Pediatric Emergency It's Not Just A Clinic

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Pediatric Emergencies

* Comprise 1/3 ED visits yearly
* Management varies by anatomy, physically, and developmentally
* Arrive to unfamiliar environment
* Children are frightened and increases stress to family

*Illnesses can be minor and/or major

*HCP must be patient and concise

*Establish provider/ patient bond

*Care must be family centered

*Provide care and resources that are needed

Presenting Complaints

* Respiratory symptoms -Viral URI, Pneumonia, Congenital
* GI and GU-vomiting, thrush, diarrhea, constipation, vaginal discharge
* Normal concerns -crying, feeding, sleep, periodic breathing
* Fever -rule out sepsis-respiratory, urinary or CNS
* Skin issues -rash, birth marks, jaundice
* Cardiac -tachyarrhythmia, murmurs, congenital disorders
* Eye- discharge, clogged duct
*Musculoskeletal- injuries, hair tourniquets
*Hematology-blood loss

Pediatric Sepsis

* Leading cause of morbidity and mortality in US and worldwide
* 100,00 children presented to CED with severe sepsis
* Top cause of death in children ages 0-14
* In past ten years major advancements have been made
* Protocol directed therapy and early administration of antibiotics
* Mortality has improved by 25% over last five years and is lower in adults

Identifying Sepsis

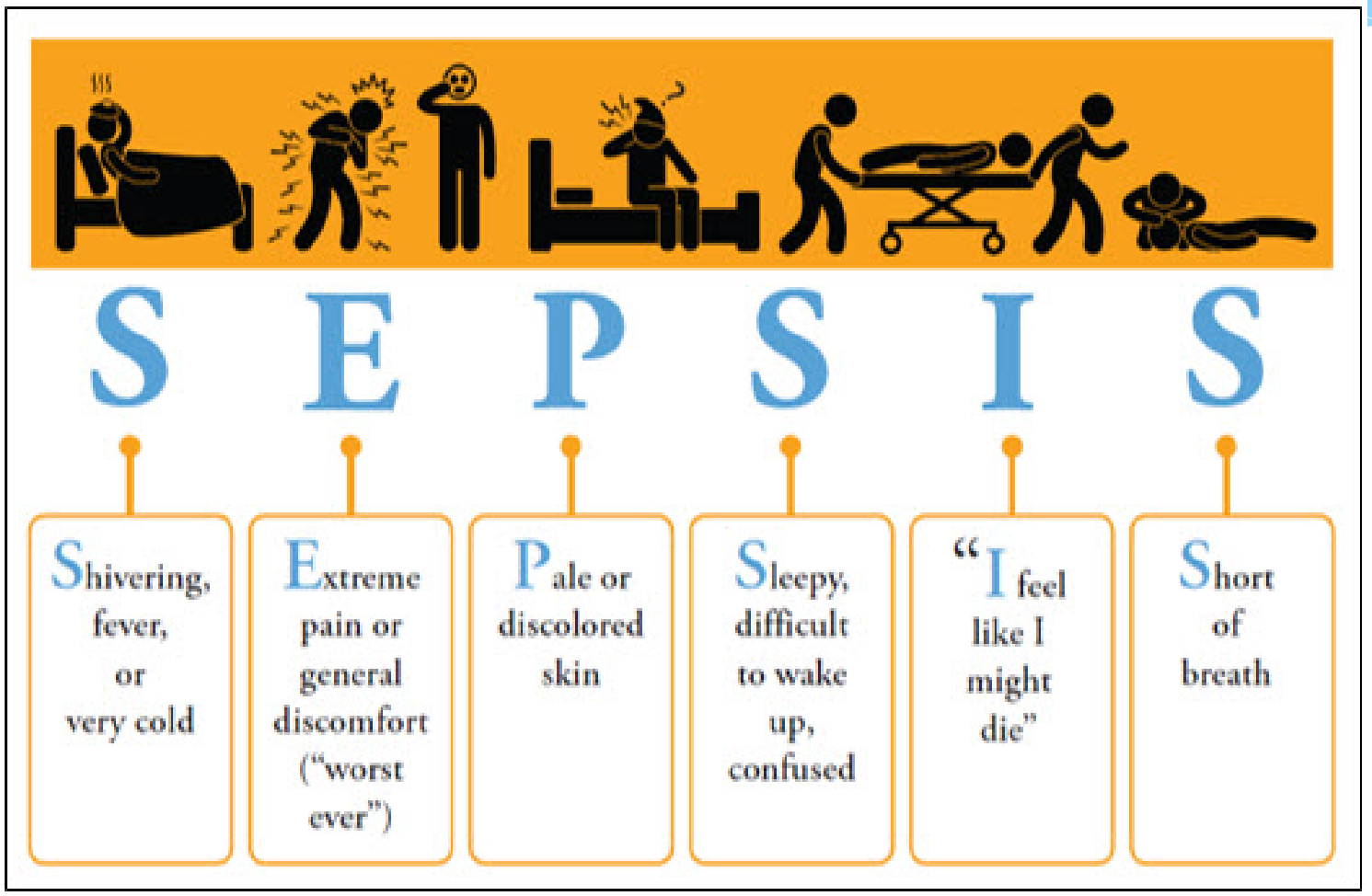
* More than one change in vital signs(Temp, HR)
* Prolonged capillary refill >2 seconds or prolonged perfusion
* Lethargy, confusion, limp
* Clinical Def- T>100.4, HR>90, RR>20
* Obtaining H&P(illnesses, wounds, vaccinations)
* Sepsis recognized and managed by pediatric age and weight ???

