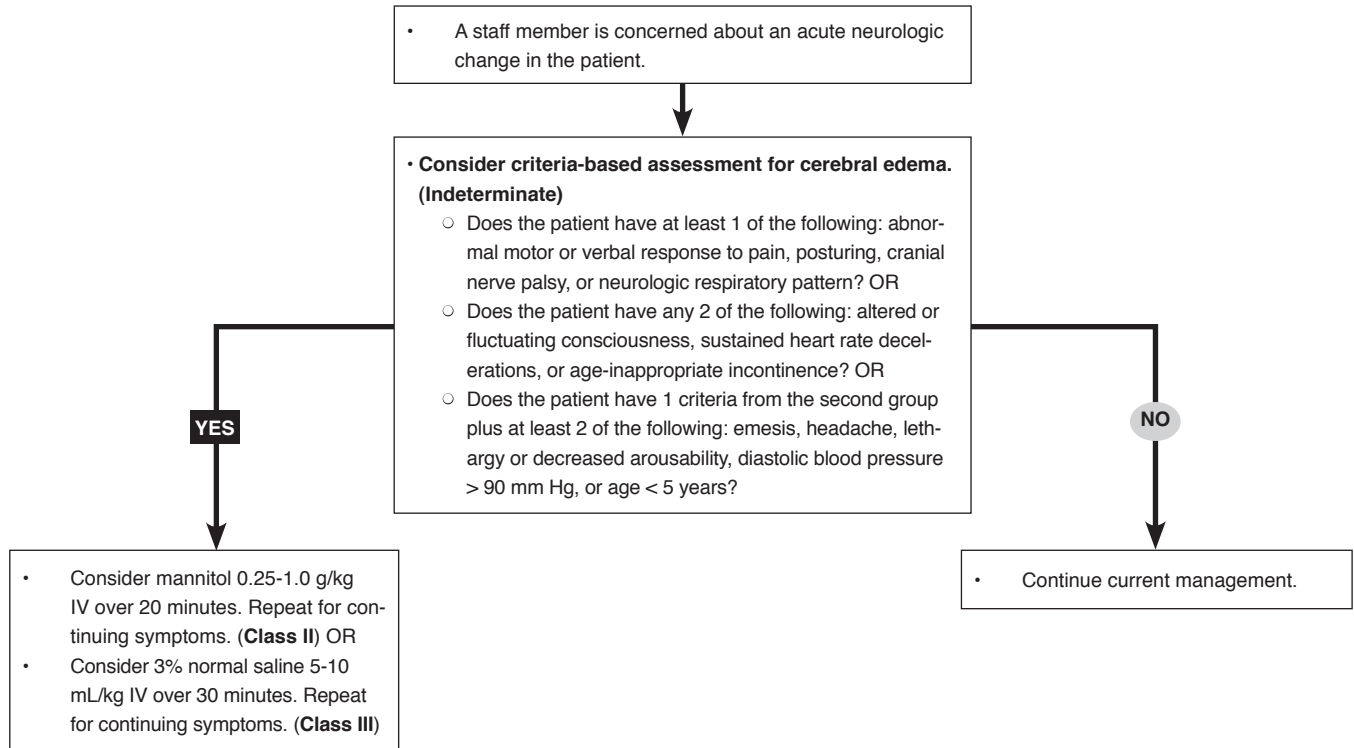
*Any patient who is ill-appearing should have broad-spectrum antibiotics initiated and should be admitted to the hospital regardless of the ANC value. The practitioner should also risk stratify based on suspected underlying cause and expected duration of neutropenia.

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Clinical Pathway For Evaluation And Treatment Of Cerebral Edema

