UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
"NICOLAE TESTEMIȚANU" DIN REPUBLICA MOLDOVA

PEDIATRIC EMERGENCIES

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OBJECTIVES

- Identify common pediatric emergencies within the emergency and urgent care
- Identification of appropriate evaluation and management of these common pediatric emergencies
- Discussion of pertinent pitfalls and pearls in common pediatric problems seen within the emergency/urgent care

Pediatric Patient Assessment

- First things first – the across the room assessment.
  - The pediatric assessment triangle (PAT).
    - Common tool found in pediatric assessment courses.
  - Is the patient “sick” or “not sick”?

FIRST IMPRESSIONS

- Focus on initial impressions within 7 seconds
- Everyone needs to understand **first impressions count**!!
- Judging quality of care in urgent and emergency settings
- Gauge general appearance form outside room
- Start conversation with parent
- Avoid eye contact with anxious child at start
- Build trust with parent first
- Then slowly engage the child
- Perform exam using parent in establishing trusting

Pediatric Patient Assessment

- Younger Children
  - Do a toe-to-head assessment.
  - Include the caregiver as intimately as possible.
  - Be aware of separation anxiety.
  - Save painful assessment and procedures for last.
  - Build trust with the patient.
  - Provide distractions.
- Older Children
  - Explain what you are doing and why.
  - Keep the caregiver in close proximity.
  - Get as much information from the patient prior to asking the caregiver.
  - Adolescents will want to be treated as adults.
  - In some instances patients may want privacy from their caregivers.

Pediatric Patient Assessment

- Assessment Components
  - Complete the primary survey.
  - Obtain vital signs.
  - Comprehensive history taking.
  - The secondary assessment is key.
  - Remember to use your diagnostics & tools.

- **Ominous Findings in Kids**
  - Head bobbing
  - Grunting
  - Hypotension
  - Bradycardia
  - Hypoxia
  - Altered mental status

If the child shows signs of decompensation, time is quickly running out!

Pediatric Patient Assessment

- Age Appropriate Vital Signs

AGE	ESTIMATED WEIGHT	HEART RATE	RESPIRATORY RATE	SYSTOLIC B/P
Premature	Less than 3 kg	160	Greater than 40	60
Newborn	3.5 kg	130	40	70
3 mo.	6 kg	130	30	90
6 mo.	8 kg	130	30	90
1 yr.	10 kg	120	26	90
2 yrs.	12 kg	115	26	90
3 yrs.	15 kg	110	24	90
4 yrs.	17 kg	100	24	90
6 yrs.	20 kg	100	20	95
8 yrs.	25 kg	90	20	95
10 yrs.	35 kg	85	20	100
12 yrs.	40 kg	85	20	100
14 yrs.	50 kg	80	18	110
ADULT	Greater than 50 kg	80	18	120

The Maryland Medical Protocols for Emergency Medical Services Providers

Common pediatric emergencies

- Fever
- Respiratory symptoms
- Chest pain
- Abdominal Pain
- Animal and Human Bites
- Fractures
- Lacerations
- Common ENT Issues
- Other...

FEVER

FEVER PEARLS

- Vital signs and general appearance
- UTI source fever in boys under 1 year age and girls under 2 years of age
  - 75 % < 5 years with febrile UTI have pyelonephritis
  - 10-50% with negative UA – always do culture
  - Leukocyte esterase and nitrite – higher specificity
  - Pyuria - not present in 20% with pyelonephritis
  - Clean catch or catheter ----no bags
- Consider CXR if fever and WBC > 20,000 and signs of respiratory distress

FEVER PEARLS

- Well appearing patients with febrile seizure usually don't require workup
- Assessment of parents
  - Temperature taking skills
  - Bundling effects
  - Treatment according to weight – weight charts for parents
    - **Acetaminophen 10-15 mg/kg/dose, max. 60 mg/kg/24h**
    - **Ibuprofen 5-10 mg/kg/dose, max. 30-40 mg/kg/24h**

FEVER : age < 28 days

- Temperature greater than 38^0 C
- 10 % febrile infants less than 2 months have bacteruria, bacteremia, or meningitis
- High risk infants with fever
  - Less than 28 days
  - Or 29-60 days with:
    - **Less 37 week delivery**
    - **Congenital comorbidities**
    - **History of prior hospitalizations**

FEVER : age < 28 days

EVALUATION:

- Blood glucose
- CBC with diff
- Blood culture
- UA with micro
- UA culture
- CSF cell count with diff, protein, and glucose
- CSF culture
  - **Infants 0-7 days**:
    - Amoxicillin 50 mg/kg/dose Q8 hours
    - Cefotaxime 50 mg/kg/dose Q8 hours
  - **Infants 8-28 days**:
    - Amoxicillin50 mg/kg/dose Q6 hours
    - Cefotaxime 50 mg/kg/dose Q6 hours

FEVER : age 29-60 days

Low risk defined by:

- Well appearing
- No previous antibiotic use
- WBC between 5,000 and 15, 000
- Band/neutrophil of less than 0.2
- UA with less than 5 WBC
- CSF with less than 8 WBC
- CXR negative

If all low-risk criteria met:

- Home while cultures pending
- Admission without antibiotics until cultures negative

