What's New in Pediatric Emergency Medicine?

Kids Rock Conference

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Disclosure

- I have nothing to declare.

Objectives

- Provide new evidence for changes in practice in pediatric emergency medicine (and general paediatrics).
  - Sepsis guidelines
  - Streptococcal pharyngitis treatment
  - Current recommendations on pneumonia
  - Review of minor head injury treatment
  - Lyme Disease

Case #1

- A 4 month old, currently fed on cow's milk formula presents with fussiness, crying, cramping, gas or diarrhea

What do you do?

A. Nothing (stay on the same formula)
B. Change to lactose-free formula
C. Prescribe oval
D. Change to a soy-based formula
E. Go to an elemental formula

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No evidence for changing formula

- Most pediatricians know that changing formula rarely effects babies' fussiness
  - Industry-supported, double blind study
  - 300 babies (mean age 5 weeks)
  - Inclusion: fed with cow's milk and presented with parent-reported fussiness/crying, cramping, gas or diarrhea
  - Randomized to lactose-free cow's milk, soy-based formula or regular lactose formula

No evidence for changing formula

- At 2 weeks, no significant differences reported to mom's with regards to efficacy, psychological well-being or psychological distress

Sherman AL et al. "Lactose-free milk or soy-based formulas do not improve caregivers' distress or perceptions of difficult infant behaviour." *Journal of Pediatrics Gastroenterology, and Nutrition.* July 2015; 61: 119.

What is the impact of stimulants for ADHD in developing tics?

A. Stimulants increase the frequency of tics
B. Stimulants do not affect the frequency of tics

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What's the story?

- Half of people with tics have ADHD, and 20% of ADHD people have associated tic disorders
- FDA has warned against stimulant use based on limited, case-report evidence
- Stimulants increase dopamine availability, while drugs used to treat tics limit dopamine availability
- Children with both ADHD and tics
- Meta-analysis conducted on 2385 participants in 22 published double-blind, placebo controlled trials

The results

- Onset of tics or worsening of tics
  - 5.7% of participants on stimulants
  - 6.5% of participants on placebo
- Pooled RR = 0.99
- No associated with dose, short- or long-acting preparations

Implications

- Can prescribe normal doses of stimulants without increasing tic disorders
- However, keep in mind that supertherapeutic doses will increase tics

Cohen SC et al. Meta-analysis: Risk of tics associated with psychostimulant use in randomized, placebo-controlled trials. *Journal of American Academy of Child Adolescent Psychiatry.* June 30, 2015. (e-pub)

Will lung ultrasound replace X-ray?

Will Lung Ultrasound Replace Chest X-ray for Pneumonia Diagnosis ?

- Safe, portable, inexpensive and easy to teach and use
- Meta-analysis of 8 studies with 765 children
- 6 general pediatric population, 2 neonates
- Sensitivity: 96%, Specificity: 93%
- Took on average 5-10 minutes

- Peredea MA et al. Pediatrics, April 1, 2015; 135: 714

A 4 year-old girl presents to the emergency with this rash …

Source: http://thrtnds.hol.es/lyme-disease/

What do you do?

- Call dermatology
- Treat with antibiotics
- Send home – it'll be fine!

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Lyme Disease

- Ticks carry *Borrelia Borgdorferi*
- Usually in wooded areas

Clinically:

- Erythema migrans: Presents with characteristic target rash, may have fever, headache, stiff neck
- Develop arthritis
- Neurologic: Meningitis, Bell's Palsy, numbness or pain
- Cardiac: arrhythmia (bradycardia)
- Eye inflammation, severe fatigue

Testing

- ELISA or Western Blot (we tend to rely on ELISA)
- Serological testing (CSF, joint fluid)

Treatment

- Amoxicillin or doxycycline 14-21 days, can give erythromycin if pregnant
- If heart symptoms, use ceftriaxone, penicillin intravenous
- If severe, may need steroids or a pacemaker

Should we be doing radiographs in children with blunt torso trauma?

Should we be doing radiographs in children with blunt torso trauma?