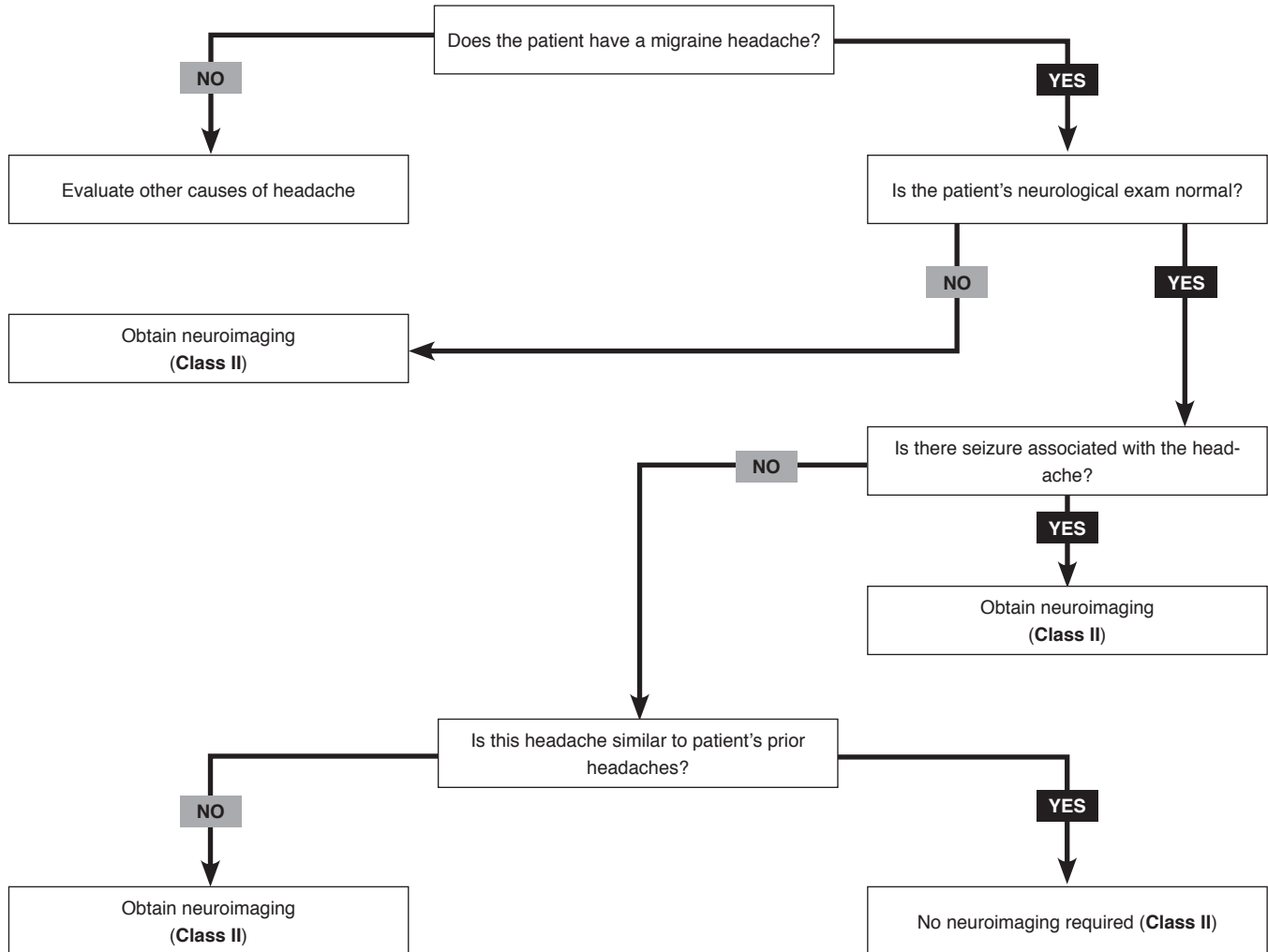


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Clinical Pathway: Migraine Headache Neuroimaging



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Class III

- May be acceptable
- Possibly useful
- Considered optional or alternative treatments

Level of Evidence:

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- Case series, animal studies, consensus panels
- Occasionally positive results

Indeterminate

- Continuing area of research
- No recommendations until further research

Level of Evidence:

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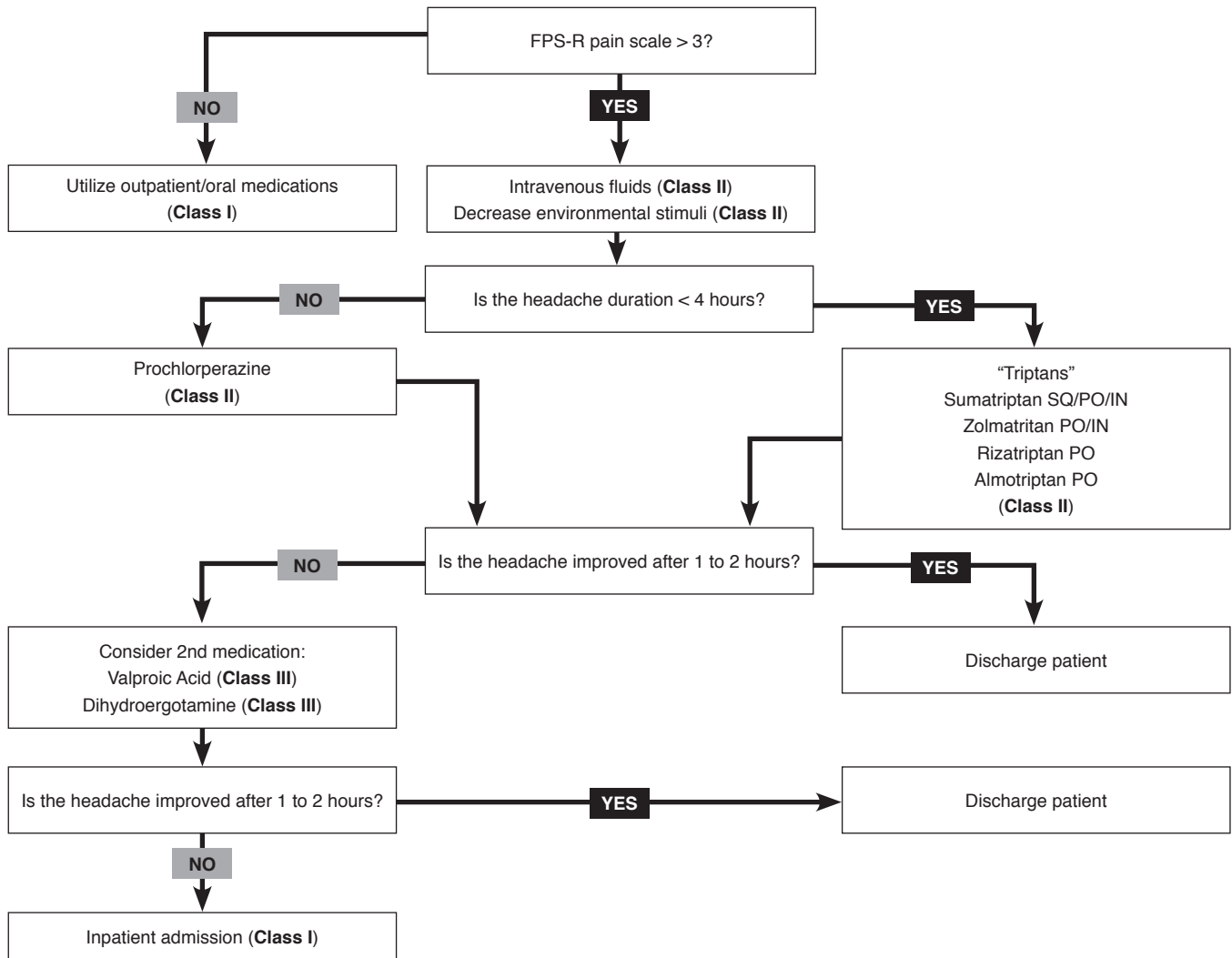
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Clinical Pathway: Pediatric Migraine Clinical Treatment Pathway



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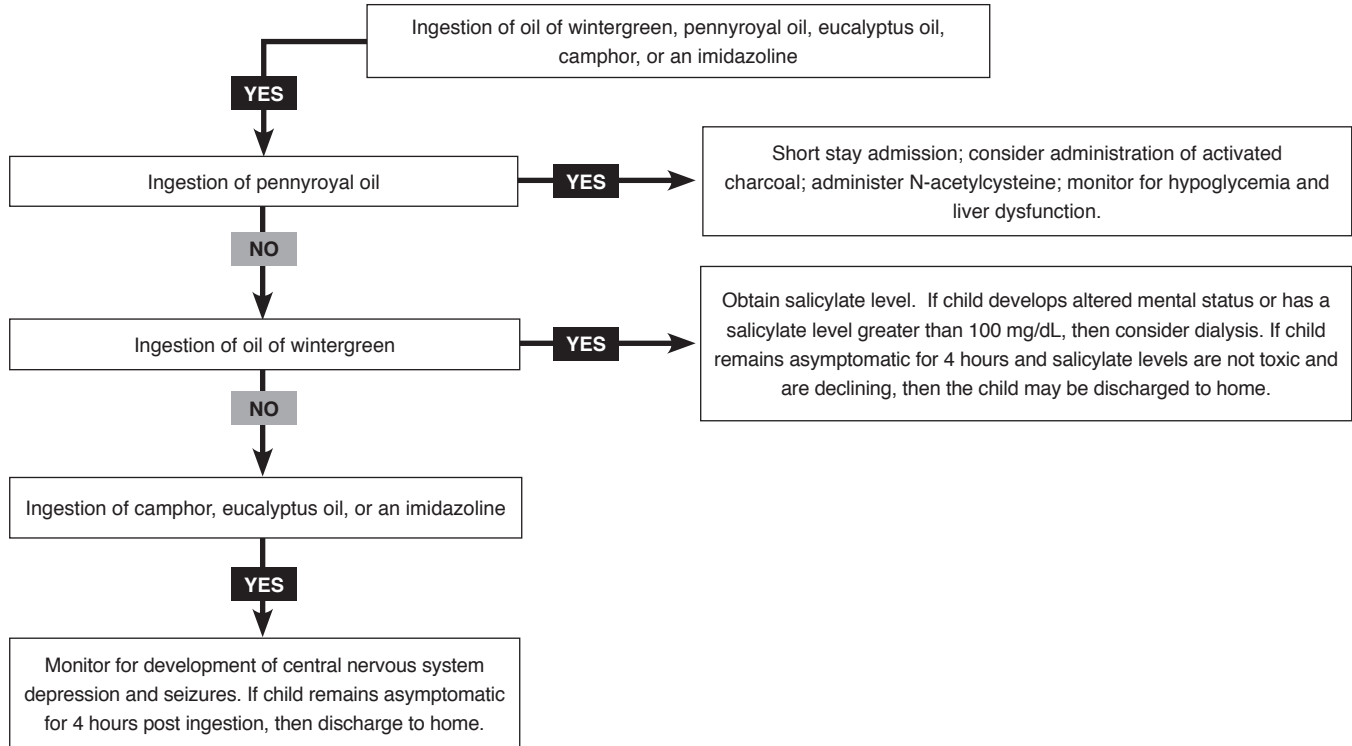
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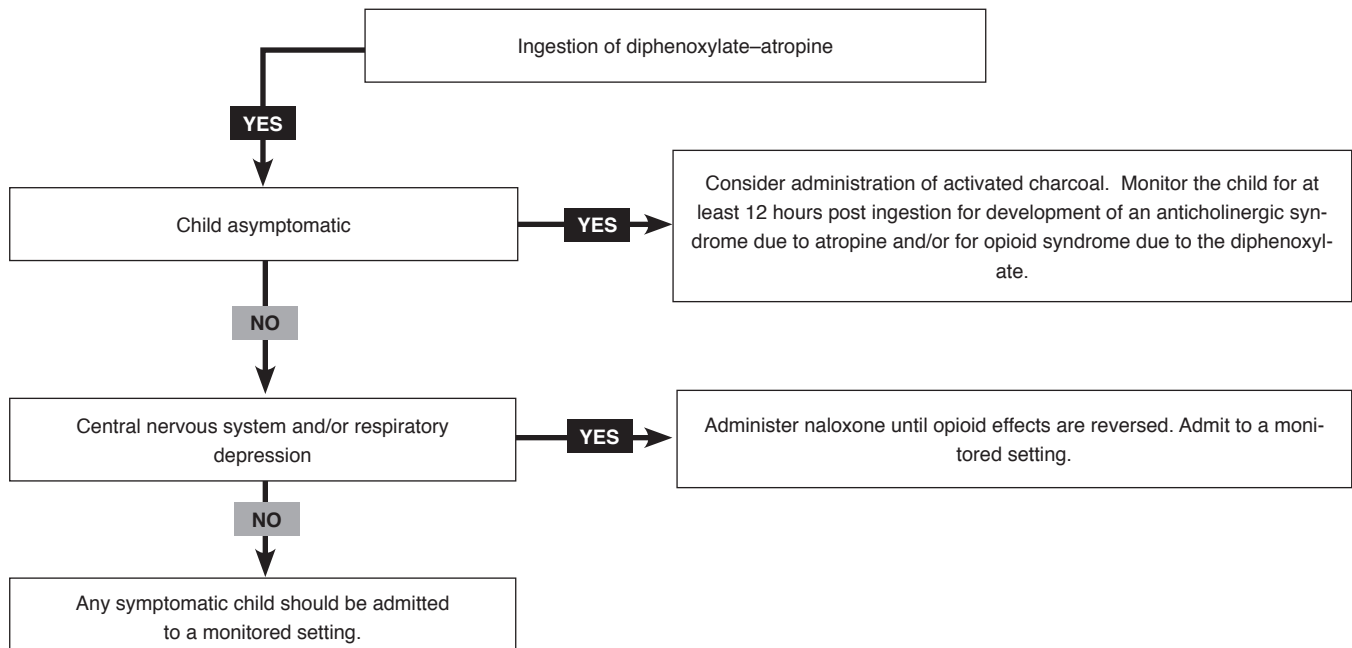
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Clinical Pathway: Oil Of Wintergreen, Pennyroyal Oil, Camphor, Eucalyptus, Imidazoline Decongestant