Otherwise, **full sepsis work-up**

  - Ceftriaxone 50 mg/kg/kg every 12 hours

FEVER – ENTEROVIRUS

- Most common illness associated with non-specific febrile illness
  - Typically warm months – spring to autumn
  - Highly contagious – stool to skin to mouth, respiratory route, infected objects
- Test all infants less than 60 days with LP done during season
- Symptoms include wide variety involving all systems:
  - Fever quite high
  - Poor feeding, vomiting with loose stools, abdominal pain
  - Sore throat, muscle aches, headaches, respiratory infections
  - Lethargy to Irritability
  - Hypoperfusion
  - Jaundice
- Complications: pneumonia, meningoencephalitis, myocarditis, hepatitis, death

Pearl: good hand washing, coughing etiquette, bleach clean surfaces and toys

FEVER – Herpes Simplex Virus

HSV testing recommended:

- Ill appearance
- Temperature less 36 degrees C rectally
- Respiratory distress
- Seizure
- Herpetic lesions
- Maternal HSV infection
- Maternal fever during L&D
- Thrombocytopenia

- **Acyclovir IV 20 mg/kg/dose Q 8 hours**
  - Additional labs if acyclovir started:
    - CSF-HSV PCR, cultures eye, nasopharyngeal, rectal, LFTs

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RESPIRATORY SYMPTOMS

Respiratory syncytial virus

RSV testing seasonal

- Tachypnea, wheezing, apnea, rhinorrhea, cough

Well appearing infant and RSV positive

- CBC with diff
- Blood culture
- UA with micro
  - If 5 or more WBC detected do LP
- Having known positive test for RSV reduces risk for serious bacterial illness from 9.6 to 2.2%

Ill appearing infant or RSV negative

- Full workup with admission

CROUP

- Common 6 months – 3 years but up to 6 years
- **Dexamethasone 0.6 mg/kg orally x 1, max 10 mg**
- **Epinephrine**
  - Nebulized racemic epinephrine for stridor at rest
    - Must observe 2-4 hours following – possible rebound
  - IM epinephrine for stridor immediately following nebulizer or impending respiratory failure
- Intubation in extreme cases

Admission with persistent respiratory difficulty

- Persistent wheezing
- Tachypnea
- Use of accessory muscles with retractions
- Oxygen sat < 92% on room air
- Inability to retain oral fluids and meds
- Prior hospitalizations and recent ED visits
- Illness – pneumonia , RSV and pre existing disease

ADMISSION CRITERIA

- Toxic appearance
- Respiratory distress or apnea
- Dehydration with vomiting
- Infants <2months
- Infants < 6months with lobar pneumonia
- Hypoxia (sat < 92%)
- Poor response to outpatient oral therapy
- Noncompliant parents concerns
- Immunocompromised child

FOREIGN BODIES ASPIRATION

- 2-4 years old
- Acute episode of choking/gagging
- Triad of acute wheeze, cough and unilateral diminished sounds only in 50 %
- Severity is determined by complete versus partial obstruction
- Peanuts are most common
- Right main stem

ASTHMA

- 5 000 ED visits per day
- 20 % admitted
- 11 deaths per day
- Goals of acute treatment
  - Reverse airflow obstruction
  - Correct hypoxemia

Severe Asthma

- **Oxygen**
- Continuous nebulized **albuterol 15 mg/hour**
- **Epinephrine IM**
- **Nebulized ipratropium**
  - 1.5 g in 1 hour continuous albuterol
- **Methylprednisolone 2 mg/kg IV**
  - Max 80 mg
- **Magnesium sulfate 50 mg/kg IV**
  - Max 2 g
- **Fluid bolus** secondary to hypotension
  - 20 ml/kg unless cardiovascular complications then reduce to 10 ml/kg

Moderate Asthma

- **Oxygen**
- **Continuous nebulized albuterol**
  - Less than 5 years – 10 mg/hour
  - Older than 5 years – 15 mg/hour
- **Nebulized ipratropium**
- **Prednisone 2 mg/kg**
  - Max 60 mg

Mild Asthma

- **Albuterol MDI** with spacer
  - Less than 5 years – 4 puffs
  - Older than 5 years – 8 puffs
- **Prednisone 2 mg/kg** if greater than 2 albuterol MDI doses given
- Observe for at least 1 hour

CHEST PAIN

CHEST PAIN

- Very common in children
- Rarely cardiac origin
- ? Cardiac history in parents
- Most common cause musculoskeletal
- Consider EKG/CXR
  - Syncope, dizziness
  - Significant cardiac history patient/parent
  - Abnormal exam (fever, respiratory distress, cardiac)
- RX
  - Reassurance, ibuprofen

ABDOMINAL PAIN

ABDOMINAL PAIN

- Extremely common in children
- Goal: differential between urgent/emergent from benign pain
- Pearls
  - Distraction is key
  - Rock pelvis
  - Hop on each foot
  - GU exam
    - Sexually active – PID, STD
    - Torsion – ovarian, testicular
  - Children do have children
  - CT versus US
  - KUB (kidney, ureter, and bladder X-ray)

VOMITING/DIARRHEA

VOMITING/DIARRHEA

- Goal
  - Rule out surgical problem

- Treatment pearls
  - Consider Odansetron (Zofran)
  - PO challenge with popsicle in Pedialyte
  - If less 5 years – (if giving IV fluids)
    - BMP (basic metabolic panel)
    - IV bolus 20 ml/kg NS

