

A faint, stylized background illustration. On the left, a child is shown from the side, reaching out with their arm. On the right, an eagle is depicted in flight, facing left. The entire illustration is rendered in a light gray, textured style.

MYTHS IN THE CARE OF CHILDREN

TIM HORECZKO, MD, MSCR, FACP, FAAP

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“Myths exist to understand the unknown.”

Hernia

Myth: “If it’s not strangulated, it’s elective”

Reality: Unlike in adults, all hernias in children are repaired at the time of diagnosis because:

- The risk of incarceration and strangulation is high
- There is a 30% risk of testicular infarction due to pressure on the gonadal vessels
- It is not worth messing around and “trying to navigate the system”

Most groin hernias in children are indirect inguinal hernias (incomplete closure of processus vaginalis).

Most **indirect hernias** are in boys (10-fold risk), and on the right (60%). Premature babies are at higher risk as well. 15% are bilateral.

Hernias often bulge further with crying. For infants, in supine position, gently restrain their feet on the gurney. They hate it and will cry. For older children, have them laugh, cough, or blow through a syringe.

The “silk glove sign” is not reliable, but if found is highly suggestive of an inguinal hernia. Roll the cord structures across the pubic tubercle. If you feel catching, like two sheets of silk rubbed together, this suggests edema from the patent processus vaginalis.

Most (80%) **incarcerated hernias** can be reduced initially and admitted for surgery 24-48 hours after edema has improved. Use age- and patient-appropriate sedation and reduce if no peritonitis or concern for strangulation.

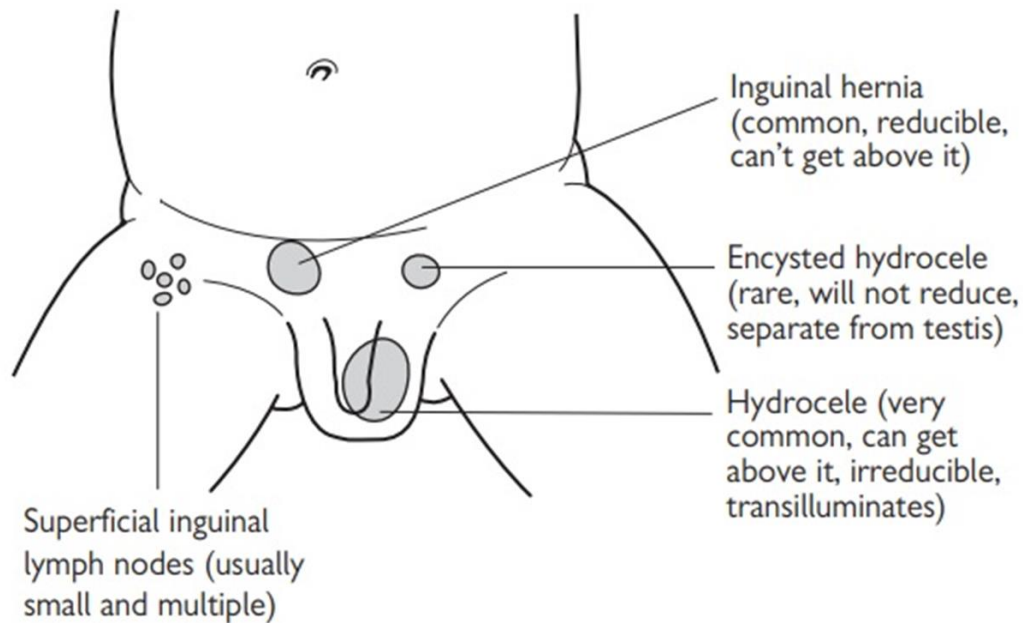
Hydroceles usually are: non-communicating (with the abdomen); worse with crying or during the day; improve by morning; and self-resolve by age 2 without intervention. Communicating hydroceles are: usually present at birth; are associated with a patent processus vaginalis; and are often repaired later, if not resolved by 1 or 2 years of age.

Girls may have an ovary incarcerated in hernial sac.

Open repair or laparoscopic techniques are used. The laparoscope offers visualization of the contralateral side without significant risk of injury to vas deferens.