Clinical Pathway: Diphenoxylate–Atropine



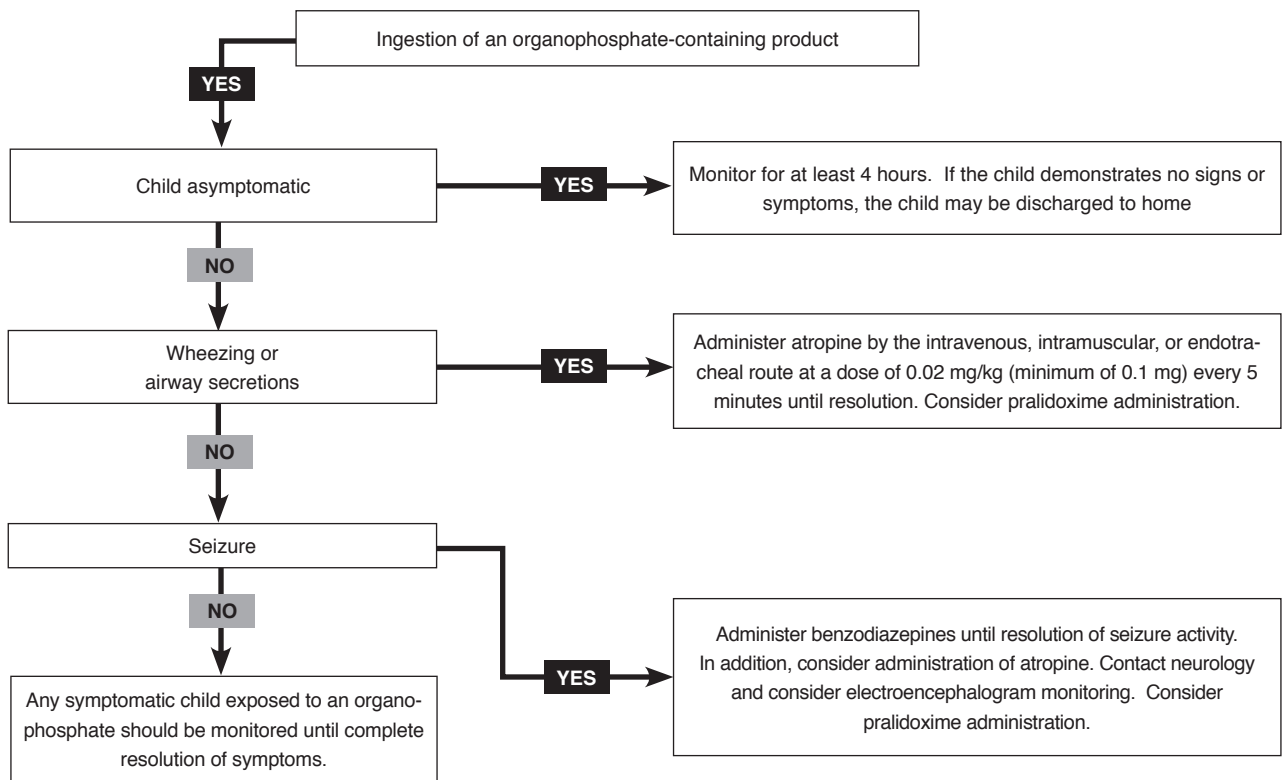
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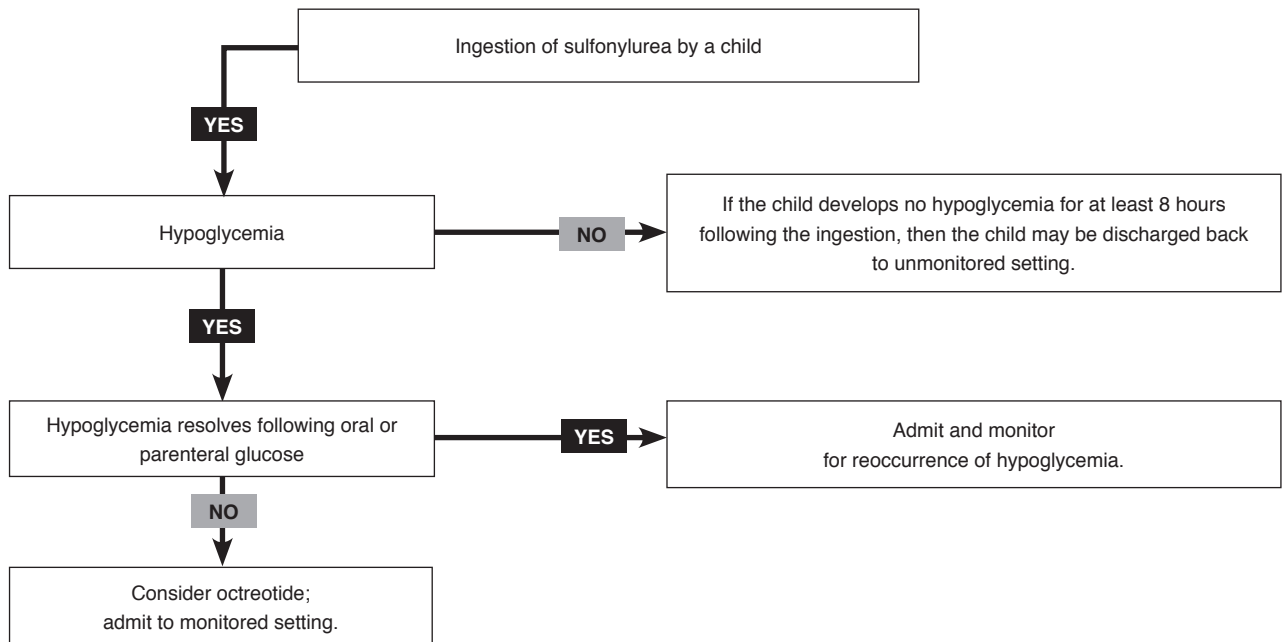
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Clinical Pathway: Organophosphates