DEHYDRATION

- Oral Rehydration Therapy (ORT) obstacles
  - Ingrained use of IV therapy in US
  - 30 % practicing pediatricians withhold ORT for children with emesis or moderate dehydration
  - Feeding through diarrhea has been a difficult practice to establish as acceptable
  - Deaths from gastroenteritis including rotavirus, are largely due to dehydration
- Phase I
  - Rehydration and replace fluid deficit quickly
- Phase II
  - Maintenance, fluids and calories, goal of quickly returning to age appropriate unrestricted diet
- Gut rest not indicated

DEHYDRATION – treatment principles

- Oral replacement solutions (ORS) should be used for rehydration – **Pedialyte®**
- Oral rehydration should be performed rapidly within 3-4 hours
- Age appropriate, unrestricted diet is recommended as soon as dehydration is corrected
- Breastfed infants are to continue nursing
- Formula-fed do not dilute formula and special formula not necessary
- For ongoing losses through diarrhea, administer additional ORS
  - **Ondansetron (Zofran®) 0.1 mg/kg**
  - **probiotics**

DEHYDRATION – treatment guidelines

Minimal dehydration

- Adequate fluids and continue regular diet
- Encourage ORS
- 10 ml/kg for each watery stool
- 2 ml/kg for each emesis
- Unrestricted nutrition

Mild to moderate

- Rapidly replace fluid deficit
- 50-100 ml/kg during 2-4 hours
- Initially 5 ml every 5 minutes and increase amount as tolerated
- Consider rapid NG rehydration
- Observe till signs of dehydration subside or increased output

DEHYDRATION – treatment guidelines

Severe dehydration

- IV rehydration
  - Ringer's Lactate Solution
  - Normal Saline 0.9% NaCl 20 ml/kg
- Labs
  - Glucose
  - Electrolytes
  - BUN/creatinine
  - bicarbonate

HYPONATREMIA

HYPONATREMIA

- Due
  - Intake hypotonic solutions
  - Elevated ADH which increase free water reabsorption

- Symptoms
  - Mild – emesis, malaise, agitation
  - Moderate – cramps, weakness, lethargy, headache, confusion
  - Severe – seizures, coma, death

HYPONATREMIA

- Treatment
  - Mild to moderate with NS
  - Severe
    - Do not raise more than 12 meq/L in 24 hours (0.5 meq/l per hour)
    - May raise 5 meq in first few hours
    - Hypertonic saline 513 meq/L or 1 meq/2 ml

SEIZURES

STATUS EPILEPTICUS

- Greater than 5 minutes, medical intervention likely needed
- Greater than 30 minutes of seizure activity
- Greater than 2 seizures without return to baseline in between
- Higher incidence in less than 1 year old
- Causes
  - Epilepsy
  - Febrile seizures
  - Infection
  - Intoxication, poisoning
  - Trauma
  - Metabolic
  - CNS hardware

FEBRILE SEIZURES

- **Benign**
  - 6 months – 6 years
  - < 15 minutes
  - Generalized tonic/clonic
  - Returns to baseline status

- **Workup**
  - Consider possible source
  - No specific workup

SEIZURES – treatment

Benzodiazepines

- Intravenous
  - Lorazepam 0.1 mg/kg, max dose 4 mg
  - Midazolam 0.2 mg/kg , max dose 5 mg
  - Diazepam 0.3 mg/kg, max 10 mg
- Per rectum
  - Diazepam
    - Less 5 years – 0.5 mg/kg
    - 6-11 years – 0.3 mg/kg
    - Greater 12 years – 0.2 mg/kg
      - max dose 15 mg
  - Midazolam – 0.5 mg/kg, max 10 mg

SEIZURES – treatment

Benzodiazepines

- NASAL
  - Midazolam 0.2 mg/kg, max 10 mg
- IM
  - Lorazepam – same dose IV/IM
  - Midazolam – same dose IV/IM
- BUCCAL
  - Midazolam 0.2 mg/kg, max 10 mg

SEIZURES – treatment

- Levetiracetam (Keppra) – 50 mg/kg
- Fosphenytoin 20 mg/kg
- Phenytoin – 20 mg/kg
- Phenobarbital – 20 mg/kg
  - If intubated with respiratory distress
- Pentobarbital 5-15 mg/kg
- Valproic acid – mg/kg
  - Take about 20 minutes to work

TRAUMATIC BRAIN INJURY

TRAUMATIC BRAIN INJURY

- Injury #1 cause of death in pediatrics
  - 40 % from TBI
  - Morbidity and mortality highest in infants
- Epidural hematoma
- Subdural hematoma
- Subarachnoid hemorrhage
- Intracerebral hemorrhage

TRAUMATIC BRAIN INJURY
NEUROIMAGING

Decision rule: <2 years

- GCS 14 or signs of depressed skull fracture – CT scan indicated (4.4% risk of clinically important traumatic brain injury (ciTBI)

- Nonfrontal scalp hematoma, or history of loss of consciousness (LOC) > 5s, or severe mechanism of injury, or not acting normally per parent - consider observation vs CT scan (0.9% risk of ciTBI)

- None of the above risk factors – CT scan not indicated (<0.02% risk of ciTBI)

TRAUMATIC BRAIN INJURY
NEUROIMAGING

Decision rule: 2 years to 18 years

- GCS 14 or signs of basilar skull fracture – CT scan indicated (4.3% risk of clinically important traumatic brain injury (ciTBI)

- History of loss of consciousness (LOC) or history of vomiting, or severe mechanism of injury or severe headache – consider observation vs CT scan (0.9% risk of ciTBI)

