

**Pediatric Emergencies – What Not to Miss in the FP Office**

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We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.

Source: [www.khomas.net/na/canada/bc/vancouver/firstations/firstations.html](http://www.khomas.net/na/canada/bc/vancouver/firstations/firstations.html)

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**Disclosures**

**No Conflict of Interests or Potential Conflicts of Interests to Declare**

**Speaker owns shares of Johnson & Johnson, Abbott Laboratories, Medtronic PLC, Merck**

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**Objectives**

- 1) Identifying important "can't miss" diagnoses in pediatric emergency medicine**
  - 1) Head Injuries
  - 2) Testicular Pain
  - 3) Bruising
  - 4) Fever in Infants
  - 5) Abdominal Emergencies
- 2) Become familiar with evidence based and validated clinical decision rules in pediatric emergency medicine**

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### CiTBI

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Epidemiology**

Head injuries account for > 500,000 ED visits/year in the US<sup>1</sup>

Those with minor blunt trauma rarely have CiTBI

GCS 14 – 15: 1%<sup>2</sup>

GCS < 14: 35%<sup>3</sup>

Rates of CT use in Canadian Pediatric EDs has increased

1995: 15%<sup>4</sup>

2005: 53%<sup>5</sup>

Trends may be reversing...

32% rate in the USA<sup>6</sup>

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### CiTBI

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Detecting CiTBI**

Rates of CiTBI are high in those with GCS < 14

All should be assessed in the ED

Rates of CiTBI in those with GCS 14-15 are < 1%

Not all patients require an ED assessment

Pediatric GCS exists to calculate score in younger children

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### CiTBI

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

	Under Age 2	Age 2 and Older
History	LOC	LOC
	Vomiting	Vomiting
	Mechanism	Mechanism
	Parental report of behaviour	Severe/worsening headache
	Post-HI seizure	Post-HI seizure
	Suspicion of NAI	Amnesia
Physical Exam	GCS/AMS/irritability	GCS/signs of AMS
	Open/depressed/palpable skull fracture	Open/depressed/ basilar skull fracture
	Non-frontal or large boggy hematoma	

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### CiTBI

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**PECARN Head CT Rule<sup>2,7</sup>**

Most widely validated

Highest sensitivity

**PECARN**  
Pediatric Head CT Rule

**2 years or older**

AMS  
GCS < 15  
Signs of basilar skull fx

**None**

History of LOC  
History of vomiting  
Severe headache  
Severe mechanism\*

**None**

**No CT Required!**

\*SEVERE MECHANISMS: MVC, falls from height, assault, etc.

**PECARN**  
Pediatric Head CT Rule

**younger than 2 years**

AMS  
GCS < 15  
Palpable skull fx

**None**

LOC > 5 sec  
Non-frontal hematomas  
Not sitting normally  
Severe mechanism\*

**None**

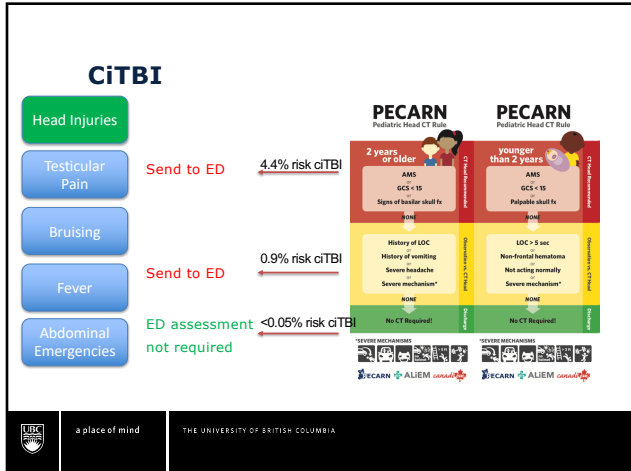
**No CT Required!**

\*SEVERE MECHANISMS: MVC, falls from height, assault, etc.