A **metachronous hernia** develops later on the other side. Some surgeons opt to explore both sides at the time of diagnosis, others take conservative approach (small risk of fertility issues if both are open-explored)

My take: regardless of presentation, needs admission



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Fever

Myth: “Fever means urine and labs”

Reality: Consider the patient, find the source.

For well-appearing infants younger than three months of age, use your institution’s approach.

Urinalysis

For older infants and children, if you have a convincing viral source on exam, a urinalysis is not required. Studies suggest children with RSV bronchiolitis have 1.7% risk of concomitant urinary tract infection (Totapally M et al, *Pediatrics*, 2019). Asymptomatic bacteriuria rate in infants is 1%, in school-aged children 3%, and in older children 1%. Those with concomitant UTI and viral infections were sicker than rest of population. Trust your exam, and don’t “get a urine just in case”.

Procalcitonin

Procalcitonin is promising, but it comes with many caveats: population selected, disease studied, thresholds/cut-offs chosen.

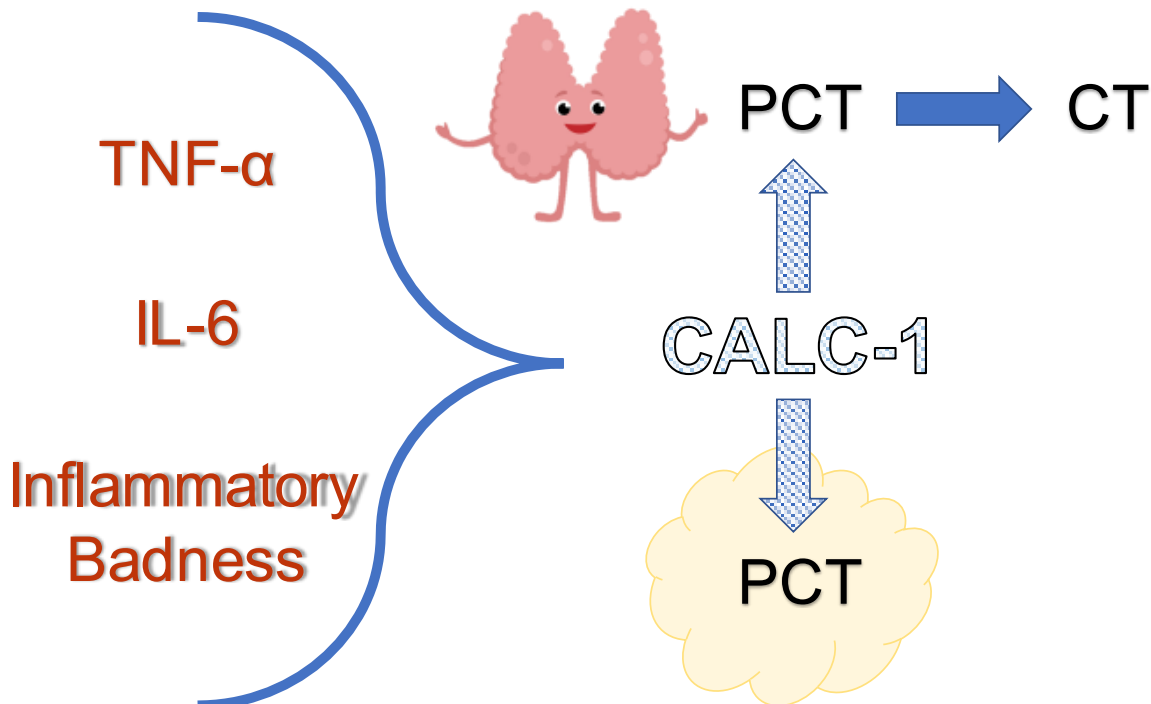
High procalcitonin levels are associated with bacterial infections, not viral infections (Assicot et al. *Lancet*, 1993). It typically rises within 2-4 hours of infection.

