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

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Emergency Medicine Practice
Pediatric Emergency Medicine Practice
EM Practice Guidelines Update
The Lifelong Learning and Self-Assessment Study Guide
EM Critical Care
ED Overcrowding Solutions
# Table Of Contents

## Allergy/Endocrine Emergencies
- Clinical Pathway For Initial Evaluation Of Diabetic Ketoacidosis ................................................................. 1
- Clinical Pathway For Treatment Of Diabetic Ketoacidosis ..................................................................................... 2
- Clinical Pathway For Emergency Care Of Patients With A Metabolic Disorder ......................................................... 3
- Clinical Pathway For The Diagnosis Of Anaphylaxis ............................................................................................. 4
- Clinical Pathway For The Treatment Of Anaphylaxis ............................................................................................ 5

## General Emergency Medicine
- Clinical Pathway: The Evaluation Of The Lower Extremity ................................................................................ 6
- Clinical Pathway: Noninvasive Ventilation In Children ....................................................................................... 7
- Clinical Pathway: Management Of Dehydration In Pediatric Gastroenteritis ......................................................... 8
- Clinical Pathway: Management Of The Critically Ill Neonate ........................................................................... 9
- Clinical Pathway: Pediatric Pain And Anxiety In The ED .................................................................................... 10
- Clinical Pathway For The Treatment Of Jaundice In 2- To 8-Week Old Infants ..................................................... 11

## Infectious Disease
- Clinical Pathway For The Treatment Of Enterovirus In The Neonate ................................................................. 12
- 2009-2010 Influenza Season Triage Algorithm For Children (≤ 18 years)
  - With Influenza-Like Illness ................................................................................................................................. 13-14

## Neurologic Emergencies
- Clinical Pathway For The Management Of Pediatric Seizures ......................................................................... 15
- Clinical Pathway: Patient With ANC < 500 Or Chemotherapy-Induced Neutropenia ........................................ 16
- Clinical Pathway: Patient With Mild To Moderate Neutropenia .................................................................... 17
- Clinical Pathway For Evaluation And Treatment Of Cerebral Edema ............................................................... 18
- Clinical Pathway: Migraine Headache Neuroimaging ....................................................................................... 19
- Clinical Pathway: Pediatric Migraine Clinical Treatment Pathway ................................................................. 20

## Toxicology And Environmental Emergencies
- Clinical Pathway: Oil Of Wintergreen, Pennyroyal Oil, Camphor, Eucalyptus, Imidazoline Decongestant ........ 21
- Clinical Pathway: Diphenoxylate-Atropine ........................................................................................................ 21
- Clinical Pathway: Organophosphates ................................................................................................................ 22
- Clinical Pathway: Sulfonylureas ........................................................................................................................ 22

## Trauma
- Clinical Pathway For The Treatment Of Pediatric Burns ...................................................................................... 23
- Clinical Pathway For The Treatment Of Mammalian Bites ................................................................................. 24
- Clinical Pathway For Treatment Of Traumatic Dental Injuries ......................................................................... 25
- Clinical Pathway For Treating Pediatric Wounds ............................................................................................... 26
Clinical Pathway For Initial Evaluation Of Diabetic Ketoacidosis

- Are results of history and physical examination consistent with diabetic ketoacidosis (ie, polyuria, polydipsia, weight loss, fatigue, nausea/vomiting)?
- Does rapid glucose testing show elevated blood glucose level?
- Are ketones present in urine or blood?

Initiate Pediatric Advanced Life Support

Are there any airway, breathing, or circulation concerns?

YES

YES

Does the patient show signs of shock?

NO

NO

Classify diabetic ketoacidosis severity (Class II).
- Severe: pH < 7.1 or bicarbonate < 5 mmol/L
- Moderate: pH 7.1-7.2 or bicarbonate 5-10 mmol/L
- Mild: pH 7.2-7.3 and bicarbonate 10-15 > 15 mmol/L

Administer 0.9% normal saline or lactated ringers 10 mL/Kg bolus over 1-2 hours. (Class II)

Follow initial management algorithm (see Clinical Pathway For Treatment of Diabetic Ketoacidosis Pathway)

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Indeterminate
- Continuing area of research
- No recommendations until further research
- Level of Evidence:
  - Evidence not available
  - Higher studies in progress
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Clinical Pathway For Treatment Of Diabetic Ketoacidosis

- Determine the extent of dehydration.
  - Consider an estimate of 5%-7% dehydration as moderate and 7%-10% dehydration as severe. (Class III)

- Calculate fluid requirement.
  - Consider 1.5-2.0 times maintenance plus deficit. (Class III)
  - Consider subtracting bolus(es) previously given for resuscitation. (Class III)
  - Calculate the rate of fluid replacement with a goal of replacing losses over 36-48 hours. (Class II)

- Place patient on electrocardiogram monitor. (Class II)
- Initiate 0.9% normal saline or LR at calculated requirements. (Class II)
- Consider evaluation for voiding. (Class III)
- Recheck serum potassium level. (Class III)

Is the patient’s serum potassium level > 5.5 mmol/L?

- Begin fluid replacement with 0.9% normal saline or LR plus 40 mEq/L of potassium chloride. (Class II)
- Consider alternatively starting with 0.9% normal saline or LR plus 20 mEq/L of potassium chloride and 20 mEq/L of potassium phosphorus if phosphorus level is < 1 mg/dL.

- Initiate insulin therapy.
  - Do not use bolus insulin. (Class II)
  - Use IV form of insulin. (Class I)
  - Start at 0.1 U/kg/h. (Class I)

- Regularly reassess the patient’s neurologic status. (Class II)
- Monitor laboratory values every 2-4 hours. (Class III)
- Add dextrose to fluid if blood glucose level has decreased to < 250 mg/dL. (Class III)
- Consider cerebral edema evaluation and treatment if neurologic examination results change (see Clinical Pathway For Evaluation And Treatment Of Cerebral Edema). (Class III)
- Consider decreasing the rate of insulin infusion if the patient’s blood glucose level decreases by more than 50-75 mg/dL per hour. (Indeterminate)
- Consider decreasing the rate of insulin infusion if the patient’s serum osmolality decreases by more than 3 mmol per hour. (Indeterminate)

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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 ½ 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

Does patient have acute onset of the following without a more plausible explanation?
- Mucocutaneous signs (urticaria, generalized flushing, pruritis, angioedema)
- One of the following: Respiratory compromise (wheeze, stridor, hypoxemia, dyspnea) OR hypotension, collapse, syncope, incontinence

NO

Does the patient have at least 2 of the following AFTER recent exposure to a likely allergen?
- Mucocutaneous signs (urticaria, generalized flushing, pruritis, angioedema)
- Respiratory compromise (wheeze, stridor, hypoxemia, dyspnea)
- Hypotension, collapse, syncope, incontinence
- Persistent gastrointestinal symptoms (vomiting, crampy abdominal pain)

NO

Does the patient have a known allergen AND hypotension* within hours of exposure to that allergen?

*or drop of at least 30% from baseline blood pressure

NO

Consider alternate diagnoses

YES

Initiate treatment for anaphylaxis.

YES

Initiate treatment for anaphylaxis.

YES

Initiate treatment for anaphylaxis.


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Clinical Pathway For The Treatment Of Anaphylaxis

**Is patient in cardiopulmonary arrest?**

- **YES**
  - Initiate Pediatric Advanced Life Support or Advanced Cardiac Life Support

- **NO**
  - **Administer epinephrine 1:1000 (1 mg/mL)**
  - **0.01 mg/kg to a maximum of 0.3-0.5 mg intramuscularly (Class II)**
  - **PLUS**
  - **Oxygen and airway management as needed**

**Are life-threatening symptoms of hypotension, respiratory distress, or stridor resolved?**

- **YES**
  - **Consider an H1 blocker for cutaneous symptoms (Class III)**
  - **Consider an H2 blocker for cutaneous symptoms (Class III)**
  - **Consider a corticosteroid to prevent biphasic reactions (Class Indeterminate)**

- **NO**
  - **Repeat epinephrine every 3-5 minutes as necessary.**
  - **Give fluid bolus as necessary.**
  - **Consider inhaled B-agonists for persistent wheezing.**

**Are symptoms resolved?**

- **YES**
  - **Consider admission to a monitored bed.**

- **NO**
  - **Consider intravenous epinephrine boluses or an epinephrine drip for persistent hypotension.**
  - **Admit to pediatric intensive care unit (PICU).**

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Clinical Pathway: The Evaluation Of The Lower Extremity

Is the patient stable?

- **YES**
  - Perform PALS/ATLS and/or ABCs. Have the patient evaluated by a trauma surgeon. Transfer patient if needed. (Class I)

- **NO**
  - Is the patient toxic appearing and/or limping?
    - **NO**
      - Do serial examinations show worsening symptoms?
    - **YES**
      - Examine for Kocher predictors and Luhan signs. Make a clinical judgment. (Class III)
    - **YES**
      - Are films abnormal or is SCFE or LCP present?
    - **NO**
      - Order laboratory studies: CBC, ESR, CRP, and films. (Class II)

Order appropriate imaging studies. (Class I)

Is a fracture present?

- **YES**
  - Order an orthopedic consult and followup. (Class I)

- **NO**
  - Does the patient have a functional deficit?
    - **YES**
      - Clear patient for activity as tolerated. Follow up with PRN. (Class III)
    - **NO**
      - Is the injury non-weight bearing? (Class II)

Is the patient stable?

- **YES**
  - Admit for observation. Consider pediatric and rheumatology consults. (Class III)

- **NO**
  - If signs and predictors are not apparent, discharge patient with followup in 24 hours. (Class III)

Are films abnormal or is SCFE or LCP present?

- **YES**
  - Is septic arthritis likely?
    - **YES**
      - Order an emergent orthopedic consult. (Class I)
    - **NO**
      - Admit for observation. Consider pediatric and rheumatology consults. (Class III)

- **NO**
  - If signs and predictors are apparent, admit patient for observation and serial exams. (Class III)

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Significantly modified from: The Emergency Cardiovascular Care Committee of the American Heart Association and representatives from the resuscitation councils of ILCOR. How to Develop Evidence-Based Guidelines for Emergency Cardiac Care.

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Clinical Pathway: Noninvasive Ventilation In Children

Hemodynamic instability?
Altered mental status?
Excessive secretions or vomiting?
Upper GI bleeding?
Recent facial, upper airway, or upper GI surgery?

NO

Explain procedure to patient.
Show patient the equipment and mask.
Ensure patient is on monitor and pulse oximeter.
Ensure adequate personnel to monitor patient.

Apply mask to patient.
CPAP: Start with low pressures (5 cm H₂O). Increase in increments of 1 cm H₂O.
BiPAP: Start with low settings. IPAP of 8-10 cm H₂O and EPAP of 2-4 cm H₂O. Titrate to effect.
Typical IPAP levels in children are 8-16 cm H₂O, and typical EPAP levels are 4-8 cm H₂O.
(Class Indeterminate)

Positive response to therapy?
• Decreased respiratory rate?
• Decreased work of breathing?
• Improved oxygenation?

YES

Worsening agitation?
Poor mask fit?
Worsening hypoxia?
Worsening respiratory distress?

NO

Continue noninvasive ventilation.
(Class III)

Intubate.
(Class II)

Intubate.
(Class III)

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Clinical Pathway: Management Of Dehydration In Pediatric Gastroenteritis

What clinical signs of dehydration are present?

NONE

MILD/MODERATE

Start ORT at 50-100 mL/kg, plus replace ongoing losses. (Class II)

Use an oral antiemetic if vomiting is present and likely to impede ORT. (Class II)

Is dehydration resolved?

YES

NO

SEVERE

Admit patient.

Give a 20 mL/kg bolus of normal saline; repeat until stable. (Class II)

Is dehydration resolved?

YES

NO

If previous dehydration was noted, observe for a period of time in the ED.

Continue patient’s regular diet.

Discharge home with hydration instructions and signs of dehydration to look for.

Admit to ward or observation unit.

Admit to PICU.

Abbreviations: ORT, oral rehydration therapy; ED, emergency department; PICU, pediatric intensive care unit

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Clinical Pathway: Management Of The Critically Ill Neonate

Does the neonate require emergent resuscitation?

NO

Perform history and physical examination; check laboratory test and radiograph results; conduct further testing as needed.

Start PGE1 at 0.05 µg/kg/min (Class 2); correct acidosis (Class 3); if indicated, consider:
- furosemide 1 mg/kg.
- dobutamine 2 to 20 µg/kg/min; packed red blood cells 10 mL/kg.

What is the suspected diagnosis?

Cardiac disease

Start ampicillin/ gentamicin (Class 1); start IV acyclovir if WBCs in CSF (Class 2). For sepsis, start normal saline with 10- to 20-L/m/kg boluses until patient is stable or 60 mL/kg is reached (Class 1).

GI disease

Insert NGT or OGT; arrange for surgical consult; IVF.

NAT

Malrotation

Schedule surgery.

Metabolic disease

Correct coagulopathy; consult neurosurgery; contact Department of Child and Family Services.

NEC

Start D10 ¼ normal saline at 1.5 times maintenance (Class 1); initiate sodium benzoate and sodium phenylacetate at 0.25 g/kg (Class 1); consider L-carnitine (Class 3); correct hypoglycemia.

YES

Secure the airway; perform chest compressions if heart rate < 60 bpm; check glucose level (Class 1); initiate appropriate PALS algorithm.

What is the suspected diagnosis?

SBI

Malrotation

Consider surgery for perforation (Class 2); administer antibiotics (Class 2); obtain radiograph every 6-8 hours (Class 3).

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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Clinical Pathway: Pediatric Pain And Anxiety In The ED

Invasive ED procedure that produces pain, anxiety, or both

Can the procedure be completed with local anesthesia alone?  
- YES → Topical anesthesia, local anesthesia, or both (Class II)
- NO

Will the addition of child life or other behavioral technique be enough to complete the procedure?  
- YES → Local anesthesia along with child life or other behavioral technique (Class II)
- NO

Will inhaled nitrous oxide be a helpful adjunct, and is this child cooperative?  
- YES → Inhaled nitrous oxide by demand mask (Class II)
- NO

Will PO midazolam be a helpful adjunct?  
- YES → Oral or intranasal midazolam (Class II)
- NO

Is there any reason that the patient is not an appropriate candidate to be sedated in the ED to complete the procedure?  
- YES → Consultation or transfer to a facility with pediatric anesthesia and surgical services (Class II)
- NO

Choose appropriate drug regimen (Class II)  
Administer sedation in the ED under appropriate, close monitoring (Class II)  
Disposition when appropriately back to baseline mental status (Class III)

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

Jaundiced infant 2 to 8 weeks old

Is the patient acutely ill?
Require urgent care?

NO

Is there direct hyperbilirubinemia?

NO

Measure serum direct bilirubin

ABNORMAL

Cholestatic Jaundice

History, physical exam,
Urinalysis, urine culture

Evaluate further (See AAP guideline)

Indirect hyperbilirubinemia

NORMAL

Evaluate further

Findings of specific disease?

NO

Is the newborn screen positive for
galactosemia or hypothyroidism?

NO

• Consult Pediatric GI
• CBC, platelet count
• Total and direct bilirubin, ALT, AST, alkaline phosphate, glucose
• Prothrombin time, albumin
• α-1 antitrypsin
• Urine reducing substances
• Abdominal ultrasound

Medical evaluation:
• Infection
• Metabolic disorders
• Genetic disorders
• Other

Evaluate further

Low α-1 antitrypsin?

NO

• Pi typing
• Further management

YES

NO

• Consult Pediatric GI
• Operative chol-angiogram

CHOLEDOKAL CYST?

YES

Is there evidence of biliary obstruction?

Consider:
• Percutaneous liver biopsy
• Scintiscan
• Duodenal aspirate
• ERCP

NO

No hyperbilirubinemia

YES

Does bilirubin normalize by 6
weeks of age?

YES

Refer for further management

YES

No hyperbilirubinemia

Clinical Pathway For Treatment Of *Enterovirus* In The Neonate

Does the neonate appear toxic?

YES

Consider the following tests to rule out sepsis:
- CBC with diff, BCx, UCx, CSFCx
- CSF protein, glucose, and cell count.
- Start antibiotics.

NO

Is the patient febrile?

YES

Consider the following tests to rule out sepsis:
- CBC with diff, BCx, UCx, CSFCx, CSF protein, glucose, and cell count.
- Start antibiotics.

NO

Is the patient experiencing mild congestion?

YES

Consider viral culture.

NO

Order nasal PCR if possible.

No workup is needed. Provide supportive care and close follow up with PMD.

Does the weather temperate where you are?

YES

Strongly consider CSF PCR.

Consider viral culture for serotype.

NO

Consider CSF PCR or viral culture for serotype.

Does patient demonstrate:

YES

Signs of heart failure?
- (cardiomegaly, prolonged feeding, shock, cold/mottled skin, gallop)

NO

Provide supportive care and close follow up with PMD.

Signs of liver failure?
- (hepatomegaly, splenomegaly, bleeding/bruising)

YES

Order liver function tests, coagulation, and bilirubin.

Consult with gastroenterology.

NO

Provide supportive care and close follow up with PMD.

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

If child < 2 years old, are all of the following present?
1. Fever or feels feverish (if no thermometer available)*
2. Irritability or cough or vomiting/unable to keep fluids down

If child ≥ 2 years old, are all of the following present?
1. Fever or feverishness*
2. Cough or sore throat
   *If antipyretics are taken, this may inhibit a patient's ability to mount a fever. If antipyretics have been taken, the patient can be reassessed 4 to 6 hours after acetaminophen or 6 to 8 hours after ibuprofen.

Are any of the following signs or symptoms present?†
Age 12 weeks to < 5 years
• Fast breathing‡ or difficulty breathing or retractions present
• Dehydration (no urine output in 8 hours, decreased tears or no tears when child is crying, or not drinking enough fluids)
• Severe or persistent vomiting/unable to keep fluids down
• Lethargy (excessive sleepiness, significant decrease in activity level, and/or diminished mental status)
• Irritability (cranky, restless, does not want to be held or wants to be held all the time)
• Flu-like symptoms improved but then returned or worsened within one to a few days
• Pain in chest or abdomen (for children who can reliably report)

Age ≥ 5 years
• Fast breathing‡ or difficulty breathing
• Dizziness or lightheadedness
• Severe or persistent vomiting/unable to keep fluids down
• Flu-like symptoms improved but then returned or worsened within one to a few days
• Pain in the chest or abdomen

Is the child at least 12 weeks old but less than 2 years old?

Although some children with influenza may not exhibit the usual influenza symptoms including fever, this child’s symptoms suggest that influenza is less likely. They do not meet criteria for this algorithm. The child should be assessed for alternative diagnoses.

Recommend immediate medical evaluation for child, preferably with child’s medical home/primary care provider, or refer for emergency medical care or 911 if any signs or symptoms of life threatening illness.

Recommend immediate medical evaluation for child, preferably with child’s medical home/primary care provider.

This child falls into a group that may be at elevated risk for complications from influenza. Recommend that they be evaluated for possible treatment. Recommend that the child’s caregiver contact the child’s medical home/primary care provider that day.

† 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

Box 1: Definition of “Fast Breathing”

<table>
<thead>
<tr>
<th>Age</th>
<th>Respiratory rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth up to 3 months</td>
<td>&gt; 60/min</td>
</tr>
<tr>
<td>3 months up to 1 year</td>
<td>&gt; 50/min</td>
</tr>
<tr>
<td>1 to &lt; 3 years</td>
<td>&gt; 40/min</td>
</tr>
<tr>
<td>3 to &lt; 6 years</td>
<td>&gt; 35/min</td>
</tr>
<tr>
<td>6 to &lt;12 years</td>
<td>&gt; 30/min</td>
</tr>
<tr>
<td>12 to 18 years</td>
<td>&gt; 20/min</td>
</tr>
</tbody>
</table>

Adapted from http://www.cdc.gov/h1n1flu/clinicians/pdf/childalgorithm.pdf
Does the ill child have any of the following conditions?

Neurological disorders such as:
1. Epilepsy, cerebral palsy, brain or spinal cord injuries, and neuromuscular disorders (eg, muscular dystrophy)
2. Chronic respiratory diseases such as those associated with impaired pulmonary function and/or difficulty handling secretions; those requiring oxygen, tracheostomy, or a ventilator; and those with asthma.
3. Moderate to profound intellectual disability (mental retardation) or developmental delay
4. Deficiencies in immune function or conditions that require medications or treatments (eg, certain cancer treatments, HIV infection) that result in significant immune deficiencies
5. Cardiovascular disease including congenital heart disease
6. Significant metabolic (eg, mitochondrial) or endocrine disorders
7. Renal, hepatic, hematological (including sickle cell disease) disorders
8. Receiving chronic aspirin therapy
9. Pregnancy

This child appears to be at lower risk for complications from influenza and may not require testing or treatment if their symptoms are mild. In order to help prevent spread of influenza to others, these patients should be advised to:

• Keep away from others to the extent possible, particularly those at higher risk for complications from influenza (see box below). This may include staying in a separate room with the door closed.
• Cover their coughs and sneezes
• Avoid sharing utensils
• Wash their hands frequently with soap and water or alcohol-based hand rubs
• Stay home (eg, no school, child care, group activities) until 24 hours after their fever resolves without the use of antipyretics (ie, acetaminophen, ibuprofen)

More information is available at: http://www.cdc.gov/flu/homecare/index.htm. In addition, remember that vaccination for seasonal influenza and pandemic (H1N1) influenza is recommended for all children 6 months through 18 years old and household contacts and out-of-home caregivers of children less than 6 months old.

For all patients triaged using this algorithm, the following should also be assessed:

Does patient live with a person at higher risk for complications of influenza including someone who is:

• Age < 2 or age ≥ 65, or
• Pregnant

Or someone with any of the following comorbid conditions:

• Chronic pulmonary disease (including asthma), cardiovascular disease (except isolated hypertension), renal disease, hepatic disease, hematological disorders (including sickle cell disease), or metabolic disorders (including diabetes mellitus)
• Disorders that can compromise respiratory function or the handling of respiratory secretions or that can increase the risk for aspiration (eg, cognitive dysfunction, spinal cord injuries, seizure disorders, or other neuromuscular disorders)
• Immunosuppression, including that caused by medications or by HIV
• Child (< 18) on chronic aspirin therapy

In addition, vaccination for seasonal influenza and pandemic (H1N1) influenza should be recommended for all children 6 months through 18 years old and household contacts and out-of-home caregivers of children less than 6 months old.
Clinical Pathway For The Management Of Pediatric Seizures

Pediatric seizure patient presents to the ED

ABC’s, IV, monitor, pulse oximetry, bedside glucose, stabilize cervical spine if trauma

If the patient is still seizing, give AEDs
1. phenobarbital
2. phenytoin
3. benzodiazepine
Consider pyridoxine and other AEDs until seizure is controlled; maintain airway

Determine type of seizure from direct observation or history

Laboratory tests: test electrolytes if patient is an infant, has a temperature less than 36.5°C, or is actively seizing in the ED

Brain CT if high-risk or predisposing condition*

Abnormal CT?

NO

YES

Admit to appropriate unit with pediatric neurology

IV antibiotics if meningitis is suspected

Does child look sick? (Abnormal labs or any signs of meningitis)

YES

NO

Does the child appear well and have follow-up arranged?

YES

NO

Discharge home with appropriate follow up and seizure precautions

NO

YES

Perform LP

Neutral surgery consult, admit to PICU

**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)

Is neonate still seizing?

NO

YES

CBC, blood cultures, AED medication level if appropriate, calcium, magnesium level, BMP

If meningitis is suspected, give IV antibiotics; if herpes is suspected, give antivirals. Perform LP if not contraindicated.

Neonatal neuroimaging
1. Brain CT
2. Possible cranial ultrasound
3. Consider inpatient MRI

Admit or transfer to appropriate level of care (ie, NICU), order pediatric neurology consult, and continue airway and seizure management

Is patient a neonate?

NO

YES

Is there fever > 100.4°F rectal plus a seizure?

YES

NO

Give anti-pyretic

If the patient is still seizing, give AEDs as appropriate until seizure stops; maintain airway

Was seizure complex?

NO

YES

Any meningitis high risk criteria**

NO

YES

Consider brain CT if high risk criteria of recent travel to endemic area for cystercercosis, suspected increased intracranial pressure, etc

Simple febrile seizure

Workup for fever with or without source: CBC, blood culture, cath UA, viral swabs, stool cultures, treat infection as appropriate.

*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, malignancy

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

Evaluate airway, breathing, and circulation.

Does the patient have hypotension or signs of shock?

NO

Obtain blood culture. (Class I)
Perform urinalysis and CXR if clinically indicated as well as further cultures based on history and physical examination. (Class II)
Start cefepime 50 mg/kg/dose or meropenem 20 mg/kg/dose with or without vancomycin 15 mg/kg/dose.*¥ (Class I)
Admit to hospital.

YES

Obtain blood culture and initiate broad spectrum antibiotics with meropenem 20 mg/kg/dose and vancomycin 15 mg/kg/dose. (Class I)
Perform urinalysis and CXR as well as further cultures based on history and physical examination. (Class II)
Treat hypotension with isotonic IVF boluses. Reassess after each 20 mL/kg bolus. (Class I)

Has hypotension resolved with isotonic boluses?

NO

Initiate inotropes. (Class I)
Admit to hospital.

YES

Admit to hospital.

*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:
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  - Case series, animal studies, consensus panels
  - Occasional 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

**Clinical Pathway: Patient With Mild To Moderate Neutropenia**

Evaluate airway, breathing, and circulation.

Is the patient unstable?

NO

Is the WBC the only cell line that is abnormal?

NO

Consult a hematologist to rule out other etiologies such as a leukemic process or aplastic anemia.

YES

Proceed to Pathway 1.

Does the patient have signs of systemic bacterial infection?

NO

Does patient have signs of localized infection?

NO

Does patient have signs of viral infection?

NO

If the patient is well appearing, without source of infection, consider blood culture and ceftriaxone 50 mg/kg with follow-up the next day.

YES

Provide supportive outpatient care with close follow-up.