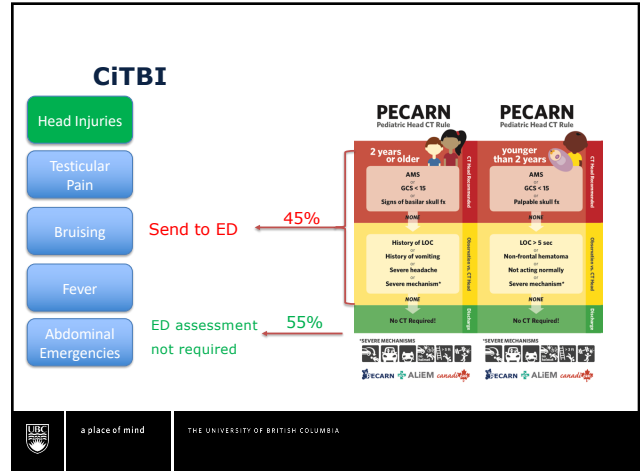
Image Source: ALIEM

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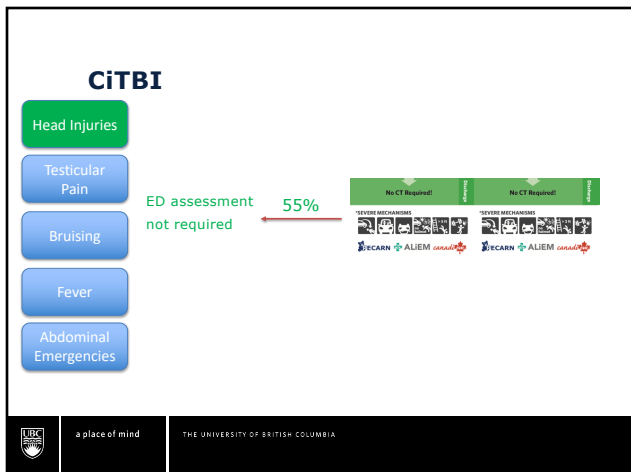
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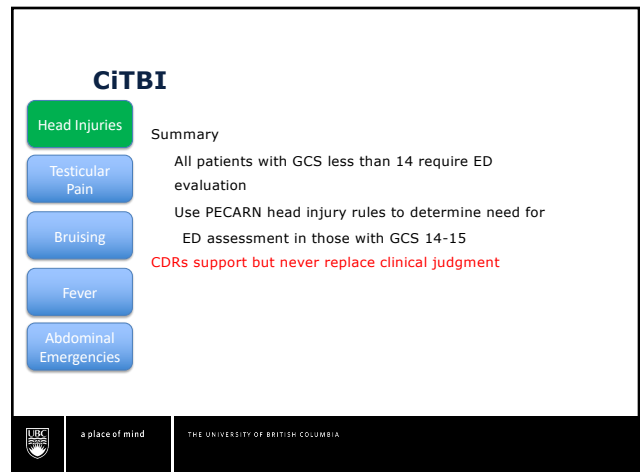
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### Testicular Torsion

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Epidemiology<sup>8</sup>**  
 Affects 1:400 males younger than 25  
 Often due to underlying anatomic predisposition  
 Threatening to viability of testicle  
 Area of active medicolegal litigation



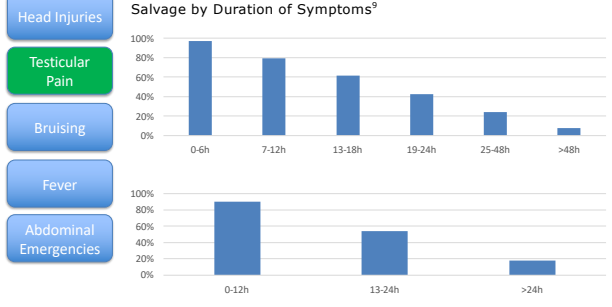
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### Testicular Torsion

Salvage by Duration of Symptoms<sup>9</sup>

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies



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### Testicular Torsion

Reliability of Historical features<sup>10</sup>

	Testicular Torsion	Torsion of the Appendix Testis	Epididymitis Orchitis
Previous Trauma	Sens: 25% Spec: 93%	Sens: 10% Spec: 88%	Sens: 5% Spec: 84%
Previous Pain Attacks	Sens: 42% Spec: 89%	Sens: 16% Spec: 81%	Sens: 8% Spec: 73%
Nausea/Vomiting	Sens: 69% Spec: 93%	Sens: 12% Spec: 75%	Sens: 4% Spec: 64%
Dysuria/micturition disorder	Sens: 11% Spec: 61%	Sens: 14% Spec: 59%	Sens: 55% Spec: 87%

No single historical feature has sufficient sensitivity to rule out torsion!

