Little Kids, Big Problems

Interesting Cases in Pediatric Emergency Medicine

Children's Hospital Colorado

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Children's Hospital Colorado

Financial Disclosures

- No relevant financial relationships with any commercial interests.

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Objectives

- Review cases
- Discuss work-up/management of patients
- Not kill any patients
- Enjoy last lecture of day 1 of ETOS conference

Case #1

- EMS call: "Please hurry my daughter was just shot with an arrow"
- What are you thinking as you are heading to scene?
- What potential injuries are you worried about?

6 y/o shot with arrow

- Was hit by an arrow from a compound bow, while in her backyard. Per report, Pt ran out from protected area and FOC did not realize she was there.

6 y/o shot with arrow

- 6 yo awake, crying, sitting on ground with arrow through chest

- What do you do?
  (well besides try not to freak out)

- Where do you start?

6 y/o shot with arrow

- A: Crying and able to clearly tell you her name
- B: Hard to take a deep breath but breath sounds on both sides.
- C: 2+ radial pulses; Cap refill <2 sec
- D: Follows commands
- E: Lift shirt up and see arrow end sticking out of front of chest near sternum and ~14 in of arrow sticking out of back.

- HR:138 RR: 20 BP: 92/48 Pox= 95%

6 y/o shot with arrow

- IN Fentanyl given
- IV access obtained
- Arrow secured with tape and gauze
- Pt able to be placed on stretcher on her side

- Call to Hospital:

Rm 2: "Chest Trauma"

- BP 113/68 | Pulse 98 | Resp 19 | Wt 21.8 kg | SpO2 99%1L NC
- General: She is active. She is not in acute distress. Normal respirations
- HENT: NC. Airway patent. EOMI Trachea midline
- Cardiovascular: RRR no m/r/g. Pulses 2+ throughout
- Pulmonary: effort normal. No distress. Normal BS.

Noted fiberglass arrow entering chest near sternum, with stabilized exit near L scapula

- Abdomen. ND. Soft. NTTP
- Skin: No additional abnormalities noted. Cap refill 2 seconds
- Neuro: No weakness.

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X-ray of patient and arrow

6 y/o chest wound

- Trauma Red
  - CXR
  - Labs obtained
  - FAST performed
    - normal
  - CT scan chest

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CT scan of patient and arrow

6 y/o penetrating chest injury

OP NOTE

- The arrow could be seen entering from the anterior mediastinum and traversing the lung and exiting posteriorly. Passing through the middle of the upper lobe.
- Under visualization, we pulled the arrow. There was some bleeding from the tract, but not significant amounts.
- There was also not much disruption of the lung parenchyma. Just a few air bubbles.
- We observed the mediastinum where it was close to large vessels, there was minimal bleeding.
- Chest tube placed