Precursor to calcitonin (calcium regulator), procalcitonin is expressed by the CALC-1 gene. In healthy state, the CALC-1 gene is expressed in endocrine tissues, such as the thyroid. There, it is readily converted to calcitonin, and levels of procalcitonin are kept very low (<0.5 ng/mL).

In bacterial infections, inflammatory markers (TNF-alpha and IL-6) induce CALC-1 to make procalcitonin throughout the body. Those non-endocrine peripheral tissues (adipose, other organs) do not have the enzymes to convert procalcitonin to calcitonin, resulting in an abnormal increase in procalcitonin levels.

Evidence for Procalcitonin:

- Procalcitonin may be a better marker for serious bacterial illness than white blood cell count in infants and children less than age 3. (Mahajan et al. *Acad Emerg Med*; 2014)
- The Step-By-Step approach uses procalcitonin in its algorithm (<0.5 ng/mL), and may be comparable to traditional fever strategies such as the Rochester criteria (Gomez B et al. *Pediatrics*; 2016).
- A clinical prediction rule for febrile infants 60 Days and Younger at low risk for serious bacterial infections identified a threshold of 1.71 ng/mL to find a sensitivity of 97.7% [95% CI: 91.3-99.6] (Kuppermann N et al. *JAMA Pediatr*; 2019)
- Neither calcitonin nor C-reactive protein have been studied in neutropenic patients. A systematic review and meta-analysis found inadequate evidence to support its use in this population (Phillips RS et al. *BMC Med*; 2012).



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Intussusception

Myth: “No red currant jelly, no problem”

Reality: Red currant jelly is a very late (and embarrassing) finding.

Median age is 18 months; typically between ages 6 months to 3 years of age.

90% of intussusception is ileocolic (ileocecal valve); other less common variants are: ileo-ileal, jejuno-jejunal, jejuno-ileal, and colo-colic.

75% of cases are idiopathic (no identifiable mass; often recent viral infection) or due to a lead point (Meckel's diverticulum, Henoch-Schönlein purpura, lymphoma).

Telescoping of the bowel into itself causes venous and lymphatic congestion, and later ischemia, perforation, and peritonitis.

“Angry type”: typical presentation, with crying, fussiness, severe crampy abdominal pain, lasting 15 min or so at a time, with or without vomiting. May or may not feel a “sausage-like” mass. Bloody stool is a late finding.

“Drowsy Type”: less common, altered, seemingly sleepy or lethargic toddler, with or without other GI symptoms.

Abdominal ultrasound has excellent sensitivity and specificity by experienced sonographers. The **“target sign”** in ileocolic intussusception is typically found in the right lower quadrant. The sagittal view may reveal the **“pseudokidney”** sign.

Abdominal plain films are not used to diagnose intussusception; they are only used to exclude perforation when suspected. Perforation requires an operative approach, rather than the more common reduction approach (pneumatic or hydrostatic enema). Pneumatic reduction has a slightly higher success rate, and no increased risk of perforation.

It is good practice to coordinate with the pediatric surgical service before the enema is performed. Institutions without pediatric surgical services should have pre-arranged consultation and/or transport agreements in the less common event of a perforation with the enema.

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- May be subclinical on presentation
- Symptoms include headache, vomiting, irritability
- Clinical presentation includes altered mental status, lethargy, high blood pressure despite dehydration. This may progress to coma and posturing.
- Laboratory investigation shows severe acidosis, increased blood urea nitrogen, low pCO_2

Treatment of cerebral edema

This is a clinical diagnosis, and should be treated immediately on suspicion with:

- Mannitol 0.5 to 1 g/kg/dose over 10 minutes. Effects seen in approximately 15 minutes.
- Avoid hypotension
- Avoid intubation in general in DKA (may worsen acidosis and CSF concentration), but in cerebral edema, may need to protect airway, protect against apnea. Hyperventilation is associated with poor outcomes (less cerebral perfusion) and should be done only when essential in dealing with dangerously elevated blood pressures.
- 3% saline is a reasonable alternative to mannitol and is better suited for the situation in which the blood pressure and systemic perfusion is poor.