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### Testicular Torsion

Reliability of Physical Examination<sup>10</sup>

	Testicular Torsion	Torsion of the Appendix Testis	Epididymitis Orchitis
Elevation of testis	Sens: 83% Spec: 90%	Sens: 20% Spec: 70%	Sens: 4% Spec: 54%
Transverse location of testis	Sens: 83% Spec: 94%	Sens: 8% Spec: 69%	Sens: 5% Spec: 61%
Anterior rotation of epididymis	Sens: 69% Spec: 98%	Sens: 2% Spec: 76%	Sens: 3% Spec: 70%
No cremasteric reflex	Sens: 92% Spec: 94%	Sens: 4% Spec: 66%	Sens: 7% Spec: 59%

No single physical examination feature has sufficient sensitivity to rule out torsion!

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### Testicular Torsion

Head Injuries	Testicular Swelling	Points
Testicular Pain	Hard Testes	2
Bruising	Absent Cremasteric Reflex	1
Fever	Nausea or Vomiting	1
Abdominal Emergencies	High Riding Testicle	1

**Head Injuries** TWIST Score<sup>11-13</sup>  
**Testicular Pain** Low Risk\* 0-2  
**Bruising** Intermediate Risk 3-4  
**Fever** High Risk 5-7  
**Abdominal Emergencies** \*Different low risk cutoff from BCCH Pathway

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### Testicular Torsion

BCCH Pathway

CHILDREN'S HOSPITAL  
 ED PATHWAY FOR EVALUATION/TREATMENT OF PATIENT WITH SUSPECTED TESTICULAR TORSION

Please affix Patients label

TWIST SCORE	
Symptoms	Score
Nausea/Vomiting	/1
Testicular Swelling	/2
Hard Testicle	/2
Absent Cremasteric Reflex	/1
High-riding Testicle	/1
<b>Total</b>	<b>/7</b>

Child with history/physical examination suspicious for testicular torsion  
 \*Order urinalysis  
 \*Other investigations may be ordered based on history and physical  
 Complete Twist Score

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### Testicular Torsion

BCCH Pathway

Complete Twist Score

- 0-1: Low Risk for Testicular Torsion
  - Reassess and PO Challenge
  - Discharge home with follow-up with PCP
- 2-5: Equivocal for Testicular Torsion
  - No sonographic evidence of torsion: Reassess and PO Challenge, Discharge home with urology follow-up
  - NPO Analgesia, Ultrasound AND Urology consultation
  - Other testicular pathology: Reassess and PO Challenge, Discharge home with urology follow-up
- 6-7: High Risk for Testicular Torsion
  - Sonographic evidence of testicular torsion or torsion cannot be ruled out: IV Fluids, NPO, Analgesia, Urology consultation, No imaging by ED Team

**Ultrasound Results**  
 No sonographic evidence of testicular torsion  
 Testicular torsion cannot be ruled out  
 Radiographic evidence of testicular torsion  
 Other:

**\*If TWIST Score > 0, do NOT delay imaging or urology consult to obtain results of urinalysis or other investigations**

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### Testicular Torsion

TWIST Score and Disposition

Testicular pain  
 Calculate TWIST  
 Score

TWIST = 0 → Home!  
 TWIST > 0 → Emergency Department!

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## Testicular Torsion

Head Injuries

**Testicular Pain**

Bruising

Fever

Abdominal Emergencies

**Summary**

Testicular pain is a time sensitive presenting complaint

Goal is to rule in or rule out testicular torsion

TWIST score can help stratify risk of testicular torsion

**CDRs support but never replace clinical judgment**

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## Child Maltreatment

Head Injuries

Testicular Pain

**Bruising**

Fever

Abdominal Emergencies

**Maltreatment investigations in Canada<sup>14</sup>**

Year	Investigations
1998	135,261
2003	235,315
2008	235,842

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## Child Maltreatment

Head Injuries

Testicular Pain

**Bruising**

Fever

Abdominal Emergencies

**Primary Category of Maltreatment<sup>14</sup>**

Category	Percentage	Count
Exposure to intimate partner violence	34%	29,259
Physical abuse	20%	17,212
Sexual abuse	3%	2,607
Neglect	34%	28,939
Emotional maltreatment	9%	7,423

Canadian Incidence Study of Reported Child Abuse and Neglect - 2008  
\* Total estimated number of substantiated investigations is 85,440, based on a sample of 6,163 substantiated investigations.