- None of the above risk factors – CT scan not indicated (-0.05 % risk of ciTBI)

TRAUMATIC BRAIN INJURY
INITIAL CARE

- **ABC**s
- **Correction and prevention of secondary brain injury** due to
  - Hypoxemia
  - Hypotension
  - Excessive fluids
  - Seizures
- **Evaluation for intracranial hypertension or impending herniation**
  - Altered LOC
  - Pupil changes
  - Extremity weakness
  - Cushing's triad – irregular respirations, bradycardia, herniation
- **Reassessment of GCS, vital signs**

TRAUMATIC BRAIN INJURY
TREATMENT

- Prophylactic hyperventilation (PaCo2 < 35 mm Hg)
- Head of bed to 30 degrees
  - increase venous draining
- Lidocaine for intubation
  - prevents tachycardia
- IV fluids
- Treatment of pain, continued sedation
- For herniation symptoms
  - 3 % saline
  - Mannitol
- Hypothermia less 35^0 C

ANIMAL/HUMAN BITES

Animal bites

Dog bites

- Accounts for 80-90%
- Crush injuries with tissue tears – primary closure loosely
- Pasteurella (50%), Strep (46%), Staph (46%), Fusobacterium (30%), bacteroides (30%)
- Antibiotics: **augmentin, doxycycline, cefuroxime**

Cat bites

- Accounts for 5-15%
- Puncture wounds with teeth imbedded within tissue – no closure
- Pasteurella (75%), Strep (46%), Staph (35%), Fusobacterium(30%), bacteroides (30%)
- Antibiotics: **augmentin, doxycycline, cefuroxime** – 60-89% infection rate

Human bites

- High rate of infection
- Clenched fist explore for broken capsule joint – OR
- Puncture wounds – no closure
- Strep, Staph
- Antibiotics: **augmentin, doxycycline**

Rabies

- About 55 000 global fatalities annually often children
- Developed countries – predominantly in wildlife such as bats, raccoon, skunks, foxes
- Transmission: saliva, aerosol, infected tissues or organs with incubation duration days
- Affects CNS with brain inflammation and dysfunction, malaise, headache, fever, anxiety, agitation, pain, paresthesia or itching at site

Rabies

- Diagnosis: CSF, MRI, skin punch biopsies
- Rabies vaccine – inactivated virus not danger to immunocompromised people
  - Healthy dog, cat, ferrett – do no give but observe 10 day
    - Suspect rabid – immediate
    - Unknown – consult health department
  - Bats, raccoon, skunks – consider rabid unless negative lab testing – immediate
  - Rodents, squirrels, hampsters, gerbils – consult health department

Rabies – vaccination guidelines

- Vaccination given with no need for post-exposure titers since essentially everyone reacts
- **Unvaccinated**
  - **Human rabies immune globulin (HRIG) 20 IU/kg** with as much as possible at site and remainder IM at site distant from vaccine site
  - **Vaccine** – human diploid cell or purified chick embryo vaccine
    - IM in deltoid in adults and thigh in kids okay
    - First dose ASAP – 1 cc IM day 0 with other doses day 3,7, 14
- Previous vaccination
  - **HRIG not necessary**
  - **Vaccine** – human diploid cell or purified chick embryo vaccine
    - IM in deltoid in adults and thigh in kids okay
    - Day 0 then day 3

FRACTURES

FRACTURES

- Typically presents with significant pain
- Address pain issue prior to x-ray
- Use Morphine 0.1 mg/kg IV for fracture pain
- Reassess in 5-10 minutes before dosing again to achieve analgesia needed

FRACTURES

- Common orthopedic issues
  - Sprains/strains – splint to ortho
  - Nursemaid elbow -hyperpronation technique was 94% successful on the first attempt, compared to supination-flexion at 69%.
    - Pearl: give dose of Motrin and when x-ray done many times reduced
  - Common fractures : wrist, forearm, clavicle, ankle – distal tibia-fibula - splint to ortho
  - RICE (**rest, ice, compression,** and **elevation**) and Pain medication (NSAIDS may be used without fear of delayed fracture healing in children)

LACERATIONS

LACERATIONS

- Parental participation required next to child
- Support personnel for procedure
  - Try to avoid restraint
  - Engage child and parent in helping during procedure
- Sedation versus topical LET/local anesthesia infiltration
- LET (lidocaine-epi-tetracaine) gel
  - Contraindications involvement of mucous membranes, digits, genitalia, ear, nose
  - Max dose 3 ml
  - Best use on face and scalp
  - Can use on neck, extremities and trunk with wounds less 5 cm
  - 30 minute application

Common ENT issues

Foreign Bodies

Nasal and Ears most common

- Common in 1-6 yo girls
- Caution with magnet and batteries – deterioration of mucosa

Removal:

- Curette
- Paper clip
- Foley catheter
- Alligator forceps
- Oral positive pressure
- Suction catheter
- Glue
- Katz extractor

Strep Pharyngitis

- GAS 15-30 % children 5-15 yo
- CDC does not recommend testing children <3 yo
- Centor criteria (age, tonsils with exudate, cervical nodes tender and swollen, fever, no cough)
- If cough present, likely hood of GAS close to 0%
- **Objectives in care**:
  - Prevent suppurative sequelae: otitis media, epiglottitis, peritonsillar abscess, cervical adenitis, mastoiditis, scarlet fever (scarlatina rash and strawberry tongue), rheumatic fever (erythema marginatum)
    - Impetigo and erysipelas not associated with strep throat
  - Improvement in clinical signs and symptoms thus rapid return to usual activities
  - Decrease infectivity thereby decrease transmission