- No

From PECARN network, 5076 had AP pelvic radiographs

- 451 participants
- Sensitivity – 78%.
- Of those seen, 82 were diagnosed with CT, 1 via MRI, 2 with repeat X-rays showing healing fractures
- Less sensitive for patients < 2 years (64% (95% CI: 35-87%), most sensitive 13-17 years (82% (95% CI: 76-87%)

Kowk MY et al. Annals Emergency Medicine. 2015; 63 (1): 63-71.

Should we be doing radiographs in children with blunt torso trauma

- **Conclusion**: Be careful around younger children when evaluation blunt trauma. If suspicion is high and plan is to do abdo/pelvic CT, go to CT. If stable, but no indication to do CT, do X-ray first.

Head Injuries

CATCH rules

- Osmond (CMAJ, 2010; 182: 341-348)
  - 4 high risk criteria (need for neurologic intervention)
    - GCS < 15 at 2 hours
    - Suspected open or depressed skull fracture
    - Worsening headaches
    - Irritability on examination
  - 3 medium risk (brain injury on CT)
    - Sign of basilar skull fracture
    - Large boggy hematoma
    - Dangerous mechanism of injury (MVA, fall > 3' or 5 stairs, a fall from a bicycle with no helmet)

PECARN rules

- Kupermann N. Lancet; 2009; 374: 1160.
- High Risk: (Do CT)
  - If GCS ≤ 14
  - Palpable skull fracture
  - Signs of agitation, somnolence, repetitive questioning
- Medium risk (Observe)
  - Occipital, parietal or temporal scalp hematoma
  - LOC ≥ 5 seconds
  - Not acting normally
  - Severe mechanism of injury

Do isolated scalp hematomas predict the risk of traumatic brain injury in children < 24 months?

Definition of isolated scalp hematoma

Isolated scalp hematoma with:

- No LOC or LOC <5 seconds
- Acting normally (per parent/guardian)
- GCS of 15
- No signs of altered consciousness
- No palpable skull fracture
- No severe mechanism of injury (MVA with ejection, death of another passenger or rollover), pedestrian or bicyclist struck by a motorized vehicle, fall > 3 feet, or head struck by a high impact object

Traumatic Brain Injury

- From the PECARN network (25 pediatric ERs), prospective cohort study
  - 10659 patients enrolled, 2998 had isolated scalp hematomas
  - Only 12 patients (0.4%, 0.2-0.7%) had clinically important traumatic brain injuries
  - 0 patients had neurosurgery (0, 0.0-0.1%)
  - 570 patients had CTs, 50 (8.8%, 6.6-11.4%) had TBI evidence
  - Younger age, non-frontal scalp hematomas, increase scalp hematoma size and severe injury mechanism associated with TBIs on CT

Dayan et al (Annals of Emergency Medicine, 2014; 64 (2): 153)

Traumatic Brain Injury (con't)

- **Conclusions**: Children > 3 months with isolated scalp hematomas should be observed (or discharged home) and NOT imaged.

Can we identify children with abusive head trauma (AHT)?

Why … yes!

- Prospective cohort of 14 different sites
  - 4 clinical predictors to help screen for AHT
    - Acute respiratory compromise before admission
    - Bruising of the torso, ears or neck
    - Bilateral/interhemispheric subdural hemorrhages or collections
    - Skull # that are not isolated, unilateral, linear, parietal fractures
  - Sensitivity: 0.96! Specificity 0.46, PPV 0.55, NPV 0.93

Hymel KP et al, Pediatrics, 2014: 134 (6): e1537

Limitations

- Study missed 5 cases
  - One was due to a probably birth injury
  - But 4 children between 3-8 months, who had a unilateral, linear parietal skull fracture, epidural hematoma, and focal, unilateral subdural hemorrhage were missed.

What are indicators of abusive head trauma?

- 6 clinical features
  - Head and neck bruising
  - Long bone fractures
  - Rib fractures
  - Apnea
  - Seizures
  - Retinal hemorrhages

Findings

- 97% < 2 years-old
- 65 had AHT, 133 nonabusive
- Combination of ≥ 3 factors, predict probability of abuse is 81%.