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## Child Maltreatment

Head Injuries

Testicular Pain

**Bruising**

Fever

Abdominal Emergencies

**Bruising**

Very common when developmentally appropriate

< 1% of those under 9 months have bruising

40—90% of children greater than 9 months have bruising<sup>15,16</sup>

Bruises may be presentation for NAI

Most common finding in physical maltreatment cases<sup>14</sup>

Underlying medical causes should be considered<sup>17</sup>

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## Child Maltreatment

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Bruising**

**Red Flags<sup>17</sup>**

- Babies not cruising
- Ears, neck, feet, buttocks, torso
- Not overlying front of body or overlying bone
- Unusually large or numerous
- Clustered or patterned
- Do not fit with mechanism

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## Child Maltreatment

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Bruising**

**Red Flags<sup>18</sup>**

*Original TEN-4  
Bruising Rule*

TEN-4 Bruising Rule

Kids are kids, and sometimes they play in ways that result in minor cuts, scrapes, and bruises. These minor injuries are often found on bony areas of the body like knees, shins, elbows, and foreheads. However, there are other types of bruises that should be a red flag for possible abuse.

For children 4 years of age or younger, bruising in these areas are cause for concern and need to be reported.

Torso

Ears

Neck

4 years or younger

Or any bruising anywhere, if the baby is not yet crawling up or taking steps.

Image Source: [faceitabase.org](http://faceitabase.org)

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## Child Maltreatment

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Bruising<sup>19</sup>**

Region	No. (N=47 children)	Abuse	Non-abuse	Total	Prevalence
Back	3022	152	2870	3022	5%
Buttocks	3022	152	2870	3022	5%
Chest (stern)	137 (31)	29 (2)	108 (29)	137 (31)	21%
Ear	132 (31)	2 (1)	130 (30)	132 (31)	1%
Angle of jaw	74 (18)	2 (1)	72 (17)	74 (18)	3%
Clavicle	34 (8)	0	34 (8)	34 (8)	0%
Back	137 (31)	64 (16)	73 (17)	137 (31)	46%
Abdomen	131 (31)	1 (1)	130 (30)	131 (31)	1%
Neck	40 (10)	2 (1)	38 (9)	40 (10)	5%
Cyanoacrylate	141 (34)	144 (34)	2 (1)	143 (34)	100%
Proximal humerus	34 (8)	1 (1)	33 (8)	34 (8)	3%
Wrist	41 (10)	4 (10)	37 (9)	41 (10)	10%
Upper arm/shoulder	34 (8)	1 (1)	33 (8)	34 (8)	3%
Ear	30 (7)	1 (1)	29 (7)	30 (7)	3%
Neonatal genital	140 (34)	1 (1)	139 (33)	140 (34)	1%
Subconjunctival hemorrhage	3 (1)	0	3 (1)	3 (1)	0%
GI or anal	10 (2)	4 (10)	6 (1)	10 (2)	40%
Scalp	34 (8)	1 (1)	33 (8)	34 (8)	3%
Scapula	34 (8)	1 (1)	33 (8)	34 (8)	3%
Upper leg	34 (8)	1 (1)	33 (8)	34 (8)	3%
Hand	34 (8)	1 (1)	33 (8)	34 (8)	3%
Elbow	34 (8)	1 (1)	33 (8)	34 (8)	3%
Hip	34 (8)	1 (1)	33 (8)	34 (8)	3%
Distal leg	34 (8)	1 (1)	33 (8)	34 (8)	3%
Distal arm	34 (8)	1 (1)	33 (8)	34 (8)	3%
Forehead	131 (31)	144 (34)	2 (1)	146 (35)	110%
Other	34 (8)	1 (1)	33 (8)	34 (8)	3%
Upper arm	34 (8)	1 (1)	33 (8)	34 (8)	3%
Lower arm	34 (8)	1 (1)	33 (8)	34 (8)	3%
Hand	34 (8)	1 (1)	33 (8)	34 (8)	3%
Elbow	34 (8)	1 (1)	33 (8)	34 (8)	3%
Forehead	34 (8)	1 (1)	33 (8)	34 (8)	3%
Other	34 (8)	1 (1)	33 (8)	34 (8)	3%
Neck	34 (8)	1 (1)	33 (8)	34 (8)	3%
Upper leg	34 (8)	1 (1)	33 (8)	34 (8)	3%
Lower leg	34 (8)	1 (1)	33 (8)	34 (8)	3%
Foot	34 (8)	1 (1)	33 (8)	34 (8)	3%
Other	34 (8)	1 (1)	33 (8)	34 (8)	3%
Total	3022	146 (35)	2876	3022	5%