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Pyloric Stenosis

Myth: “No olive, no problem”

Reality: Rare finding, since we diagnose earlier

Pyloric stenosis occurs in young infants because the pyloric sphincter hypertrophies, causing near-complete obstruction of the gastric outlet.

More common in boys, preterm babies, first-born. Less common in older mothers. Association with macrolide use.

Presentation

Young infant arrives with forceful vomiting, but can't quite get enough to eat “the hungry, hungry, not-so-hippo”.

Early presentation from 3 to 5 weeks of age: projectile vomiting

Later presentation up to 12 weeks: dehydration, failure to thrive, possibly the elusive olive

Labs may show hypOchloremic, hypOkalemic metabOlic acidosis: “all the Os”

Watch out for hyperbilirubinemia, the “icteropyloric syndrome”: unconjugated hyperbilirubinemia from dehydration.

Ultrasound shows a pylorus of greater than 3 mm wide and 14 mm long. Memory aid: 3.14 is “pi”. **In pyloric stenosis, π -lorus > 3 x 14**

Treatment

Various options, may be deferred depending on age, availability, severity of illness, including:

Pyloromyotomy — definitive. The Ramstedt pyloromyotomy is an open procedure and involves a longitudinal incision along the pylorus, and blunt dissection just to level of the submucosa. The laparoscopic approach (umbilicus) is less invasive but may convey an



99%
Specific!

Sensitivity
was 73%
Now, 27%



Courtesy of Dr. Tim Batchelder

increased risk of incomplete relief of the obstruction or perforation through the mucosa. Also, this approach involves longer OR and anesthesia time.

Endoscopic balloon dilation – not as effective as pyloromyotomy; reserved for poor surgical candidates.

Conservative management — an NG tube is passed by IR, and the infant slowly feeds and “grows out of it”. Atropine is sometimes used to relax the pyloric sphincter. Also usually reserved for poor surgical candidates.

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Anaphylaxis

Myth: “No hives – no anaphylaxis”

Reality: **Infants present subtly.** Also, everyone underutilizes epinephrine.

National Institute of Allergy and Infectious Disease Criteria (Sampson et al. 2006)

Adults and Children:

Anaphylaxis is highly likely when any one of the following 3 criteria are fulfilled:

1. Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (e.g., generalized hives, pruritus or flushing, swollen lips-tongue-uvula)

AND AT LEAST ONE OF THE FOLLOWING:

a. Respiratory compromise (e.g., dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)

b. Reduced BP or associated symptoms of end-organ dysfunction (e.g., hypotonia [collapse], syncope, incontinence)

2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):

a. Involvement of the skin-mucosal tissue (e.g., generalized hives, itch-flush, swollen lips-tongue-uvula)

b. Respiratory compromise (e.g., dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)

c. Reduced BP or associated symptoms (e.g., hypotonia [collapse], syncope, incontinence)

d. Persistent gastrointestinal symptoms (e.g., crampy abdominal pain, vomiting)

3. Reduced BP after exposure to known allergen for that patient (minutes to several hours):

a. Infants and children: low systolic BP (age specific) or greater than 30% decrease in systolic BP*

b. Adults: systolic BP of less than 90 mm Hg or greater than 30% decrease from that person's baseline



Anaphylaxis in infants is subtle, and is often missed initially

Non-specific symptoms:

- Regurgitation
- Flushing
- Hoarseness after crying
- Drowsiness after a meal
- Lethargy
- Hypotonia
- Clinginess
- Abruptly stopping play

Risk factors for anaphylaxis in infants:

- Recurrent wheezing/asthma
- Eczema (atopic dermatitis)
- History of mastocytosis
- Caregiver issues: depression, social or cognitive dysfunction, substance abuse (delay or inability to recognize signs and symptoms of allergy)

Immediate intramuscular treatment

Give the epi! Just do it!