YES

Send blood culture. (Class I)
Perform urinalysis and CXR as well as further cultures based on history and physical examination. (Class II)
Start cefepime 50 mg/kg/dose or meropenem 20 mg/kg/dose. (Class I)
Admit to hospital.

YES

If the patient is well appearing with mild to moderate neutropenia unrelated to cancer or primary immunodeficiency, consider discharge to home with appropriate oral antibiotic coverage. Close follow-up must be ensured. Admission to the hospital will be required if infection does not improve with oral antibiotics.

*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.*
Clinical Pathway For Evaluation And Treatment Of Cerebral Edema

• A staff member is concerned about an acute neurologic change in the patient.

• Consider criteria-based assessment for cerebral edema. (Indeterminate)
  - Does the patient have at least 1 of the following: abnormal motor or verbal response to pain, posturing, cranial nerve palsy, or neurologic respiratory pattern? OR
  - Does the patient have any 2 of the following: altered or fluctuating consciousness, sustained heart rate decelerations, or age-inappropriate incontinence? OR
  - Does the patient have 1 criteria from the second group plus at least 2 of the following: emesis, headache, lethargy or decreased arousability, diastolic blood pressure > 90 mm Hg, or age < 5 years?

- YES
  - Consider mannitol 0.25-1.0 g/kg IV over 20 minutes. Repeat for continuing symptoms. (Class II) OR
  - Consider 3% normal saline 5-10 mL/kg IV over 30 minutes. Repeat for continuing symptoms. (Class III)

- NO
  - Continue current management.

18

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### Clinical Pathway: Migraine Headache Neuroimaging

**Does the patient have a migraine headache?**

**Evaluate other causes of headache**

**Is the patient's neurological exam normal?**

**Obtain neuroimaging (Class II)**

**Is there seizure associated with the headache?**

**Obtain neuroimaging (Class II)**

**Is this headache similar to patient's prior headaches?**

**Obtain neuroimaging (Class II)**

**No neuroimaging required (Class II)**

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- Results consistently positive

**Class III**
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- Possibly useful
- Considered optional or alternative treatments

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Clinical Pathway: Pediatric Migraine Clinical Treatment Pathway

FPS-R pain scale > 3?

Utilize outpatient/oral medications (Class I)

Intravenous fluids (Class II)
Decrease environmental stimuli (Class II)

Is the headache duration < 4 hours?

Prochlorperazine (Class II)

“Triptans”
Sumatriptan SQ/PO/IN
Zolmitriptan PO/IN
Rizatriptan PO
Almotriptan PO (Class II)

Is the headache improved after 1 to 2 hours?

Consider 2nd medication:
Valproic Acid (Class III)
Dihydroergotamine (Class III)

Discharge patient

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

Ingestion of oil of wintergreen, pennyroyal oil, eucalyptus oil, camphor, or an imidazoline

- **YES**
  - **YES**: Short stay admission; consider administration of activated charcoal; administer N-acetylcysteine; monitor for hypoglycemia and liver dysfunction.
  - **NO**: Obtain salicylate level. If child develops altered mental status or has a salicylate level greater than 100 mg/dL, then consider dialysis. If child remains asymptomatic for 4 hours and salicylate levels are not toxic and are declining, then the child may be discharged to home.

- **NO**
  - **YES**: Monitor for development of central nervous system depression and seizures. If child remains asymptomatic for 4 hours post ingestion, then discharge to home.
  - **NO**

Ingestion of camphor, eucalyptus oil, or an imidazoline

- **YES**: Monitor for development of central nervous system depression and seizures. If child remains asymptomatic for 4 hours post ingestion, then discharge to home.

Clinical Pathway: Diphenoxylate–Atropine

Ingestion of diphenoxylate–atropine

- **YES**
  - **YES**: Consider administration of activated charcoal. Monitor the child for at least 12 hours post ingestion for development of an anticholinergic syndrome due to atropine and/or for opioid syndrome due to the diphenoxylate.
  - **NO**: Administer naloxone until opioid effects are reversed. Admit to a monitored setting.

- **NO**
  - **YES**: Any symptomatic child should be admitted to a monitored setting.
  - **NO**: Central nervous system and/or respiratory depression

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Clinical Pathway: Organophosphates

Ingestion of an organophosphate-containing product

- YES
  - Child asymptomatic
    - YES: Monitor for at least 4 hours. If the child demonstrates no signs or symptoms, the child may be discharged to home
    - NO: Inhalation or airway secretions

- NO
  - Seizure
    - NO: Any symptomatic child exposed to an organophosphate should be monitored until complete resolution of symptoms.
    - YES: Ingestion of an organophosphate-containing product

Clinical Pathway: Sulfonylureas

Ingestion of sulfonylurea by a child

- YES
  - Hypoglycemia
    - NO: Ingestion of sulfonylurea by a child
    - YES: Hypoglycemia resolves following oral or intravenous glucose
      - NO: Consider octreotide; admit to monitored setting.
      - YES: Admit and monitor for reoccurrence of hypoglycemia.