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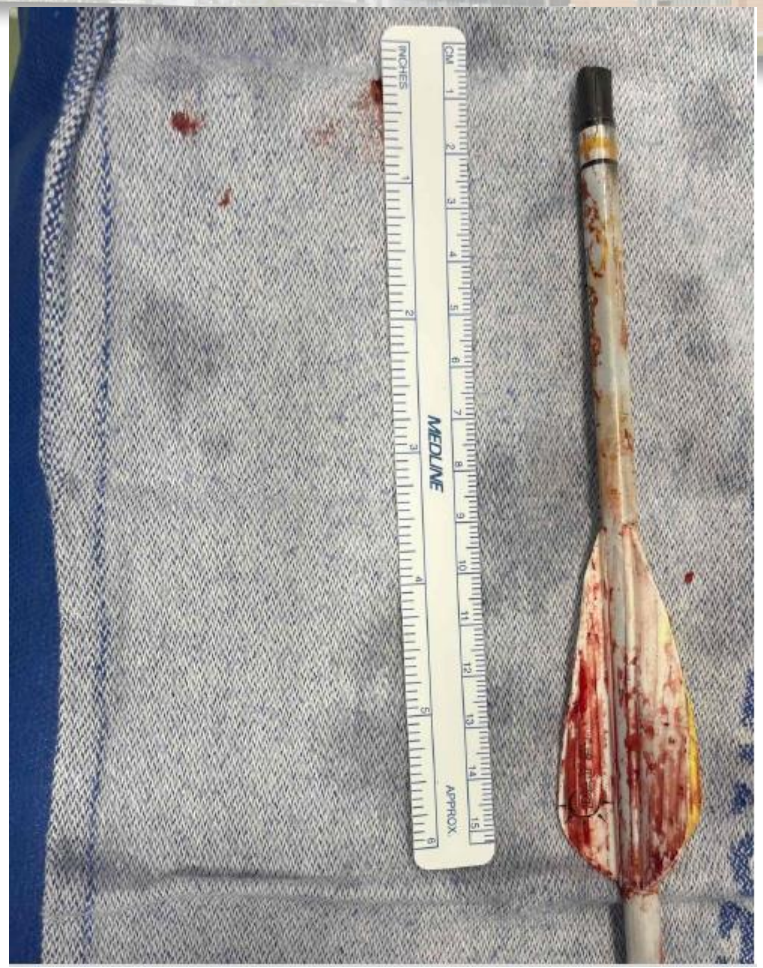

Traumatic Chest Injury

- ED management
  - ATLS
  - Common injuries include PTX, hemothorax
    - Needle decompression
    - Chest tube
  - MTP if hemorrhage
    - GSW penetrating into vascular bleed – consider thoracotomy

6 y/o penetrating chest injury

- Admitted to TACs for chest tube management
- Antibiotics
- Chest tube removed on POD#3 after minimal drainage
- Discharged home POD #4

2 yo “Not breathing”

- Call to EMS:
  - “Help my child is not breathing. Please hurry”
- What are you thinking about when on wat to home?
- What do you want to have ready to go?

2 yo “Not breathing”

- Floppy and dusky child
- Now what?

2 yo "Not breathing"

- Position child to open airway
  - Any foreign body in mouth? → No
  - Any improvement with opening airway? → No
- Any chest rise? → No

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- Right Size
- Right Positioning
- Right Rate

Correct
Covers mouth, nose, and chin but not eyes

Incorrect
Too large: covers eyes and extends over chin

Incorrect
Too small: does not cover nose and mouth well

2 yo "Not breathing"

- 60 seconds after starting BVM
  - Improved color;
  - Stronger brachial pulses
  - Vital signs: Pulse Ox 90% HR: 100

- Now what?

- What is on your differential diagnosis?
- Anything you want to ask family?
- Any physical exam findings you looking for?

2 yo “Not breathing”

- Pt continues to require BVM.
- Not fighting BVM
- No movement of limbs.

- Call to ED:
  - This is **** coming lights and sirens with 2 y.o. female with unresponsiveness and requiring bagging. HR 90 Pulse ox 94% being bagged and delayed cap refill. We are 3-5 min out.

2 yo "Not breathing"

- Arrives to ED with BMV in progress.
- Floppy child when moved to bed.
- HR: 100 Pox: 94% BP: 78/44 T: 37.5
- A: No structural abnormalities; no FB seen.
- B: No respiratory effort. Fair aeration with bagging
- C: 2+ brachial pulses.
- D: No obvious major injuries; Dextrose: 94
- E: Warm blanks asked for to make sure patient does not get cold

- What else do you want to know?
- What do you want to do?

2 yo “Not breathing”

What do you think is going on?

2 yo “Not breathing”

- What do you think is going on?
  - Head injury?
    - NAT
  - Sepsis?
  - Ingestion?
  - Seizures?

- What do you want to do?