How do we manage concussions?

Comprehensive guidelines for 5-18 years

- Ontario Neurotrauma Foundation (onf.org)
  - Systematic review to standardize diagnosis, assessment and management of children

Key recommendations

- For children in high-risk sports, consider baseline neurocognitive testing
- Initial presentation:
  - Manage acute symptoms
  - Consider neuroimaging if (worsening headaches, seizures, focal neurologic signs, patient looks drowsy, slurred speech, can't recognize people/places, repeated vomiting);
  - Acute concussion evaluation using a standardize tool
  - Physical and cognitive rest

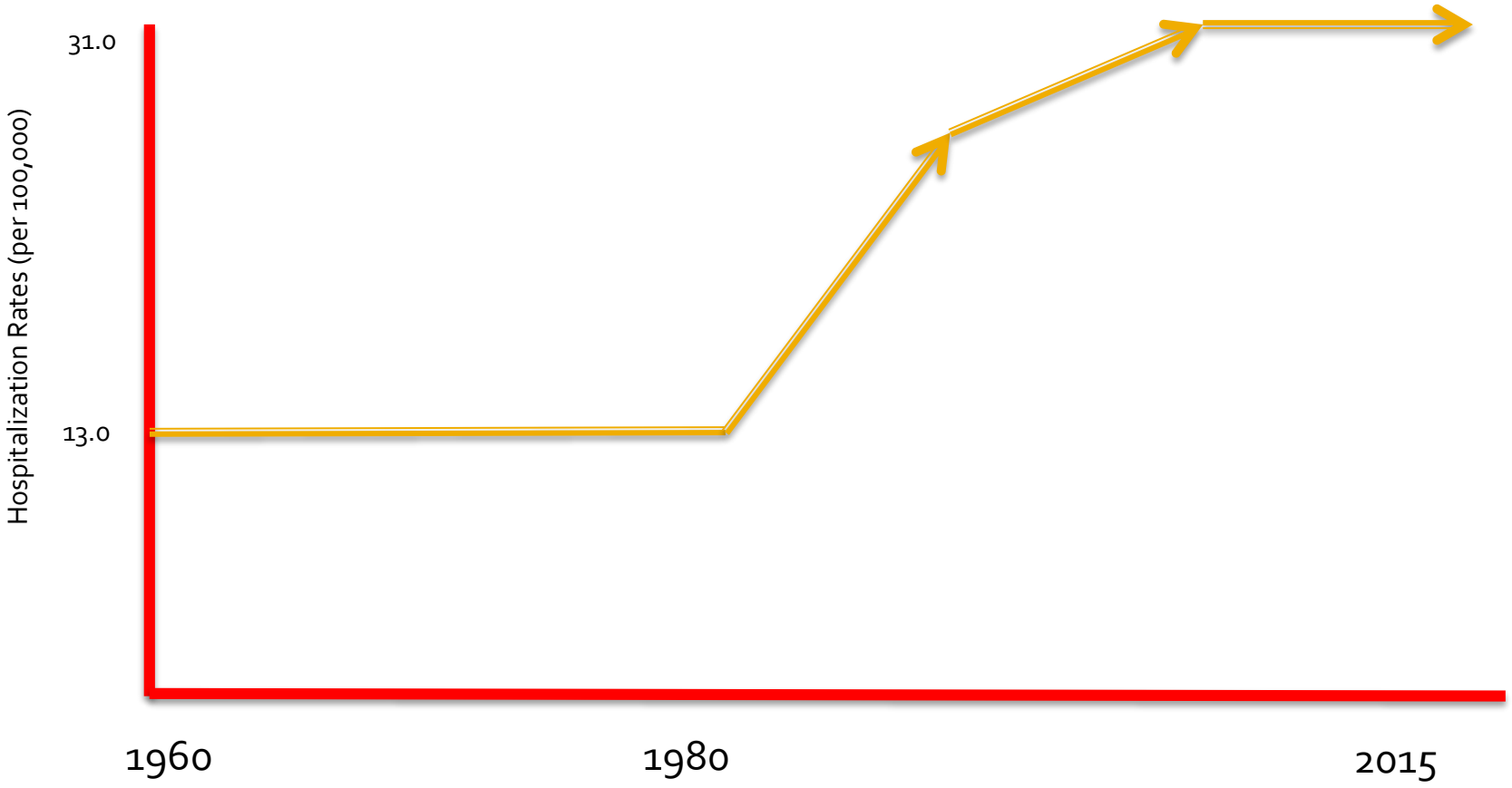
Key recommendations (con't)