Clinical Pathway: Sulfonylureas



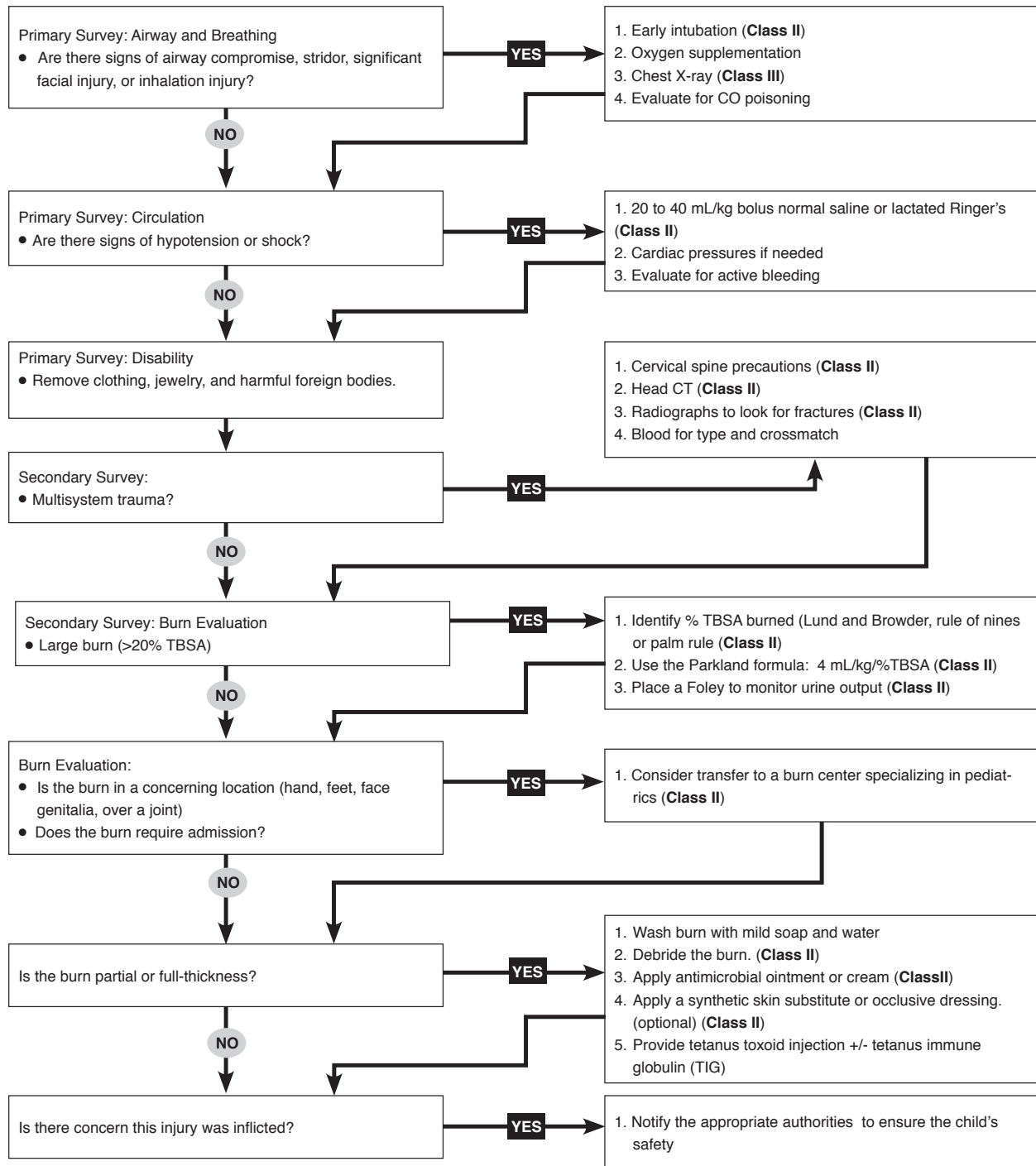
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Clinical Pathway For The Treatment Of Pediatric Burns



The **evidence for recommendations** is graded using the following scale. **Class I:** Definitely recommended. Definitive, excellent evidence provides support. **Class II:** Acceptable and useful. Good evidence provides support. **Class III:** May be acceptable, possibly useful. Fair-to-good evidence provides support. **Indeterminate:** Continuing area of research.

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Clinical Pathway For The Treatment Of Mammalian Bites

Perform wound care.