Strep Pharyngitis

- Pain relief
- **Penicillin** - gold standard
  - Amoxicillin has better taste, equal efficacy
    - 50 mg/kg once daily x 5-7 days
    - Problematic: may cause whole-body rash in mono and could cause a non-allergic non-pruritic rash
  - IM Bicillin LA
    - 600,000 IU for <26 kg
    - 1.2 million IU for >26 kg
- **Macrolides and cephalosporins are acceptable in the allergic patient** > 12% resistance in GAS
  - Some studies demonstrated slightly higher cure rates with cephalosporin (cross allergies < 1%)
  - Erythromycin plus azithromycin for first line alternative penicillin-allergic

Otitis Media

- Most common pediatric outpatient diagnosis in US
- > $5 billion per year to treat AOM in pediatrics
- Mostly kids age 1-3 years
- 30% of all antibiotics prescribed for children are for AOM
- Treatment options:
  - Observation if > 2 yo and not ill appearing
  - Treat

    <6 months

    Suggested all 6 months – 2 years if T>39C and moderate otalgia

    > 2 years with bilateral disease or otorrhea

    - Duration

      < 5 years 10 days

      > 6 years 5-7 days

Otitis media

- **Amoxicillin** is drug of choice
  - 80-90 mg/kg day, max of 3 g/day
  - Unless previous AOM in last 30 days or concurrent conjunctivitis
- **PCN allergic patients**
  - **Cefdinir 28 mg/kg/day** divided BID dosing
  - IM **ceftriaxone 50 mg/kg** x 1 (need for 3 days)
  - **Azithromycin 10 mg/kg day 1 then 5 mg/kg day 2-5**
- If otorrhea or tympanostomy tubes
  - Oral antibiotic for simple otorrhea
  - Otic drops preferred if tympanostomy tubes with otorrhea
    - Ofloxacin or ciprofloxacin

Sinusitis

- Most commonly viral and self limited
- Bacterial sinusitis complication of viral URI in 7% of patients
  - Risk factors: daycare, allergic rhinitis, anatomic obstruction, irritants
- Similar to viral URI, but clinical course distinguishing
- HA and facial pain variable
- Complications without treatment of bacterial infections
- 2013 AAP guidelines for diagnosis:
  - Persistent illness (nasal discharge w/wo daytime cough > 10 days
  - Worsening course, new nasal discharge, daytime cough or fever
  - Severe onset fever > 39C and purulent nasal discharge > 3 days

Sinusitis – treatment

- CT cannot distinguish microbiology, but can identify complications
- Micro not usually necessary – usually S.pneumoniae, H.flu
- Antihistamine on for allergic component
- **Nasal saline**
- **Steroids** (nasal or po)
  - Fluticasone nasal better than oral steroids
  - Dexamethasone orally
- **Antibiotics**:
  - Augmentin 90 mg/kg divided BID
  - Cefpodoxime 10 mg/kg divided BID
  - Cefdinir 14 mg/kg divided BID
  - Doxycycline allergy penicillin.
  - Caution with Bactrim, cephalosporin, macrolides with high resistance

Metabolic and other disorders

Hyperglycemia

- What is it?
  - A level of sugar in the blood.
  - Diabetic ketoacidosis (DKA): the body begins using fats for energy, releasing ketones and lactic acid.
- What causes it?
  - Almost exclusively related to diabetes mellitus type 1 in pediatric patients.
    - May have triggers.

- Signs & Symptoms
  - The "3 P's" of hyperglycemia
    - Polyuria
    - Polyphagia
    - Polydipsia
  - Headache
  - Altered mental status
  - Kussmaul respirations
  - Smell of ketones
  - GI distress and abdominal pain
  - Hypotension
  - Tachycardia
  - Usually the onset is gradual

Hyperglycemia

- Treatment: Basic Life Support
  - ABCs
  - Provide oxygen and ventilations as needed
- Treatment: Advanced Life Support
  - Attach the monitor
  - Obtain IV access
  - IV/IO lactated Ringer's

- Treatment is primarily supportive.
- Provide 10mL/kg fluid bolus of LR. Fluid replacement.
- IV fluid is important to correct dehydration, but does not lower glucose levels.
- Definitive treatment involves the administration of insulin.

Hypoglycemia

- What is it?
  - A blood sugar level below 40 in neonates.
  - A blood sugar level below 70 in children over 28 days of age.
- What causes it?
  - Usually a complication of insulin administration in a child with type 1 diabetes.
- Signs & Symptoms
  - Hunger
  - Irritability
  - Altered mental status
  - Pallor and diaphoresis
  - Usually a sudden onset

Hypoglycemia

- Treatment: Basic Life Support
  - ABCs
  - Provide oxygen and ventilations as needed
  - Oral glucose
- Treatment: Advanced Life Support
  - Attach the monitor
  - Obtain IV access
  - IV/IO dextrose 10%
  - IM/IN glucagon

- Administer 10-15g of oral glucose, repeat 1x if needed without consult.
- D10: <28 days, 2ml/kg; >28 days 2-4mL/kg, max 25g/250mL. Repeat with consult. Glucose.
- Glucagon: 28 days- <5 years 0.5mg; 5 and above 1mg. Repeat to a max of 3mg with consult. Stimulates glycogen release; glycogen is turned into glucose.