Pediatric Vital Sign Normal Ranges

Age Group	Respiratory Rate	Heart Rate	Systolic Blood Pressure	Weight in kilos	Weight in pounds
Newborn	30 - 50	120 - 160	50 - 70	2 - 3	4.5 - 7
Infant (1-12 months)	20 - 30	80 - 140	70 - 100	4 - 10	9 - 22
Toddler (1-3 yrs.)	20 - 30	80 - 130	80 - 110	10 - 14	22 - 31
Preschooler (3-5 yrs.)	20 - 30	80 - 120	80 - 110	14 - 18	31 - 40
School Age (6-12 yrs.)	20 - 30	70 - 110	80 - 120	20 - 42	41 - 92
Adolescent (13+ yrs.)	12 - 20	55 - 105	110 - 120	>50	>110

Pediatric Age Definition

* Neonate- Birth to 28 days old
* Infant- 29 days to 1 year old
* Child > 1 year


S E P S I S
Shivering, fever, or very cold
Extreme pain or general discomfort ("worst ever")
Pale or discolored skin
Sleepy, difficult to wake up, confused
"I feel like I might die"
Short of breath

Case Study #1
3 year old male

Mother relates he was not waking up from a nap. Hot to touch, fever 102.5 at home. Runny nose and congestion 1-2 days. Older brother influenza+ two days ago.