- Discharge instructions:
  - Educate about risks of persistent symptoms – provide education and post-concussion care plan
  - Sleep, fatigue and headaches may persists
  - Reduce alcohol and drug use
  - Caution around driving
  - If symptoms go beyond 1 month, refer to concussion specialist
- If at 1 month
  - Look for physical/mental health issues
  - Caution around sleep hygiene
  - Short-term medications
  - Refer to specialists

Bronchiolitis … what do we know?

When should patients go home from the ER for bronchiolitis? (or also when should patients go home from hospital with bronchiolitis) …

Hospitalization for bronchiolitis



What Changed?

What Changed?

- The usage of oxygen saturation monitoring

Reliance on oximetry readings increases hospitalization admissions

- Randomized, double blind, parallel group trial from 2008 to 2013
- 213 otherwise healthy infants, 4 weeks to 12 month with mild-moderate bronchiolitis and a true oxygen saturation of 88% or higher
- There was a group with 3 percentage points higher than the actual reading

Schuh et al. JAMA. August 20, 2014; 312 (7): 712.

Results

- 41% in the true oximetry group were hospitalized, compared to 25% in the altered oximetry group
- There was no significant different in the length of stay, hourly physician level of agreement with discharge or supplemental oxygen use.
- There was also no difference in delayed hospitalization between the two groups
- **Those with higher oxygen saturation readings were more likely to be discharged**

Limitation

- One of the study's weaknesses was that there were very few low oxygen saturation levels
  - This limits the determination of the threshold of oxygen levels that are considered safe

Things not stated in the results …

- What's not clearly stated (but is true from the actual data) is that the vast majority of children who looked well would be discharged home if oxygen saturations were not known.
- As stated in Jeff's presentation, if we were to sample healthy children, a proportion of children would have oxygen saturations below 92%.
- Oxygen saturations should not be used as the sole guide for admitting children to hospital
  - The corollary to this is that oxygen saturations should not be used as a sole guide for discharging children from hospital

So …

- That's one of the research questions I'd like to work on over the next year or two …

Is there a value in waiting for the automated urinalysis or is the urine dipstick sufficient?

Dipstick accuracy

- Leukcocyte esterase or nitrite positive (88% (82-91%)) sensitive and 79% (69-87%)) specific
- A negative dipstick does not imply that a culture is negative – culture still should be sent

William et al. Lancet Inf Dis. 2010; 10: 240.

Automated Urinalysis

- WBC ≥ 100/mcl had a sensitivity of 86% and specificity of 98%
- Bacterial count ≥ 250/mcl had a sensitivity of 98% and specificity of 98%
- In comparison, POC urine dipstick with ≥ 1+ leukocyte esterase or positivity nitrite had a sensitivity of 95% and a specificity of 98%

- CONCLUSION: Automated bacterial counts of ≥ 250/mcl has the best sensitivity. However, if not available POC urine dipstick is an acceptable alternative. (But note this is much higher than the meta-analysis.

Kanegaye JT. Pediatrics. September 2014; 134 (3): 523-529.

The age old question … should kids go on antibiotic prophylaxis for UTI?

Well …

- 2 year, multi-site, randomized, placebo RCT involving 607 children after first or second UTI
  - Placed on either Septra prophylaxis or nothing

The RIVUR Trial Investigators. NEJM; 2014: 370: 2367.