2 yo “Not breathing”

- Decision made to give Narcan
- How much?
- Pt screams and starts to breath on own.
- Urine Fentanyl POSITIVE

2130: Rm 3: EMS "Eye is Out"

- ES is an 8y/o female BIBA with left eye injury sustained at basketball practice today. Patient reports a hook that was connected to a gym locker door struck her left eye, and caused her eye to "pop out" of the orbit. Patient reports pain to left eye and vision changes. Denies any other injury. Denies any loss of consciousness

Rm 3: "eye is out"

- T:37.2 °C (99 °F) HR: 95 RR: 22 BP: 128/75
  POx: 96% RA
- General: She is alert, she is active. Scared/anxious
- HEENT: NC/AT. Nose, mouth normal with MMM. **Eye exam notable for left eye with significant proptosis. Firm to touch. Fluorescein uptake 9 o'clock cornea** with **Scant hemorrhage, controlled, 2-3 o'clock. EOM intact. Symmetric pupils 3mm, PERRL. Vision to hand movement only**
- Pulm: LCTAB
- CV: RRR, no m/r/g.
- Abdomen: soft, NTTP

(Warning: next slide can be difficulty to look at)

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(patient photo of eye dislocation)

Rm 3: Proptosis Differential Dx

- Swelling, bleeding behind the eye which causes it to "protrude" from socket"

- Traumatic injury causing subluxation from the socket
- Infection – Abscess
- Bleeding – hemorrhage
- Hormone dysfunction – thyroid

- Acute Proptosis is a medical emergency
- If hemorrhage – perform a lateral canthotomy

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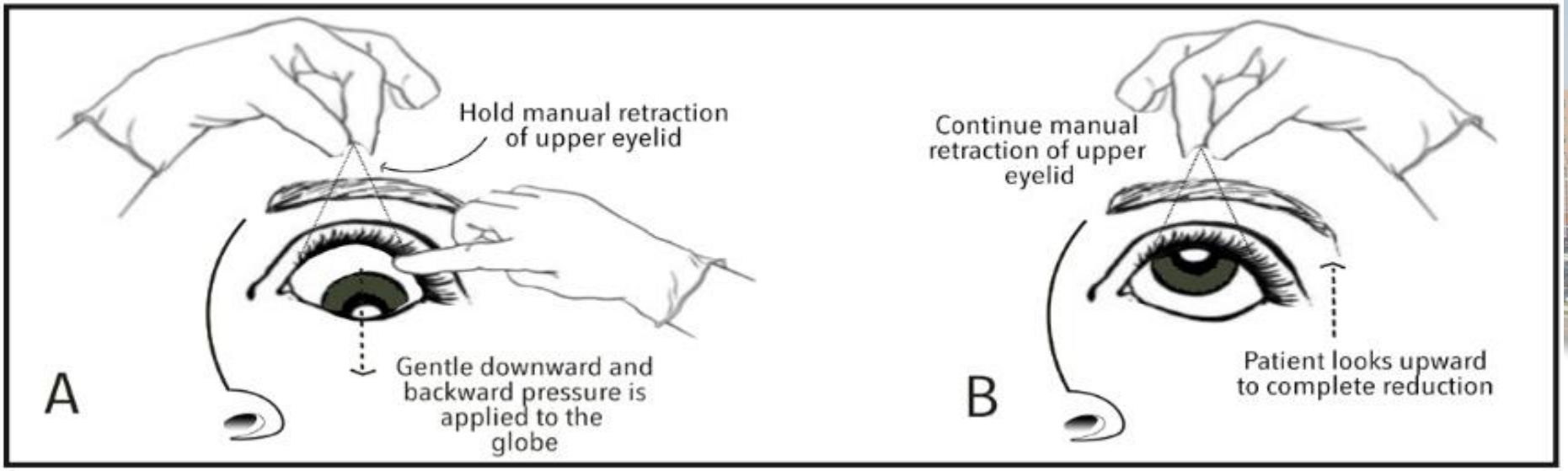
What do you want to do?

Rm 3: "Eye is out"

- Ophthalmology emergently consulted
- Intraocular pressure performed:
  - 35 by Tonopen
  - (normal 20 or less)



- The left globe was uneventfully reposited into the orbit: the eye was anesthetized with topical proparacaine and the ocular surface was copiously lubricated with artificial tear gel. The patient was instructed to look downwards while the left upper eyelid was firmly retracted with a gloved finger. A sterile piece of gauze was placed onto the lubricated ocular surface and gentle digital pressure was applied posteriorly with easy repositioning of the globe back into the orbit. The patient tolerated the procedure well but did experience nausea/vomiting immediately after.

Rm 3: "Eye is out"

- Re-examined and normal eye exam including normal vision and normal intraocular pressure
- Discharged home with strict return precautions
- f/u with Ophthalmology in 10 days

At Ophthalmology appointment – normal exam, normal vision. No f/u needed.

"My baby is having trouble breathing"

- What are you thinking of in route to scene?
- What are primary causes of respiratory distress in pediatric patients?
- What equipment/medications are you getting ready?

“My baby is having trouble breathing”

- 18 mo with ~4 hours of breathing hard and now is lethargic.
- Hx admission at 11 months for bronchiolitis.

- No known fevers.
- + vomiting multiple times for about 12 hours.

18 mo w/ Respiratory Distress

- 10:22 Arrive at scene
- Pt in arms of mother; pale appearing
- HR: 185 RR: 24 Pox: 94%
- What else do you want to ask?
- What physical exam findings are you looking for?
- What do you do next?

18 mo w/Respiratory Distress

Physical Exam:

- Vitals: HR: 190 RR: 24 Pox: 94% Temp: 37.8 BP: 82/42
- General: ill appearing in pale; sleepy
- Mucous membranes dry, no lesions;
- Chest: Min intercostal and belly breathing, no wheezing
- Circulation = skin pale, mottled extremities, tachycardic

Now what?

What do you think is going on?

18 mo Respiratory Distress

- What is going on?

- What do you do next?

18 mo Respiratory Distress

- Blood sugar: 480

What is your diagnosis for 18 mo with "respiratory distress"?

What now?

Presentation:

- Common symptoms
  - Polyuria (including enuresis)
  - Polydipsia,
  - Weight loss
  - Fruity breath odor

- Younger the patient more difficult to make diagnosis.

- Signs/Symptoms of SEVERE DKA:
  - Kussmaul breathing
  - Altered mental status
  - Persistent vomiting

Initial Workup/Labs:

- IV access, monitor
- Initial labs:
  - Bedside glucose
  - iStat VBG
  - BMP, Phos
  - Beta-Hydroxybuterate
  - Lipase
  - HgbA1c
  - U/A
- Remove pump patient has insulin pump

Starting Insulin

- If in DKA, start insulin drip after IVF bolus is completed

- DKA Criteria:
  1. Hyperglycemia with glucose >200 mg/dL
  2. pH< 7.3 or HCO3<15
  3. Ketonemia or Ketonuria

- Initiate insulin drip at 0.1Units/kg/hr
- Do not bolus insulin.

What Fluids and How Much?

- Signs of shock?
  - No: NaCl 0.9% 10-20ml/kg over 60 min
  - Yes: NaCl 0.9% 20 ml/kg over 30 min (repeat up to 40 ml/kg)
    - Consider early pressor support

After completion of initial bolus recheck blood glucose and place second PIV.