Hypovolemia

- What is it?
  - An inadequate amount of fluid in the body.
- What causes it?
  - Vomiting and diarrhea
  - Blood loss
  - Diabetic ketoacidosis
  - Exertion and/or poor fluid intake
- Signs and Symptoms
  - Generalized weakness
  - Lethargy
  - Altered mental status
  - Pallor
  - Dry skin and mucus membranes
  - Sunken fontanelles
  - Poor skin turgor
  - Tachycardia
  - Hypotension

Hypovolemia

- Treatment: Basic Life Support
  - ABCs
  - Provide oxygen and ventilations as needed
  - Monitor glucose
- Treatment: Advanced Life Support
  - Attach the monitor
  - Obtain IV access
  - IV/IO lactated Ringer's
  - IV/IO/IM ondansetron

- GI disturbances can cause glucose problems, treat accordingly.
- Consider 20mL/kg or LR (10mL/kg in volume sensitive children). Fluid replacement.
- Ondansetron: 28 days-12 years 0.1mg/kg (max 8mg). ≥13 years 8mg. May repeat once without consult. Serotonin antagonist, antiemetic.
- Give for nausea/vomiting.

Overdose & Poisoning

- What is it?
  - The exposure to a substance which causes harm to the body.
- What causes it?
  - The action depends on the specific mechanism of the substance taken.
- Signs & Symptoms
  - Can vary widely based on the substance taken.

Overdose & Poisoning

- Treatment: Basic Life Support
  - ABCs
  - Provide oxygen and ventilations as needed
  - Activated charcoal
  - Naloxone
- Treatment: Advanced Life Support
  - Attach the monitor
  - Obtain IV access
  - Specific antidotes
    - IV/IO atropine
    - IV/IO calcium chloride
    - IV/IO/IN/IM naloxone
    - IV/IO sodium bicarbonate

- BLS
  - Charcoal 1g/kg
  - Naloxone ≥28 days 2mg
- ALS
  - Atropine: organophosphates, 0.2mg/kg q 5-10 mins
  - Calcium: Calcium channel blocker OD, 20mg/kg max of 1g.
  - Naloxone: Opiates, 0.1mg/kg
  - Bicarb: Phenobarbital & tricyclics, 1mEq/kg, dilute at 1:1 for children under 1.

Guidelines for medications for use in pediatric patients in EDs

Resuscitation Medications	Other Drug Groups
Atropine Adenosine Amiodarone Antiemetic agents Calcium chloride Dextrose Epinephrine (1:1000; 1:10 000 solutions) Lidocaine Magnesium sulfate Naloxone hydrochloride Procainamide Sodium bicarbonate (4.2%, 8.4%)	Activated charcoal Topical, oral, and parenteral analgesics Antimicrobial agents (parenteral and oral) Anticonvulsant medications Antidotes Antipyretic drugs Bronchodilators Corticosteroids Inotropic agents Neuromuscular blockers Sedatives Vaccines Vasopressor agents

Guidelines for equipment and supplies for use in pediatric patients in the ED

General Equipment

- Patient warming device
- Intravenous blood/fluid warmer
- Restraint device
- Weight scale, in kilograms only (not pounds), for infants and children
- Tool or chart that incorporates both weight (in kilograms) and length to assist physicians and nurses in determining equipment size and correct drug dosing (by weight and total volume), such as a length-based resuscitation tape
- Pain-scale–assessment tools appropriate for age

Guidelines for equipment and supplies for use in pediatric patients in the ED

Monitoring Equipment

- Blood pressure cuffs (neonatal, infant, child, adult-arm and thigh)
- Doppler ultrasonography devices
- Electrocardiography monitor/defibrillator with pediatric and adult capabilities including pediatric-sized pads/paddles
- Hypothermia thermometer
- Pulse oximeter with pediatric and adult probes

Guidelines for equipment and supplies for use in pediatric patients in the ED

Respiratory Equipment and Supplies

- Endotracheal tubes
  - ✓ Uncuffed: 2.5 and 3.0 mm
  - ✓ Cuffed or uncuffed: 3.5, 4.0, 4.5, 5.0, and 5.5 mm
  - ✓ Cuffed: 6.0, 6.5, 7.0, 7.5, and 8.0 mm
- Feeding tubes (5F and 8F)
- Laryngoscope blades (curved: 2 and 3; straight: 0, 1, 2, and 3)
- Laryngoscope handle
- Magill forceps (pediatric and adult)
- Nasopharyngeal airways (infant, child, and adult)

Guidelines for equipment and supplies for use in pediatric patients in the ED

Respiratory Equipment and Supplies

- Oropharyngeal airways (sizes 0 –5)
- Stylets for endotracheal tubes (pediatric and adult)
- Suction catheters (infant, child, and adult)
- Tracheostomy tubes (sizes 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5 mm)
- Yankauer suction tip
- Bag-mask device (manual resuscitator), self-inflating (infant size: 450 mL; adult size: 1000 mL)

Guidelines for equipment and supplies for use in pediatric patients in the ED

Respiratory Equipment and Supplies

- Clear oxygen masks (standard and non-rebreathing) for an infant, child, and adult
- Masks to fit bag-mask device adaptor (neonatal, infant, child, and adult sizes)
- Nasal cannulas (infant, child, and adult)
- Nasogastric tubes (sump tubes): infant (8F), child (10F), and adult (14F–18F)
- Laryngeal mask airway (sizes 1, 1.5, 2, 2.5, 3, 4, and 5)