Results

- Prophylaxis reduce the risk of UTI recurrence by 50% (from 27 to 15%), especially if febrile;
- However, there is **NO** difference in renal scarring
- There is much higher antibiotic resistance to Septra (63%) in the prophylaxis group vs. (19%) in the no treatment group
- Need 8 children on prophylaxis to prevent one recurrent UTI.

Conclusion

- The verdict is still out – it may reduce recurrent UTIs, but it doesn't affecting underlying kidney damage, with the increased resistance to antibiotics

Fever and Sepsis

Has the epidemiology of bacteremia changed?

The evidence

- Study from Jan 1, 2006 to Dec 31, 2012 (7 years) of all children admitted ≤ 90 days to a general care unit across 6 hospital systems in different geographic regions
  - Note: Excluded NICU admissions
- 181 cases in 177 infants – 19 different species
  - 42% were E. Coli – 90% had UTI
  - 23% were GBS – 27% associated with meningitis
  - 6% were S. Pneumoniae – older children
  - 5% were S. aureus
  - No cases of Listeria – suggested stopping coverage for Listeria with ampicillin

Biondi E. Pediatrics. 2013; 132: 990.

Can we identify children who are at risk of early-onset sepsis?

Children at risk of early-onset-sepsis?

- There are maternal factors, demographics, clinical milestones and vital signs that can help determine the risk of early-onset-sepsis
- High Risk:
  - First 12 hr: 5 minute Apgar <5, nasal CPAP, mechanical ventilation, vasoactive drugs, seizures, significant respiratory distress (nasal flaring, grunting, retraction with supplemental O2)
- Medium Risk:
  - First 12 hr: 2 measurements with HR $\geq$ 160, RR $\geq$ 60, Temperature above 38 C or below 36 C, or respiratory distress (without oxygen)
- Low Risk: None of the above

Escobar GL. Pediatrics. 2014; 133: 30.

Maternal factors

- Gestational age, increased risk of sepsis
- GBS status
- Prolonged ROM
- Intrapartum temperature
- No intrapartum antibiotic treatment

Results

CLINICAL PRESENTATION	Sepsis risk at birth estimated from maternal risk factors		
	< 0.65/1000 live births	0.65-1.54/1000 live births	≥ 1.54/1000 live births
Well appearing	**CONTINUED OBSERVATION** 85% of live births NNT=9,370	**OBSERVE AND EVALUATE** 11% of live births NNT=823	
Equivocal presentation	**OBSERVE AND EVALUATE** 11% of live births NNT=823	**TREAT EMPIRICALLY** 4% of live births NNT=118	
Clinical illness			

3 groups

- High risk group
  - High maternal risk factors
  - Medium maternal risk factors and not looking so well
  - Ill looking children
    - 4% of children – treat with antibiotics and do blood cultures
- Medium risk group
  - Medium maternal risk with well looking children or low risk children with equivocal presentations
    - 11% of children – do blood cultures and observe
- Low risk group
  - 85% of children -- observe

What does this have to do with emergency?

- The medium risk group:
  - First 12 hr: 2 measurements with HR $\geq$ 160, RR $\geq$ 60, Temperature above 38 C or below 36 C, or respiratory distress (without oxygen)
- Look at the vital signs! Useful as a stratification test to look at the risk of sepsis

What are doing from a diagnostic and treatment perspective for fever ≤ 90 days?

What's being done?

- Retrospective cohort in 37 EDs for 2 year (July 2011-June 2013)
- Significant variation in complete sepsis workup
  - ≤ 28 days: 72.0% (71.0-73.0%)
  - 29-56 days: 49.0% (48.2-49.8%)
  - 57-89 days: 13.1% (12.5-13.6%)

Aronson. Pediatrics. Oct 2014; 134; 667.