\*The % values were derived from tests of bruising in which the region (upper extremities, lower extremities, torso, head) was the independent variable. The dependent variable was the presence of bruising. The dependent variable was the presence of bruising. The dependent variable was the presence of bruising. The dependent variable was the presence of bruising.

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## Child Maltreatment

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Bruising<sup>19</sup>**

**TEN-4 positive?**

419 Abuse	
1713 Non-abuse	
2132 Total	
No	No (Specificity in abuse, positive BCDR result)
n=1466	
74 Abuse	1392 Non-abuse
1466 Total	

**Patterned bruise?**

2 Abuse	
1324 Non-abuse	
1326 Total	
No	No (Specificity in abuse, positive BCDR result)
n=1322	
34 Abuse	1288 Non-abuse
1322 Total	

**FACES bruise?**

8 Abuse	
1420 Non-abuse	
1428 Total	
No	No (Specificity in abuse, positive BCDR result)
n=1322	
34 Abuse	1288 Non-abuse
1322 Total	

**Classification summary**

BCDR result	Abuse	Non-abuse	Total
Positive	74	1392	1466
Negative	18	1306	1324
Total	92	2698	2790

**Diagnostic accuracy**

Characteristic	Data based	Bootstrapped
Sensitivity	95.6 (95.0-97.3)	91.5 (91.1-94.7)
Specificity	91.1 (90.4-91.8)	94.5 (93.9-95.1)
NPV	98.8 (98.1-99.3)	97.3 (95.7-98.7)
PPV	61.9 (60.6-63.2)	58.6 (60.4-64.8)
LR positive	7.37 (6.56-8.19)	5.90 (4.42-7.50)
LR negative	0.05 (0.04-0.06)	0.11 (0.06-0.19)

A Classification of patients into abuse and non-abuse groups based on dichotomous independent variables (ie, TEN-4 Bruising to the torso, ear, and/or neck or any bruising on infant or preschooler's angle of jaw, patterned bruise, or FACES 20 results, angle of jaw, clavicle (Shin's specific, subconjunctival) bruise) according to an expert panel. The BCDR results were positive for 423 patients, of whom 392 were abuse patients and 221 non-abuse patients. The BCDR results were negative for 1763 patients, of whom 162 were non-abuse patients and 1601 were abuse patients. In Classification summary, C, Diagnostic accuracy statistics. Data in parentheses are 95% CI. LR indicates likelihood ratio; NPV, negative predictive value; PPV, positive predictive value.

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### Child Maltreatment

**Head Injuries** Bruising<sup>19</sup>

**Testicular Pain** Trunk  
Ears  
Neck

**Bruising** 4 years or younger  
Frenulum  
Auricular area  
Cheek  
Eyes  
Sclera  
Patterned bruising

**Fever**

**Abdominal Emergencies**

4 Any bruising on a child less than 4 months

Yes? → Initiate NAI Work-up

No? → Unlikely to be result of NAI

Image Source: acepnw.com

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### Child Maltreatment

**Head Injuries** Maltreatment considered?

**Testicular Pain** If suspected:

**Bruising** Contact your local Suspected Child abuse or Neglect team for advice  
604-875-2345 (ask for Child Protection Service Unit)