Maintenance fluid calculation:

0-10kg →4ml/kg/hr

10-20kg→2ml/kg/hr

>20kg →1ml/kg/hr

14 kg patient:

0-10 kg→ 10x4ml/hr= 40ml/hr

10-20kg→ 4x 2ml/hr= 8ml/hr

20+ kg→ 0x 1ml/hr= 0ml/hr

Total maintenance

32kg patient:

0-10 kg→ 10x4ml/hr= 40ml/hr

10-20kg→ 10x2ml/hr= 20ml/hr

20+kg→ 2x 1ml/kg= 2ml/hr

Total maintenance

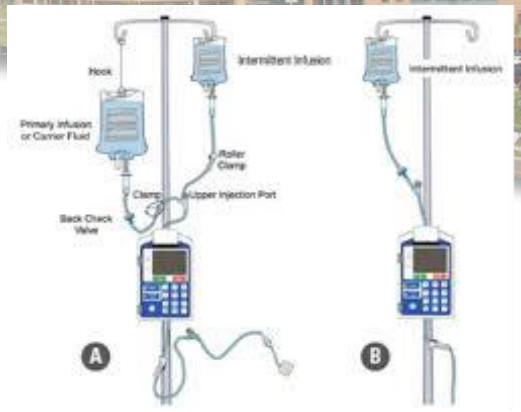
What Fluids and How Much?

- Two Bag Set Up
  - Bag 1: NS + electrolytes (i.e., K)
  - Bag 2: D10 NS + electrolytes

Initial Serum K+	K+ in fluids
K>5.5	None
K=4.5-5.5	20 mEq/L K-acetate + 20 mEq/L Kphos *
K<4.5	30 mEq/L K-acetate + 30 mEq/L Kphos *

- *May use 40 mEq/L KCl if K-acetate and Kphos are not available.
- Hold off starting inulin until K>3.0

What Fluids and How Much?



- Two Bag Set Up
  - Bag 1: NS + electrolytes (i.e., K)
  - Bag 2: D10 NS + electrolytes

Blood glucose (mg/dL)	% rate NS w/electrolytes	% rate D10 w/electrolytes	Final dextrose concentration
>300	100	0	0
251-299	50	50	5
200-250	25	75	7.5
151-199	0	100	10

What Fluids and How Much?

- Alternative fluids if unable to get specific fluids made up.
  - Bag 1: NS + 40 KCl
  - Bag 2: D5NS + 20 KCl
  - Bag 3: D10 1/2NS
- Total infusion rate 1.5X Maintenance

Blood glucose (mg/dl)	% of rate from NS+ 40KCl	% of rate from D5NS +20KCl	% of rate from D10 1/2NS	Final dextrose concentration
≥ 300	100	0	0	0
251-299	0	100	0	5
200-250	0	50	50	7.5
151-199	0	0	100	10
<150	Contact pediatric endocrinology for dextrose and insulin infusion recommendations			

Monitoring while on insulin drip

- Labs:
  - POC blood glucose Q1h while on insulin drip
  - BMP Q2h while on insulin drip
- HCO3 and pH may drop from initial level when first starting insulin and fluids

- CHCO PICU admission criteria
  - Initial pH<7.15 or HCO3<5
  - Concerns/treating for suspected cerebral edema
  - Consider PICU admission for any patients in which may be difficult to assess mental status
    - Age < 5 years
    - Developmental delay/impaired ability to communicate

Cerebral Edema

- Signs/symptoms
  - Severe/worsening headache
  - Bradycardia (or relative slowing HR)
  - Irritability
  - Irregular breathing
  - Decreased LOC; GCS<13
  - Focal neurological abnormalities
  - Persistent vomiting

Clinical Criteria for Cerebral Edema

- Diagnostic Criterion
  - Abnormal motor or verbal response to pain
  - Decorticate or decerebrate posture
  - Cranial nerve palsy (esp III, IV, VI)
  - Abnormal neurogenic respiratory patterns (grunting, apneusis, Cheyne-Stokes)
- Major Criteria
  - Altered mentation, confusion, fluctuating LOC
  - Sustained decrease in HR (decrease by 20+) not contributed to fluid resuscitation
  - Age-inappropriate incontinence
- Minor Criteria
  - Vomiting
  - Headache
  - Lethargy
  - Diastolic BP >90
  - Age less than 5 years