Results

- Overall Serious Bacterial Infection (SBI) rates 8.4%
  - 11.1% in ≤ 28 days (and highest in the 3rd week of life)
  - 5.3% had UTI
  - 2.4% had bactermia/sepsis
  - 0.3% had meningitis
- 6 deaths
  - 3 : ≤ 28 days
  - 3 : 29-56 days

Discussion

- Challenge – since there is no clear consensus on best practice, enormous variation
  - Also, in the post-pneumococcal conjugate vaccination, increasingly shown that Strep pneumoniae infections are less frequent in the older age groups
  - Increasing challenge that Ampicillin may not be needed to cover Listeria, and a high "ampicillin resistant" rate of 36-56%
  - Acyclovir given in 19% of children – even in older aged children, with little evidence that neonatal HSV occurs frequently past 21 days of age

Appendicitis

Pediatric Appendicitis Score

- Cough or percussion or hop tenderness = 2
- Anorexia = 1
- Pyrexia = 1
- Nausea/emesis = 1
- Tenderness in RLQ = 2
- Leukocytosis > 10,000 = 1
- Polymoyphonuclear neutrophilia = 1
- Migration of pain = 1

What do we do next?

- Do ultrasound – 28% +ve, 24% -ve, 48% unsure
- For those we're unsure, wait 4 hours + and re-examine, and consider re-U/S
  - Of that 48% unsure
    - 25 % will turn positive
    - 70% will be negative
    - Only 5% will require CT
- **Conclusion**: For the vast majority of patients, you should be able to clinically detect appendicitis, or confirm by ultrasound. Very few children require CT.

Clinical Pathway for Suspected Appendicitis

- Saucier et al. Pediatrics. Jan 2014: e88.

- PAS = 1-3 – low risk → send home
- PAS = 4-7 – medium risk → do U/S
- PAS = 8-10 – high risk → go to OR

- Overall diagnostic accuracy = 94% (91-97%), sensitivity = 92.3% (83.0-97.5%), specificity of 94.7% (89.3-97.8%)
- Similar to our results to be published in Academic Emergency Medicine

Why do they keep coming back?

Characteristics of Recurrent Utilization in Pediatric ED

- Children with ≥ 4 ED visits (8%) account for 24% of all visits and 31% ($1.4 billion) of all costs
- Kids with more frequent visits:
  - <1 year (33.2%)
  - Chronic condition (54.4%)
  - Also, not given tylenol/advil, tested, or admitted
    - Especially children <1 year without chronic conditions
      - Could these kids be directed to primary care physician usage?
- Newman ML. Pediatrics. 134; e1025.

What about eczema? Is pimecrolimus better than topical steroids?

Topical Steroids vs. Pimecrolimus for Infants with Eczema

- Pimecrolimus 1% cream, is improved in children ≥ 2 years
- Study looked at 2418 infants 3-12 months age for mild-moderate eczema over 5 years
- More events of bronchitis and infected eczema
- Similar immunization titers, lymphocyte levels, T-cell cytokine production and immunoglobulin
- Similar rapid resolution and sustainance >85% after 5 years

- Siguergueisson et al. Pediatrics, Apr 2015; 135 (4): 597-606.

What do we do with children with anaphylaxis?

Anaphylaxis

- Late phase anaphylactic reactions are not rare in children – 14.6% of children will have a late phase anaphylactic reaction within 48 hours
  - Age 6-9
  - Delay in presentation to ER > 90 minutes
  - Wide pulse presentation
  - More than 1 treatment of Epinephrine at initial presentation
  - Administration of Ventolin at initial presentation
- Epinephrine is the treatment of choice
- Benadryl also effective, especially for skin findings
- No evidence of benefit for steroids or ranitidine

(Alqureshi W, Steill I, Chan K, et al. Annals of Allergy/Immunology. Sept 2015; 115 (3): 217-223.

Last minute thoughts …

- There is increasing evidence that the pneumococcal conjugate vaccine is decreasing pneumonia hospitalizations
  - 72% reduction from rates before pneumococcal conjugate vaccine, and PCV 13 has given a further 27% decrease to 4.1 per 1000 population of a group of children in Tennessee

MMWR, Nov 7, 2014: 63 (44): 995-998.

Conclusions

Any questions?
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