**Fever** Report suspected abuse to:

**Abdominal Emergencies** Ministry of Children and Family Development  
Delegated Aboriginal Child and Family Services Agency  
Helpline for Children  
310-1234

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### Child Maltreatment

**Head Injuries** Summary

**Testicular Pain** Bruising is common

**Bruising** Some bruises are due to maltreatment

**Fever** TEN - 4 FACESp can help decide which patients require further investigation

**Abdominal Emergencies** If maltreatment is considered, there is a duty to report to MCFD

CDRs support but never replace clinical judgment

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### Febrile Infants

**Head Injuries** Infants < 60 days

**Testicular Pain** Higher risk of SBI

**Bruising** UTI

**Fever** Bacteremia } IBI

**Abdominal Emergencies** Meningitis }

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### Febrile Infants

Infants < 60 days<sup>20</sup>

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

	UTI	Bacteremia	Meningitis
0-28 d	5-9%	2.9%	1.2%
29-60 d	3-6%	1.6%	0.4%

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### Febrile Infants

Infants < 60 days<sup>21</sup>

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

< 21 days: All need admission. Send to ED.

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### Febrile Infants

Infants < 60 days<sup>21</sup>

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

22 to 28 days: Will need admission or LP or both. Send to ED.

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### Febrile Infants

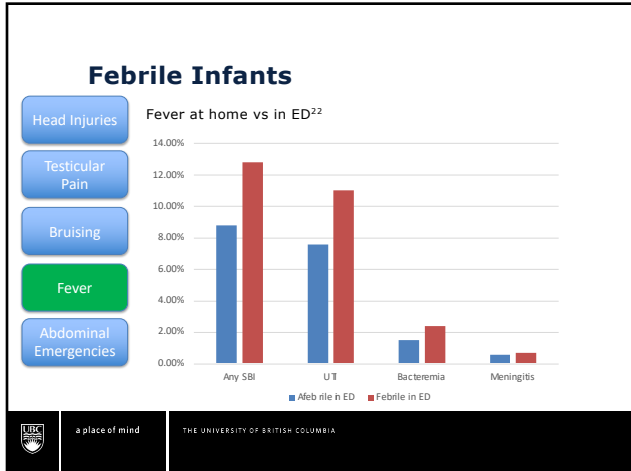
Infants < 60 days<sup>21</sup>

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

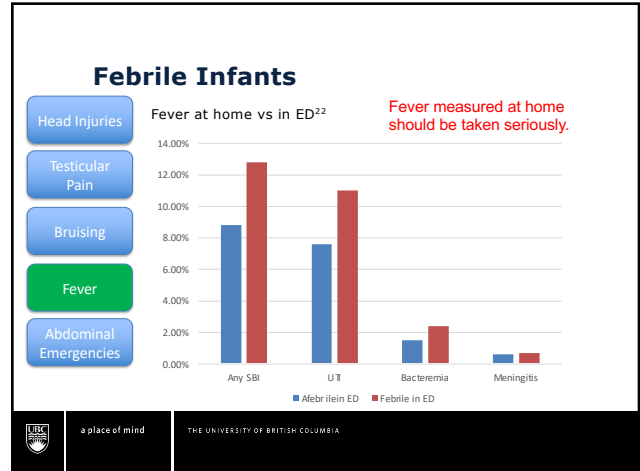
29-60 days. Need investigations. LP/admission may be required. Send to ED.

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### Febrile Infants

Viral Source vs No Viral Source<sup>23</sup>

	UTI	Bacteremia	Meningitis
Viral Source	2.8%	0.8%	0.4%
No Viral Source	10.7%	2.9%	0.8%

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### Febrile Infants

Viral Source vs No Viral Source<sup>23</sup>

	UTI	Bacteremia	Meningitis
Viral Source	2.8%	0.8%	0.4%
No Viral Source	10.7%	2.9%	0.8%

Lower risk of SBI in those with viruses. Will still need risk stratification in ED.