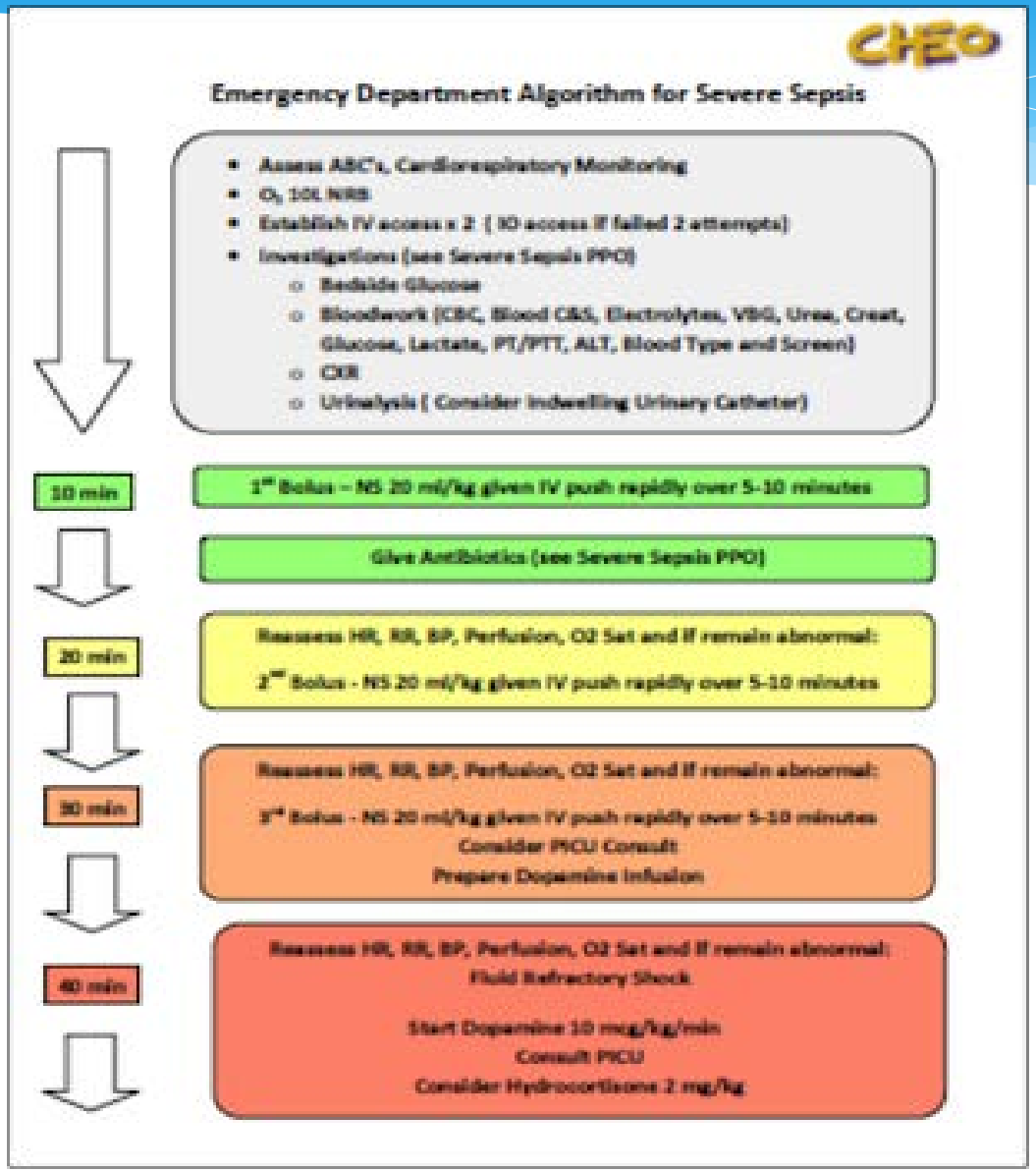
T-105 rectal, HR-220, RR-24, BP-114/80, capillary refill >2 secs, he is lethargic.

Case Study 3 yr old male

* WBC-23.6, Bands-6, ESR-12, CRP-7
* NA 138, GLU-100, K-3.8, BUN-12, Creat-.6
* RSV- neg, Influenza-+, Rapid Strept neg
* U/A Leuk+, WBC 68
* Blood, urine and throat cultures pending
* Chest x-ray-no infiltrate, no mass
* EKG-Sinus Tachycardia
* NS 20mg/kg bolus x2, Tylenol suppos, Tamiflu, Ceftriaxone 75mg/kg

Common Causes of Sepsis

* Respiratory- Pneumonia, RSV, Bronchiolitis
* GI- Appendicitis, Cholecystitis
* GU- UTI


CHEO
Emergency Department Algorithm for Severe Sepsis
Assess ABC's, Cardiorespiratory Monitoring
O_2 10L NRB
Establish IV access x 2 (IO access if failed 2 attempts)
Investigations (see Severe Sepsis PPO)
Bedside Glucose
Bloodwork (CBC, Blood C&S, Electrolytes, VBG, Urea, Creat, Glucose, Lactate, PT/PTT, ALT, Blood Type and Screen)
CXR
Urinalysis (Consider Indwelling Urinary Catheter)
10 min
1st Bolus – NS 20 ml/kg given IV push rapidly over 5-10 minutes
Give Antibiotics (see Severe Sepsis PPO)
20 min
Reassess HR, RR, BP, Perfusion, O2 Sat and if remain abnormal:
2nd Bolus - NS 20 ml/kg given IV push rapidly over 5-10 minutes
30 min
Reassess HR, RR, BP, Perfusion, O2 Sat and if remain abnormal:
3rd Bolus - NS 20 ml/kg given IV push rapidly over 5-10 minutes
Consider PICU Consult
Prepare Dopamine Infusion
40 min
Reassess HR, RR, BP, Perfusion, O2 Sat and if remain abnormal:
Fluid Refractory Shock
Start Dopamine 10 mcg/kg/min
Consult PICU
Consider Hydrocortisone 2 mg/kg

Case Study #1 Outcome

Alert and at baseline

Drinking, voiding

Discharged home with pediatrician follow up next day

Admitted next day Blood culture and urine culture +

Suggested Guidelines for the Evaluation and Management of Neonates, Infants, and Children with Fever