1 Diagnostic criterion or
2 Major criteria or
1 major and 2 minor criteria

92% Sensitivity , 96% specificity

If Cerebral Edema is suspected

- Do not delay treatment to obtain imaging
- Elevate head of bed
- Decrease fluid rate to 1x maintenance
- Hypertonic saline (3%) 5ml/kg over 15 min (or mannitol 1g/kg over 15 min)
- DO NOT give $NaHCO_3$ or steroids

- Try not to intubate even if GCS<8

Transferring patient

- Transfer to pediatric hospital with PICU if:
  - Concerns for cerebral edema
  - Severe DKA (pH<7.15 or HCO3<5)
  - Unable to admit insulin drips to general pediatric floor

- Transfer via critical care transport team that can monitor labs in route and adjust fluids/insulin accordingly.

THE END

Questions?

Patrick Mahar, MD

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23:50
Room 2 Rash and Fever

- HPI: 4 yo healthy boy who presents OSH ED w/2 days of painful rash. Started with pain all over, especially mouth. Did not want to open mouth. Pain got worse and then the patient complained of whole body pain.
- At NOC site
  - Exudative pharyngitis
  - Rapid strep negative
  - Dx: Viral illness
  - Sent home with Tylenol and Benadryl PRN
- Now with worsening rash, pain, and fever of 102.6F
- Rash spreading and forming blisters.

23:50
Room 2 Rash and Fever

- HPI: Previously healthy 4 year old, fully vaccinated male who presents with blistering rash that started 4 days ago.
- Initially on his lower jaw with redness that progressed further on his groin, underarms, face and nose.
- Seen at PCP on 3 days ago and started oral steroids (pred) and topical mupirocin which did not seem to improve symptoms.
- Rash continued to progress until today where it started to cover his whole eyes/mouth. He was eating and drinking well until today where he has not wanted anything to eat.

23:50
Room 2 Rash and Fever

- Pt playing in high grass/ gardening weeds on the day prior to symptom onset. They personally do not use insecticides but their neighbors do. (A less severe version of facial redness occurred 1 year ago after gardening)
- Family went to a fish hatchery last week.
- Has a dog and a cat at home.
- Attends daycare.
- No similar symptoms in family members.