Guidelines for equipment and supplies for use in pediatric patients in the ED

Vascular Access Supplies and Equipment

- Arm boards (infant, child, and adult sizes)
- Catheter-over-the-needle device (14 –24 gauge)
- Intraosseous needles or device (pediatric and adult sizes)
- Intravenous catheter–administration sets with calibrated chambers and extension tubing and/or infusion devices with ability to regulate rate and volume of infusate
- Umbilical vein catheters (3.5F and 5.0F)‡
- Central venous catheters (4.0F–7.0F)
- Intravenous solutions to include: normal saline; dextrose 5% in normal saline; and dextrose 10% in water

Guidelines for equipment and supplies for use in pediatric patients in the ED

Fracture-Management Devices

- Extremity splints, including femur splints (pediatric and adult sizes)
- Spine-stabilization method/devices appropriate for children of all ages

Guidelines for equipment and supplies for use in pediatric patients in the ED

Specialized Pediatric Trays or Kits

- Lumbar-puncture tray including infant (22-gauge), pediatric (22-gauge), and adult (18- to 21-gauge) lumbar-puncture needles
- Supplies/kit for patients with difficult airway conditions (to include but not limited to supraglottic airways of all sizes, such as the laryngeal mask airway, needle cricothyrotomy supplies, surgical cricothyrotomy kit)
- Tube thoracostomy tray

Guidelines for equipment and supplies for use in pediatric patients in the ED

Specialized Pediatric Trays or Kits

- Chest tubes to include infant, child, and adult sizes (infant: 10F–12F; child, 16F–24F; adult, 28F– 40F)
- Newborn delivery kit (including equipment for initial resuscitation of a newborn infant: umbilical clamp, scissors, bulb syringe, and towel)
- Urinary catheterization kits and urinary (indwelling) catheters (6F–22F)

Cardiopulmonary Resuscitation

The International Liaison Committee on Resuscitation (ILCOR) Consensus on Science With Treatment Recommendations for Pediatric and Neonatal Patients: Pediatric Basic and Advanced Life Support

The International Liaison Committee on Resuscitation

The authors have indicated they have no financial relationships relevant to this article to disclose.

European Resuscitation Council

American Heart Association®

Learn and Live℠

Basic Life Support

Age Definitions:

- Newborn
- Infant - under 1 year
- Child - from 1 year to puberty

Compression Techniques

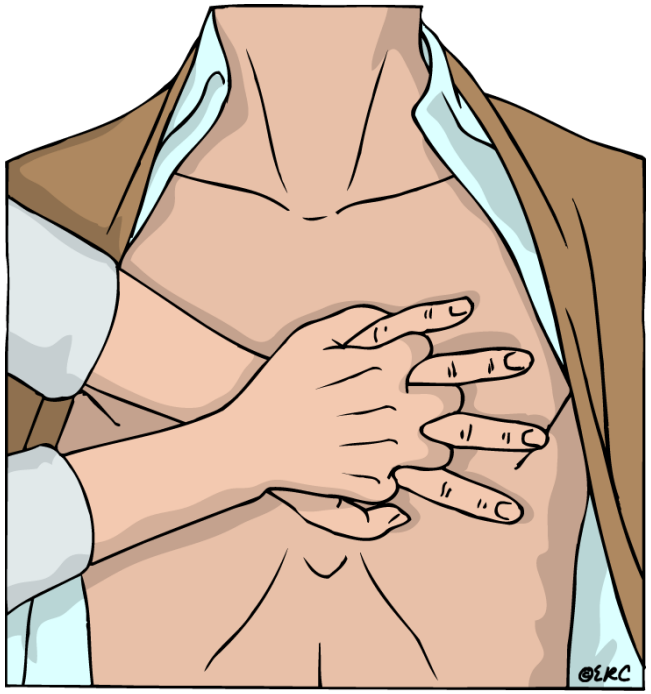
Position:

for all ages: compress the lower third of the sternum

number of hands:

- In infants: two thumbs or two fingers
- in children: use one or two hands: depressing the sternum by approximately one third of the depth of the chest

Chest Compressions

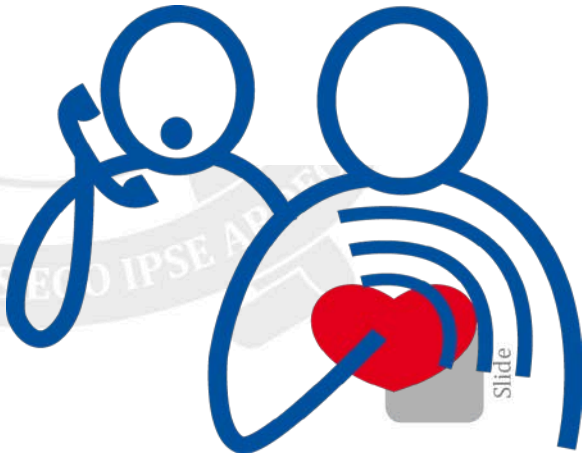


- Push hard
- Push Fast
- Complete chest recoil
- Minimize interruptions

Calling for help!!