- Irrigate.
- Debride if indicated.
- Perform incision and drainage if an abscess is present.
- Consider wound closure in cosmetically important areas.
- Elevate and immobilize if wound is on extremity.

Gather the history of the injury.

- Obtain patient information including past medical history, medications, drug allergies, tetanus immunization status, and social factors.
- Obtain animal information including rabies immunization status, animal's health, and location of animal.
- Obtain information regarding the injury including provoked vs unprovoked injuries, timing, and delay in seeking medical treatment.

High risk injury?

(including those with delayed presentation, bites to the hand, and immunocompromised patients)

Consider a consultation and prescribing antibiotics.

Lower risk injury?

(including those to young, otherwise healthy patients who were not bitten on their hand)

Perform physical examination.

- Note the location of wound.
- Note the depth and type of wound (eg, avulsion, puncture, crush).
- Assess function if an extremity is involved.
- Perform a neurovascular examination.
- Assess patient for signs of infection if delayed presentation.

Order diagnostic studies.

- Order radiographs if bony injury, violation of joint, or foreign body is suspected.
- Order a wound culture and Gram stain for infected wounds.
- Order additional studies if bacteremia/sepsis is present including a complete blood cell count, blood culture, coagulation studies, and liver panel.

If the injury is complicated:

(involves tendons, joints, bones, and/or nerves, or sepsis is evident)

Consider a consult and possible admission.

If the injury is uncomplicated, ask:

Is it a puncture wound?

YES

Cleanse and dress the wound. Consider antibiotics.

YES

Suture the laceration.

Is it a laceration?

YES

Is the laceration of cosmetic concern?

NO

Consider suturing the wound if needed.

NO

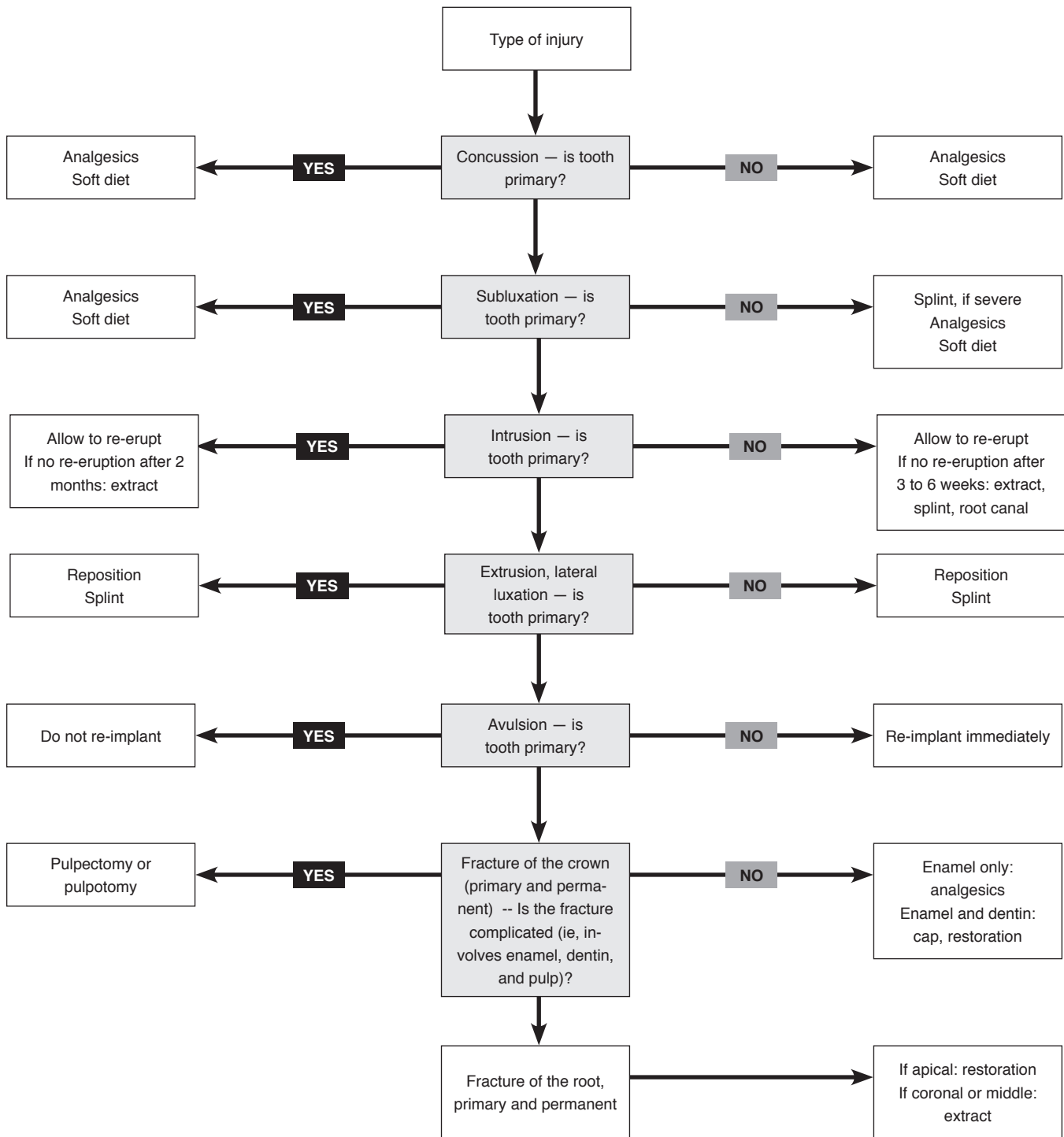
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Clinical Pathway For Treatment Of Traumatic Dental Injuries