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## Febrile Infants

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Summary**

Infants less than 2 months of age are at high risk of SBI

Those who have a fever at home but not in clinic remain at high risk of SBI

Those who have a likely viral source still have risk of SBI

Send all febrile infants under 2 months of age to ED regardless of measured temp in clinic or symptoms

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## Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

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## Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

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## Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Pyloric Stenosis**

**Epidemiology**

Age 3 to 6 weeks

Male > female, Preterm > term, First born

**History**

Progressive, projectile, non-bilious

**Exam**

Palpable "olive" RUQ } Rare

Peristaltic waves

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Pyloric Stenosis**

Evaluation

- Electrolytes (Low K+ and Cl- & High HCO3-)
- Ultrasound

Management

- Correction of metabolic derangements
- Surgery

Need ED assessment.

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies

**Malrotation/Volvulus**

Epidemiology

- 80% in neonatal period
- 90% < 12 years

History

- Neonates: bilious vomiting
- +/- Fussiness or blood stools

Exam


- Late findings are distention, hematochezia, shock

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies**



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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies**

Malrotation/Volvulus

Evaluation

- History and high index of suspicion
- ?Plain films
- UGI

Management

- NG tube
- Fluid resuscitation
- Emergent transfer

**Immediate transfer to ED.**

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
- Bruising
- Fever
- Abdominal Emergencies**

Incarcerated Hernia

Epidemiology

- Peak in neonates, usually < 12 months
- Boys > girls, preterm > term, R > L

History

- Fussiness/Obstructive symptoms

Exam

- Inguinal/scrotal mass
- In girls, 50% are incarcerated ovary

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
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- Abdominal Emergencies**

Incarcerated Hernia


Evaluation

- Physical Exam
- (always check diaper area)**

Management

- Manual Reduction

**Immediate transfer to ED.**



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## Abdominal Emergencies

Head Injuries

Testicular Pain

Bruising

Fever

Abdominal Emergencies

**Intussusception**

**Epidemiology**  
 Peak age 4-7 months, rare < 4 months  
 Male > female, ?seasonal, ?rotavirus vaccine

**History/Exam**  
 "Classic Triad" Intermittent abdominal pain, vomiting,  
 "current jelly" stool uncommon  
 Progressive lethargy

**Evaluation**  
 US is gold standard

**Management**  
 Air enema +/- admission Immediate transfer to ED.

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## Abdominal Emergencies

Head Injuries

Testicular Pain

Bruising

Fever

Abdominal Emergencies

**Summary**

Beware of surgical pathology in young children  
 Projectile vomiting -> PS  
 Beware of bilious vomiting  
 Always check the diaper area  
 Worry about severe colicky abdominal pain

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## Take Home Pearls

Head Injuries

Testicular Pain

Bruising

Fever

Abdominal Emergencies

**In those with a head injury, always rule out CITBI**  
 PECARN Head Injury Rule

**In those with testicular pain, always rule out testicular torsion**  
 TWIST Score

**In those with bruising, always consider non-accidental injury**  
 TEN - 4 FACESp

**In those with fever < 2 months, high rates of SBI**  
 Always send to ED

**Watch out for red flags with fussiness/vomiting**  
 Projectile or bilious vomiting, groin mass, colicky pain or lethargy

**CDRs support but never replace clinical judgment**

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Head Injuries

Testicular Pain

Bruising

Fever

Abdominal Emergencies

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Head Injuries  
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Head Injuries  
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### Questions?

Head Injuries  
 Testicular Pain  
 Bruising  
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 Abdominal Emergencies

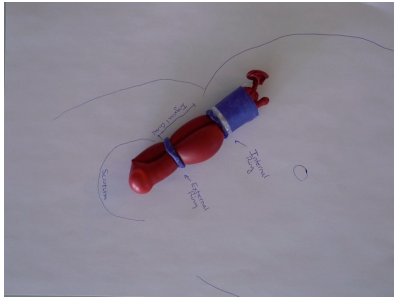
Thank you for your attention!

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### Abdominal Emergencies

- Head Injuries
- Testicular Pain
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- Abdominal Emergencies**



The diagram shows a lateral view of the male reproductive system. Labels include: Epididymis (top), Testis (middle), Vas Deferens (line from testis), Utricle (small sac), and Penile Bulb (bottom). The testis is colored red, and the epididymis is blue.

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