- Perform 5 cycles or about 2 minutes of CPR before calling for help

- Indications for activating EMS before BLS by a lone rescuer are:
  - witnessed sudden collapse with no apparent preceding morbidity
  - witnessed sudden collapse in a child with a known cardiac abnormality



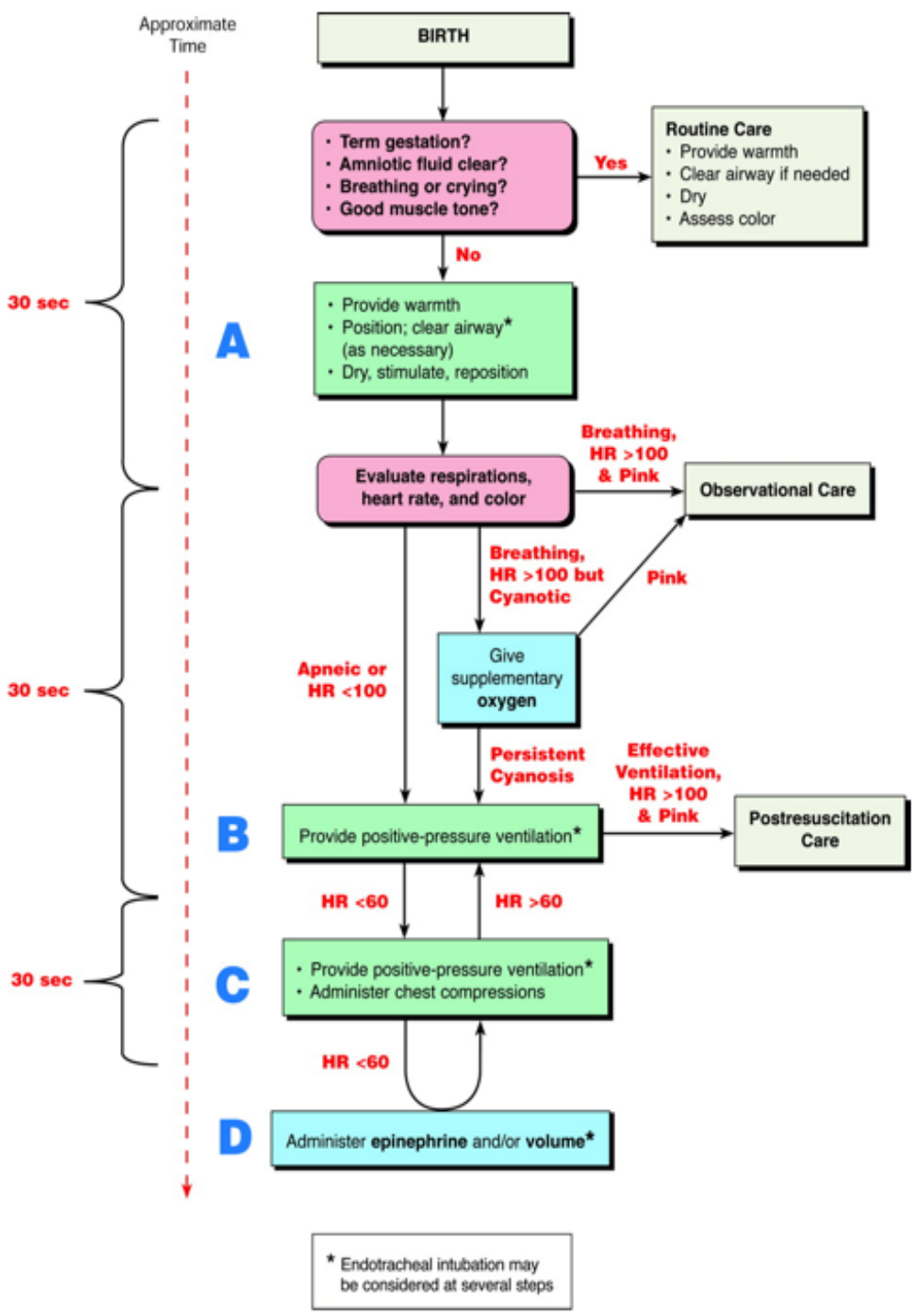
Choking

Universal Algorithm

Asystole and PEA

VF/VT

Neonatal Resuscitation



Drugs in Cardiac Arrest

- 10 mcg/kg of adrenalin as the first and subsequent iv doses.
- high dose iv adrenalin is not recommended and may be harmful
- Insufficient evidence to recommend for or against the routine use of vasopressin in children

Route of drug delivery in ALS

- where possible give drugs intra-vascularly rather than via the tracheal route
  - lower adrenaline concentrations may produce transient beta adrenergic effects resulting in hypotension.
- Intra-osseous access is safe for fluid resuscitation and drug delivery.

Airway Management

- guedel airways

- laryngeal airways
- Cuffed or uncuffed endotracheal tubes

Fluid Resuscitation

- Boluses of fluid may be required to maintain systemic perfusion
- Crystalloids - ringers or normal saline
- Septic children may require in excess of 100ml/kg fluid resuscitation

When to stop CPR?

- In the absence of reversible causes eg drowning with severe hypothermia, poisoning, prolonged CPR in children is unlikely to result in intact neurological survival.

- One should consider stopping resuscitation after 20 minutes.

Post Resuscitation Care

- Ventilate to normo-capnoea
- Hypothermia for 12-24 hours post arrest may be helpful, whilst hyperthermia should be treated aggressively
- Vaso-active drugs should be considered to improve haemodynamic status.
- Maintain normoglycaemia

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