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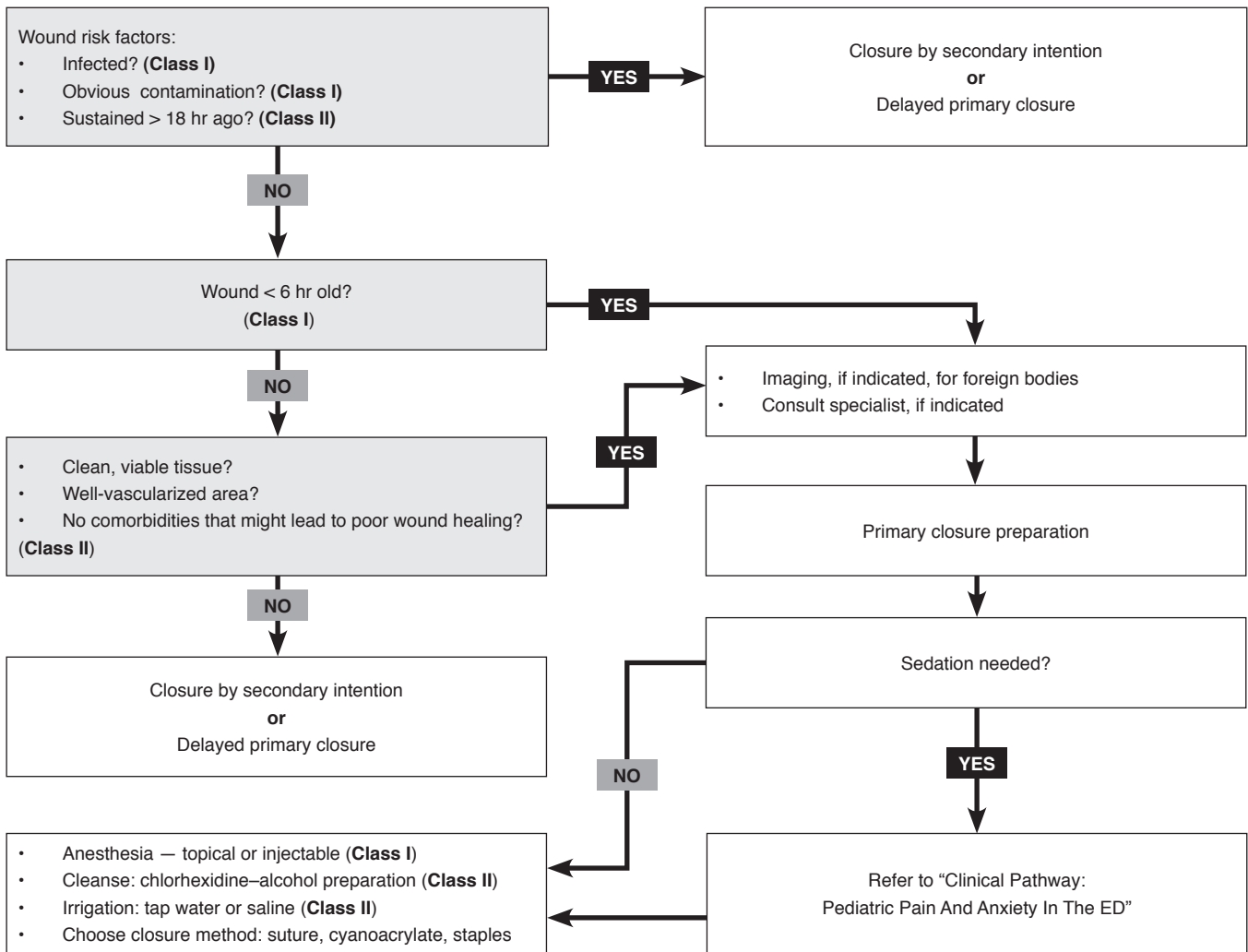
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Clinical Pathway For Treating Pediatric Wounds



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Class III

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- Considered optional or alternative treatments

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Indeterminate

- Continuing area of research
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Level of Evidence:

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