- NO: Ingestion of sulfonylurea by a child

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Clinical Pathway For The Treatment Of Pediatric Burns

Primary Survey: Airway and Breathing
- Are there signs of airway compromise, stridor, significant facial injury, or inhalation injury?

Primary Survey: Circulation
- Are there signs of hypotension or shock?

Primary Survey: Disability
- Remove clothing, jewelry, and harmful foreign bodies.

Secondary Survey: Multisystem trauma?

Secondary Survey: Burn Evaluation
- Large burn (>20% TBSA)

Burn Evaluation:
- Is the burn in a concerning location (hand, feet, face, genitalia, over a joint)
- Does the burn require admission?

Is the burn partial or full-thickness?

Is there concern this injury was inflicted?

1. Early intubation (Class II)
2. Oxygen supplementation
3. Chest X-ray (Class III)
4. Evaluate for CO poisoning

1. 20 to 40 mL/kg bolus normal saline or lactated Ringer’s (Class II)
2. Cardiac pressures if needed
3. Evaluate for active bleeding

1. Cervical spine precautions (Class II)
2. Head CT (Class II)
3. Radiographs to look for fractures (Class II)
4. Blood for type and crossmatch

1. Identify % TBSA burned (Lund and Browder, rule of nines or palm rule (Class II)
2. Use the Parkland formula: 4 mL/kg/%TBSA (Class II)
3. Place a Foley to monitor urine output (Class II)
4. Consider transfer to a burn center specializing in pediatrics (Class II)

1. Wash burn with mild soap and water
2. Debride the burn, (Class II)
3. Apply antimicrobial ointment or cream (Class II)
4. Apply a synthetic skin substitute or occlusive dressing. (optional) (Class II)
5. Provide tetanus toxoid injection +/- tetanus immune globulin (TIG)
6. Notify the appropriate authorities to ensure the child’s safety

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.

**Perform physical examination.**
- 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.
- No
  - Is it a laceration?
    - Yes
      - Is the laceration of cosmetic concern?
        - Yes
          - Suture the laceration.
        - No
          - Consider suturing the wound if needed.
    - No
      - Gather the history of the injury.
Clinical Pathway For Treatment Of Traumatic Dental Injuries

Type of injury

- Concussion — is tooth primary?
- Analgesics, Soft diet
- Subluxation — is tooth primary?
- Analgesics, Soft diet
- Intrusion — is tooth primary?
- Analgesics, Soft diet
- Extrusion, lateral luxation — is tooth primary?
- Analgesics, Soft diet
- Avulsion — is tooth primary?
- Analgesics, Soft diet
- Fracture of the crown (primary and permanent) -- is the fracture complicated (ie, involves enamel, dentin, and pulp)?
- Fracture of the root, primary and permanent
- Enamel only: analgesics
- Enamel and dentin: cap, restoration
- If apical: restoration
- If coronal or middle: extract
- Reposition, Splint
- Do not re-implant
- Pulpectomy or pulpotomy
- Allow to re-erupt
- If no re-erupt after 2 months: extract
- Allow to re-erupt
- If no re-erupt after 3 to 6 weeks: extract, splint, root canal
- Re-implant immediately

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Clinical Pathway For Treating Pediatric Wounds

Wound risk factors:
- Infected? (Class I)
- Obvious contamination? (Class I)
- Sustained > 18 hr ago? (Class II)

Closure by secondary intention or Delayed primary closure

Wound < 6 hr old? (Class I)

NO

• Clean, viable tissue?
• Well-vascularized area?
• No comorbidities that might lead to poor wound healing? (Class II)

Primary closure preparation

YES

• Imaging, if indicated, for foreign bodies
• Consult specialist, if indicated

Sedation needed?

NO

YES

Refer to “Clinical Pathway: Pediatric Pain And Anxiety In The ED”

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  - Results consistently positive

Class III
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- Possibly useful
- Considered optional or alternative treatments

Level of Evidence:
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- Case series, animal studies, consensus panels
- Occasional positive results

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- Continuing area of research
- No recommendations until further research

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