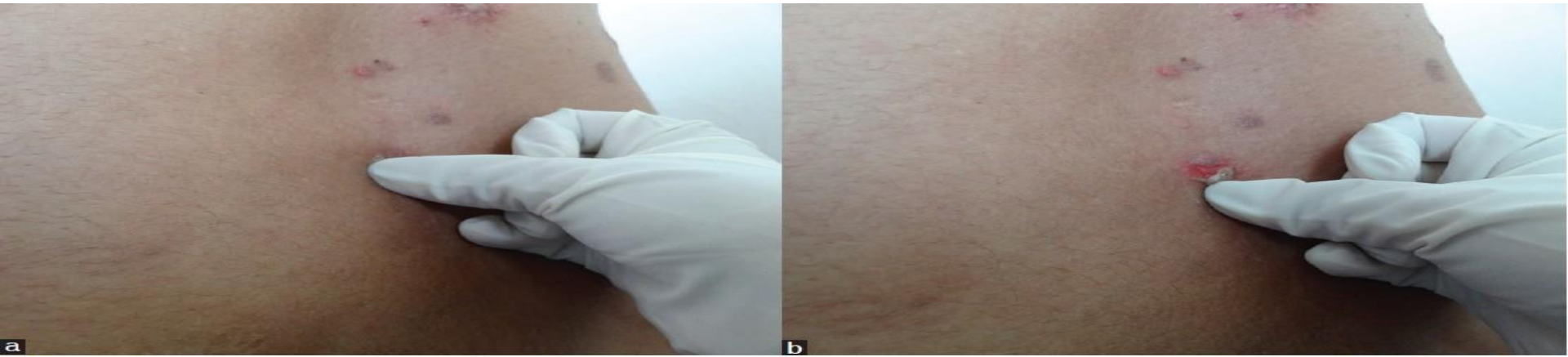
23:50
Room 2 Rash and Fever

- PE: T: 39.2 HR:122 RR: 24 BP:96/42 Pox:92% on RA
- GEN: appeared uncomfortable. Very fussy when touched. Non-toxic.
- HEENT:
  - Pt uncooperative with opening eyes and mouth.
  - Periorbital erythema and edema.
  - Nares and mouth with dried yellow crust.
  - Open blisters near mouth, with clear fluid.
  - No lips/oral lesions. No cervical lymphadenopathy
- CV: normal
- PULM: normal
- ABD: normal

23:50
Room 2 Rash and Fever

23:50
Room 2 Rash and Fever

- SKIN: Crusting and erythema of perioral skin. Erythematous rash in periumbilical region. Multiple unroofed vesicles on chest, abdomen, back and wrists. Some desquamation of the skin on hands and in diaper region, normal urethral meatus
- Positive Nikolsky's sign (gentle stroking of the skin causes the skin to separate at the epidermis)
- NEURO: normal CNS exam



23:55
Room 2 Rash and Fever

- What is going on?
- What do you want to do?
- Workup?

23:55
Room 2 Rash and Fever

- Differential:
  - Stevens Johnson Syndrome-
    - Rash: Target lesions; No separation of layers of skin; Mucous membranes involved
  - Scarlet Fever
    - Sandpaper rash
    - Strep positive
  - Kawasaki's Disease
    - 5 days of fever
    - Strawberry tongue
    - Non-exudative conjunctivitis
  - Toxic Shock Syndrome
    - Shock; multi-organ failure
  - Staph Scalded Skin Syndrome

23:55
Room 2 Rash and Fever

- Differential:
  - Stevens Johnson Syndrome
  - Staph Scalded Skin Syndrome
  - Scarlet Fever
  - Kawasaki's Disease
  - Toxic Shock Syndrome

- What to do?
  - IVF
  - Cultures:
    - Blood, Eye discharge, Throat, Nares/crusting skin
  - CBC, ESR/CRP
  - Antibiotics?

23:50
Room 2 Rash and Fever

- ED course:
  - IN fentanyl given for pain
  - Still unable to get patient to open eyes.
- Consult Burn and ophthalmology.
- Ketamine sedation for ophtho exam and wound cleaning/dressing

- No eye involvement and no oral lesion.

23:55
Room 2 Rash and Fever

- 

Staphylococcal scalded skin syndrome

- Signs and symptoms
  - Generalized tender erythematous skin
  - Flaccid bullae (large blisters) form
  - Bullae rupture easily producing large eroded areas surrounded by crust
  - No mucous membrane involvement
  - Positive Nikolsky sign

- How to make the diagnosis
  - Blister fluid usually sterile
  - Blood culture, urine and nasopharynx cultures. may be positive
  - Skin biopsy if diagnosis uncertain

Staphylococcal scalded skin syndrome

- Caused by an exfoliative toxin produced by S. aureus.
  - Toxin is spread hematogenously from the primary site of infection.
  - Toxin cleaves the epidermis to lead to blister formation.
- Most often seen in children < 5 years old.
- Common initial sites of infection include conjunctivae, nares, perioral area, umbilical region or infected circumcision site.

Staphylococcal scalded skin syndrome

- Treatment
  - Majority of cases are self-limited
  - Anti-staphylococcal antibiotics (IV Clindamycin)
  - Aggressive fluid resuscitation and monitoring of electrolytes
  - Vaseline gauze applied to denuded areas
  - Pt admitted to pediatric service
  - Consult dermatology in AM

- Prognosis
  - Prognosis is generally good
  - Skin heals without scarring
  - Neonates have increased morbidity and mortality

THE END

Questions?

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