Age Group Evaluation Treatment

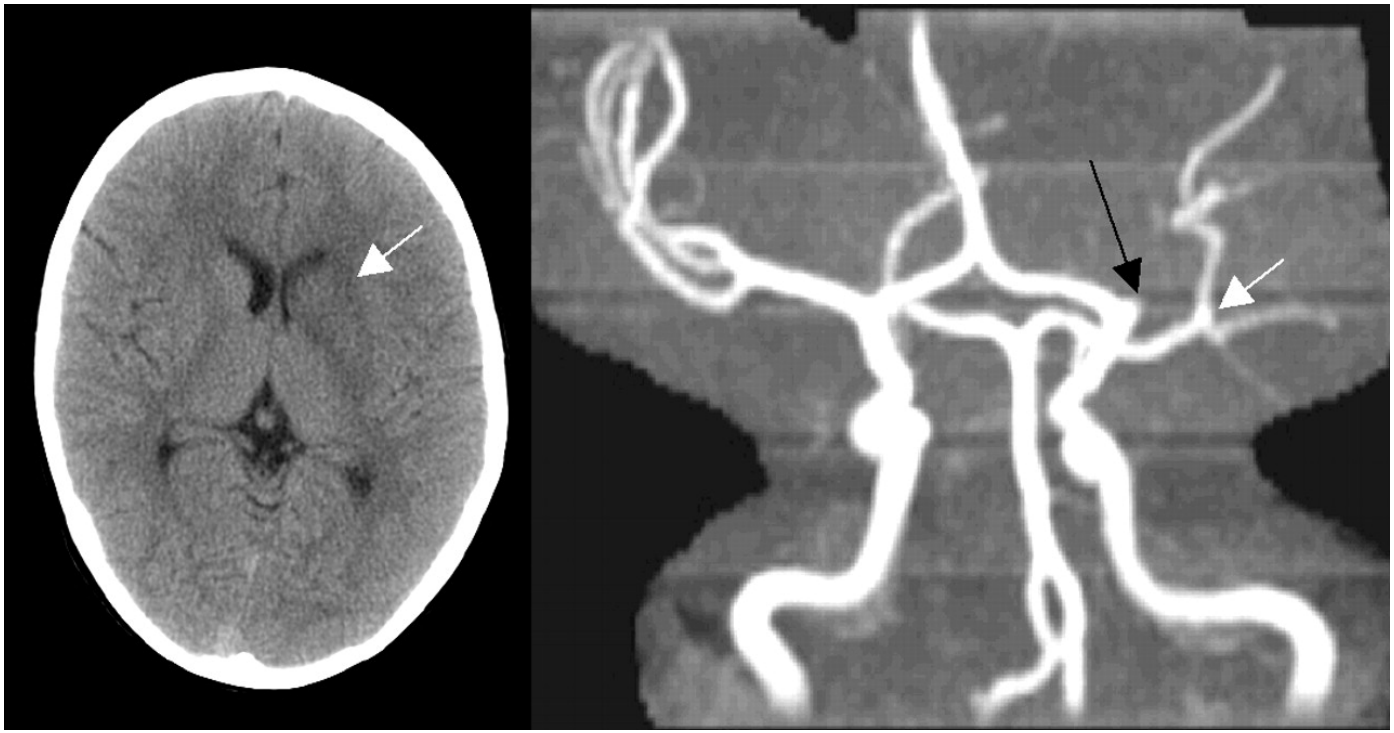
Neonate, 0–28 d* of age,
≥38°C (100.4°F) CBC and blood culture.
Admit.
Incidence of ill appearing: 13%–21%; if not ill appearing: <5%
Urinalysis and urine culture. Parenteral antibiotic therapy with ampicillin, 50 milligrams/
kg, and cefotaxime, 50 milligrams/kg, or gentamicin, 2.5
milligrams/kg.
CSF cell count, Gram stain, and culture.
Chest x-ray is optional, if no respiratory symptoms.
Stool testing if diarrhea is present.

Infant 29–56 d* of age,
≥38.2°C (100.8°F)
(Philadelphia Protocol)
Same as for neonates. Discharge if:
WBC
≤15,000/mm3 and ≥5000/mm3 and
<20% band forms.
SBI incidence of ill appearing: 13%–21%;
if
not ill appearing: <5%
Urinalysis negative.
CSF WBC <10 cells/mm
3.
Negative chest x-ray or fecal
leukocytes if applicable.
Admit if any of above criteria are not
met and treat with parenteral
ceftriaxone, 50 milligrams/kg with
normal CSF, 100
milligrams/kg with signs of meningitis.

Infants 57 d* to 6 mo* of age,
≥38°C
(100.4°F)
Urinalysis and urine culture alone.
Discharge if negative.
Treat for UTI with cefixime, 8
milligrams/kg/d daily or
divided twice a day, or cefpodoxime,
10 milligrams/kg/d
divided twice a day, or cefdinir, 14
milligrams/kg/d divided
every 12–24 h for 7–10 d as outpatient.
Non-UTI SBI incidence is estimated to
be negligible
For conservative management, treat
infants 57–90 d using
Philadelphia Protocol above.
UTI is 3%–8%
Admit and treat with the parenteral
ceftriaxone if fails conservative
criteria for discharge.

Infants/children 6–36 mo of age
Urinalysis and urine culture. Discharge if negative.
Non-UTI SBI incidence is <0.4% Girls 6–24 mo. Treat for UTI as above as outpatient.
UTI in girls
≤8% Boys 6–12 mo.
UTI in boys (<12 mo)
≤2% Uncircumcised boys 12–24 mo.
Uncircumcised boys (1–2 y) remains 2%
Children >36 mo and older
No further workup is routinely necessary. Discharge and treat with acetaminophen, 15 milligrams/kg PO/PR every 4 h, or ibuprofen, 10 milligrams/kg PO every 6h

Pediatric Stroke



Stroke

* Brain attack
* Any interruption of blood flow to the brain
* Loss of oxygen and glucose
* Causes edema, and mass effect and exacerbate previous injury
* Several types Ischemic (87%),hemorrhagic(10%) and nontraumatic subarachnoid hemorrhage (3%)
* 10-25% children die
* 25% have a reoccurrence
* 66% neuro deficits, seizures, learning or development disorders

Pediatric CVA

*1.2-13 per 100,000

*Symptoms are subtle

*Incidence have doubled

*More common in boys than girls

*Prevalence in African Americans

* Symptoms that resolve in 24 hours are defined as TIA

CED Objective

* Early recognition
* Rapid neuro consultation
* Imaging
* Treatment
* Improved outcomes

How do they present?

* Newborn-focal seizures or lethargy
* Lethargy, apnea spells or hypotonia infants
* Toddlers show deterioration-crying, irritable, poor feeding, vomiting, sepsis like symptoms with cold extremities
* Older child-Hemiparesis, language/speech difficulties, visual deficits

Risk Factors and Causes

* **Cardiac** most common-cardiac cath repair occurs in 72 hours
* Cardiomyopathies, Rheumatic Heart Disease, prosthetic valves, PFO-patent foramen ovale
* **Hematologic**-Sickle Cell Disease-also common. Most after 5 years of age, as early as 18 months
* Prothrombotic disorders-protein C & S, Factor VII & VIII deficiency, iron deficiency anemia-without other etiology

Risk Factors Continued

* **Infection** Varicella, HIV-induced vasculitis, vasculopathy
* Mycoplasma, Flu A coxsackie, Rocky Mountain spotted fever, parvovirus19, chlamydia, enterovirus
* Bacterial & TB meningitis, viral
* **Vascular**- AVM, moyamoya associated with Down syndrome, neurofibromatosis, and sickle cell

Risk Factors Continued

* **Syndromic and Metabolic disorders**-Marfans, tuberous sclerosis, homocysteinuria, folic acid and B12 deficiencies
* **Oncologic-**Leukemia or Lymphoma, radiation therapy optic area (vasculopathies)
* **Vasculitis**-children>14-Idiopathic, Kawasaki disease, Henoch-Schonlein Purpura (HSP), polyarteritis nodosa, Takayasu's arteritis, juvenile RA, Systemic lupus, IBS, sarcoidosis, Sjogren syndrome, consider Behcet's disease

Risk Factors Continued

* Trauma- head and neck. Symptoms can be delayed 24 hours.
* Intraoral trauma- pencil to mouth, tonsillectomy
* Chiropractor manipulation
* Drugs- illicit and prescribed. Such as amphetamines, PCP ecstasy, cocaine, glue sniffing, stimulants and heroine
* Oral contraceptives
* Overuse of ergot alkaloids treating migraines

Imaging and Labs

* CT noncontrast
* MRI/MRV
* Transcranial Doppler
* Lumbar puncture
* Blood glucose, CBC, pregnancy, LFTs, ESR, ANA

Treatment

* Depends on cause
* Prevent rebleed. Correction anticoagulation
* Factor VIIa
* Low molecular weight heparin
* Transfer to tertiary facility
* Surgical management of hemorrhagic stroke, early evacuation, stereotactic radiosurgery, microsurgical or endovascular techniques
* Thrombolytic therapy
* Contact 1-800-NOCLOTS

Case #2 15 year old female

* Onset of headache and blurred vision
* Vitals T-98, HR-77, RR-18, BP-112/80
* Vaccines UTD, Hx Ovarian Cyst, no previous surgery
* Meds- started birth control two months ago
* No fever, rash, injury, insect/tick bite or trauma. No travel.
* Neurological exam normal
* Mother recent Dx Factor VII deficiency and teen has not been tested

Case #2 15 year old female

- CBC, CMP, pregnancy, PT/APPT
- CT Brain vs MRI
- Pediatric neurologist
- CBC, CMP, PT APTT , all normal
  Pregnancy-negative
- MRI +Cerebral infarct
- Treatment- TPA vs heparin
- Transferred to tertiary facility after she was started on Heparin

Heart Failure

The Pediatric Patient

What is Heart Failure ?

* Result of ventricular pump dysfunction
* Loss of myocardium, reduced contractility
* Leads to inadequate perfusion, shock, and pulmonary edema
* More common in adults
* 90% occur < 1 year old

Sign/Symptoms

* Feeding-lower intake, longer time . Sluggish weight gain
* Less active, more irritable
* Higher resting heart rate
* Tachypnea
* No rales in infants or children
* Enlarged liver
* S3 gallop
* Diminished peripheral pulse
* Arrhythmias can occur and cause sudden death

Causes of Heart Failure

Neonatal Sepsis- prolonged rupture of membranes, maternal infection

Hematology- anemia, cancer

Metabolic- hypoglycemia, hypocalcemia

Congenital defects

Arrhythmias- SVT, bradycardia

Scoring is Age Specific

* In the Infant
* I No limitations or symptoms
* II Mild tachycardia or diaphoresis with feeding
* III Marked tachypnea/diaphoresis with feeding or exertion. Prolonged feed times
* IV Symptomatic at rest with tachypnea, retractions, grunting or diaphoresis

Scoring continued

* Diaphoresis- 0 to 2
* Tachypnea- 0 to 2
* Age 0-1 year RR <50, 50-60 >60
* Age 1-6 year RR <35, 35-45, >45
* Age 7-10 year RR <25, 25-35, >35
* Age 11-14 year RR <18, 18-28, >28
* Age 0-1 year HR <160, 160-170, >170
* Age-1-6 year HR <105, 105-115, >115
* Age7-10 year HR <90, 90-100, >100
* Age 11-14 year HR <80, 80-90, >90

Staging for Infants and Children

* **A** Risk of developing HF, normal cardiac function and no cardiac overload
* **B** Abnormal cardiac function, no symptoms of HF
* **C** Underlying structural or functional heart disease with HF symptoms
* **D** End Stage NF treated with continuous inotropic drugs, circulatory support, heart transplant or hospice

Management

* Diuretics- treat volume overload. Furosemide, HCTZ, spironolactone
* Inotropes- reduce preload. Digoxin,
* ACE inhibitors-Agents that reduce afterload, Captopril, Enalapril
* B adrenergic antagonists-improve cardiac output
* Beta Blockers- increase afterload and vasoconstriction. Metoprolol, Carvedilol
* IV Drug therapy-Inotropes, Catecholamine, Milrinone, Nesiritide
* CPAP, BiPAP, Mechanical ventilation

Management continued

* Nutrition- calorie intake 120 kcal/kg via nasogastric or gastrostomy tube. Breast feeding less stressful than bottle.
* Exercise Rehab-data limited further study needed
* Surgery-correct congenital problem, AICD. Risk after surgery is CHF.

Case Study #3

12 Year old male arrives with mother. Has had abdominal pain and fatigued.

T-97, HR-122, RR-22, BP-138/80 Sat98 % RA Ht- 62 inches, Wt-160 lbs.

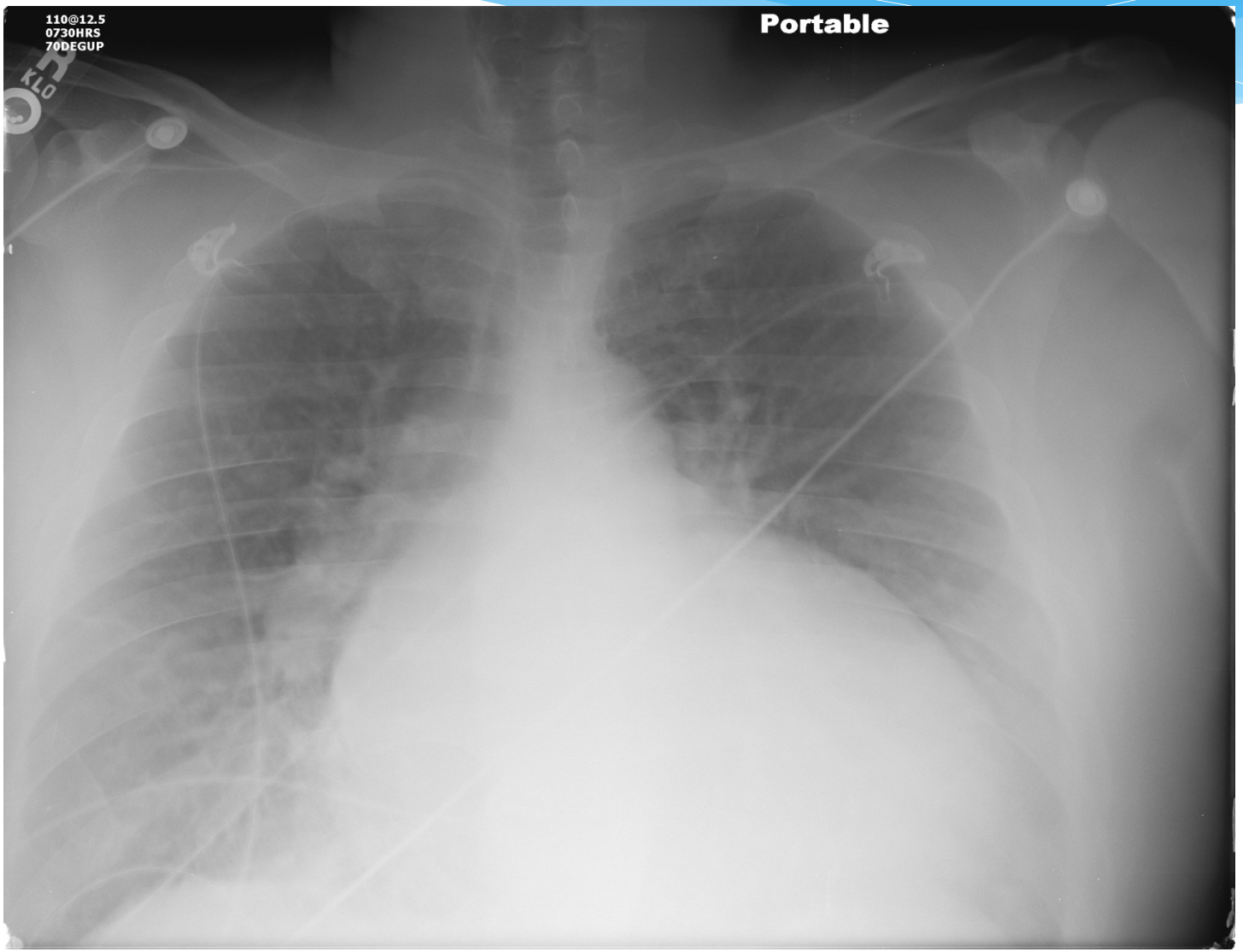
Hx vaccines UTD, premature, HF, HTN. Surgery-Repaired PFO.

No medications

Case Study #3

* Labs-CBC, CMP, PT/APTT, BNP, CK Troponin
* EKG
* Chest x-ray

* CBC, CMP, PT/APTT-normal
* BNP-155, Troponin <.04
* Chest x-ray + HF
* EKG- Sinus Tachycardia


110@12.5
0730HRS
70DEGUP
Portable

Case Study #3

* Started on IV Furosemide 20mg, nasal cannula oxygen 2 L
* Maintained cardiac monitoring for arrhythmias
* Transferred to tertiary facility- PICU

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