- Epinephrine (1 mg/mL solution) IM. May calculate IM dose based on measured weight, but autoinjectors are fast and reliable:
- Epinephrine autoinjector for children: (e.g. Epipen Junior: 0.15 mg epinephrine IM) up to 15 kg
- Epinephrine autoinjector: (e.g. Epipen: 0.3 mg epinephrine IM) greater than 15 kg
- For children, adolescents, and adults > 50 kg: 0.5 mg epinephrine IM

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Gunshot wounds in children

Myth: *“Only lethal at close range”*

Reality: Temporary cavitation is 30 x the size of the permanent cavitation

Trauma is the leading cause of death between ages of 1-18 years

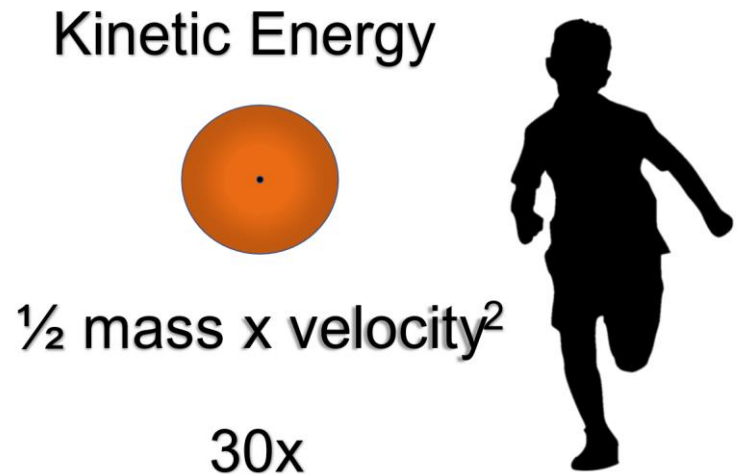
Penetrating injury accounts for 10% -20% of all trauma in pediatric patients

Penetrating wounds are more lethal than blunt trauma

Mortality is higher for younger children

Projectile dispersion

- Kinetic energy
- Impulse (how much the momentum changes as a result of a force acting on it for a period of time)
- Yaw (rotation of the bullet tip as it travels; “bullet tumble”)
- Deformation
- Fragmentation



St. Louis Scale for Pediatric Gunshot Wounds to the Head (DeCuyepere et al. 2006)

Predictive Criteria	Description
Primary (3 points each)	Bilateral fixed pupils on arrival; involvement of deep nuclei &/or 3rd ventricle; ICP >30 mm Hg
Secondary (2 points each)	Mixed supra-/infratentorial involvement; at least 3 lobes involved (single lobe for cerebellum); transventricular injury
Tertiary (1 point each)	Bihemispheric injury; SBP <100 mm Hg on arrival; midline shift

Clinical and radiological findings in survivors, children with gunshot wounds to head
(DeCuyepere et al. 2006)

Variable	Survived	Died	NNT	p Value
ICP >30 cm H ₂ O	2	4	16	0.4077
GCS score*				
3–5	6	31	2	<0.0001†
6–8	7	3	5	0.2219
Bilat fixed pupils	2	25	2	<0.0001†
SBP <100 mm Hg	2	13	4	0.009†
Hematocrit <30%	4	13	4	0.006†
Base deficit <–5.0 mEq/L	5	15	4	0.0038†
INR >1.5	2	3	12	0.0962
Deep nuclear/3rd ventricular injury	10	26	2	<0.0001†
Mixed supra-/infratentorial injury	2	6	8	0.1346
Injury to ≥3 lobes	10	19	4	0.0084†
Transventricular trajectory	5	26	2	<0.0001†
Bihemispheric injury	5	26	2	<0.0001†
Midline shift	19	22	7	0.1697
Age in yrs				
0–9	5	5	41	0.8853
10–18	32	29	41	0.8853

NNT = number needed to treat.

* All patients with GCS score > 8 survived.

† Statistically significant.

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Old myth trivia

Practice evolves. We used to:

- give fractionated-dose immunizations to reduce side effects
- perform end-of-treatment lumbar puncture
- aspirate gastric contents to work-up neonatal sepsis
- use of silver nitrate for newborn eye prophylaxis and triple dye for newborn cord
- give aspirin to children for fever
- recommend that newborns sleep on their stomachs

...and many more yet to come!

Thank you for coming. For more tips and tricks, visit:

<http://pemplaybook.org/>

Or point your smartphone camera at this beauty:

