Scrotal Ultrasound in 2016

Richard A. Barth, M.D.
Disclosures

I have nothing to disclose
Pediatric Scrotum

- Normal Sonography
  - Gray Scale and Doppler Anatomy
- Acute Scrotum
  - Testicular Torsion
- Atypical Scrotal Masses
- Testicular Microlithiasis
Pediatric Scrotum – Technique

Gray Scale
Which side is normal?

Right testis  
Left testis

15 yo boy with scrotal pain
Asymmetry 2° to Technique - Both testes are normal.
Assymetry 2° to Technique - Both testes are normal.
Symmetrical Testes - Both testes are normal

15 mHz 15 mHz

Right testis Left testis
Normal Scrotal Wall and Testis
Normal Appendage

Appendix Epididymis

Epididymis

Testis
Pediatric Scrotum – Technique

Doppler
Pediatric Scrotum Doppler Parameters

- Doppler frequency of transducer
  \[ f_D = \frac{2f_o V \cos \theta}{c} \]
Pediatric Scrotum Doppler Parameters

- Doppler frequency of transducer
  \[ f_D = \frac{(2f_o \cdot V \cdot \cos \theta)}{c} \]
Pediatric Scrotum Doppler Parameters

• Doppler frequency of transducer
  \[ f_D = \frac{(2f_o V \cos \theta)}{c} \]
Normal Testis-Same Patient

6 MHz

15 MHz
Pediatric Scrotum Doppler Parameters

- Doppler frequency of transducer
  \[ f_D = \frac{(2f_o V \cos \theta)}{c} \]

- Pulse repetition frequency (PRF)
  Nyquist frequency (max. detectable frequency shift) = \( \frac{1}{2} \) PRF
Normal Testis-Same Patient

Low PRF

High PRF
Pediatric Scrotum
Doppler Parameters

- Filter Setting
  - Filters exclude undesirable low frequency shift (respiratory, peristalsis)

- Doppler gain
  - Amplification of Doppler frequency shift
Symmetrical Color Doppler Flow

Doppler Comparison—Don’t Change Settings!
Spermatic Cord
Suspected Hernia in 13 yo boy
Pediatric Scrotum Doppler Display

- Spectral wave form
  - frequency shift over time for ROI
- Testicular artery has high diastolic flow in infants and post-pubertal males
- Often low diastolic flow in prepubertal males
Doppler-Normal Spectral Tracing
Doppler-Normal Spectral Tracing

Pre-Pubertal Male
ACUTE SCROTUM
## Final Dx in children presenting with Acute Scrotum* Multicenter study (919 pts)

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<thead>
<tr>
<th>Diagnosis</th>
<th>Count</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Torsion of Testicular Appendages</td>
<td>307</td>
<td>33.4%</td>
</tr>
<tr>
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<td>9</td>
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Kalfa N et al, J Urology (2007) 177:297-301
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Final Dx in children presenting with Acute Scrotum*
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Spermatic Cord Torsion - 208 (22.6%)

Most common after birth and during puberty

Kalfa N et al, J Urology (2007) 177:297-301
Testicular Torsion Outcomes
Retrospective review of 342 Boys*

- Torsion confirmed in 29 boys
- 69% of testes were salvageable
- Mean and Median times for ED presentation to OR for salvageable testes (196 and 157 minutes)
- Mean and Median times for ED presentation to OR for non-salvageable testes (494 and 248 minutes)

Testicular Torsion
Sonographic Findings

- Normal gray scale
- Enlarged hypoechoic testis (early)
- Heterogeneous testis $2^\circ$ to hemorrhage/necrosis (late)
- Absent or diminished Doppler flow - specific for torsion
Acute Torsion

Right Testis

Left Testis
Lt Testis Partial Torsion-Assymetric Flow

Right Testis

Left Testis
Color Doppler Dx Accuracy for suspected Testicular torsion (prospective 236 pts)*

- Prospective Study
  Median age - 13 yo (0-53 yo)
- Torsion 119/226 (53%)
- Color Doppler Sensitivity 100%
  Specificity 75.2%
  PPV 80.4%
  NPV 100%

Sono Dx accuracy for Testicular Torsion (Retrospective 342 Boys)*

- Torsion confirmed in 29 boys
- Ultrasound Sensitivity (100%), Specificity (97.9%) and accuracy (98.1%)
- Sonographic heterogeneity seen in 80% of nonviable testes at surgery and 58% of viable testes

Testicular Torsion and Infarction
Dx of Testicular Torsion in Children
Multicenter study (919 pts)*

- Torsion of Spermatic Cord (surgically confirmed)
  - Absent Doppler Flow 158/208 (76%)
  - Twist in cord (snail) 199/208 (96%)
  - Cord twist OR absent flow 208/208 (100%)
  - Linear cord ruled out torsion in all other pts

*Kalfa N et al, J Urology (2007) 177:297-301*
Cord Twist
Cord Twist

Displaced Epididymus
Abnormal Epididymus in acute testicular torsion BUT preserved testicular blood flow*

- Abnormal location and size of epididymal head (9 boys)
- Epididymal head displaced & did not have normal “capping” of the upper pole of testis.
- 4/9 (44.4%) with torsion ≤ 270° had no cord twist

Displaced Epididymus in Torsed Testis

Normal Epididymus

Absent Epididymus

Displaced Epididymus

Left Testicular Torsion
Displaced Epididymus
Left Testicular Torsion
Displaced Epididymus

Sag Right

Sag Left
Neonatal Testicular Torsion
Newborn Testicular Torsion
Newborn-Infarcted Right Testis
Newborn (Perinatal) Testicular Torsion
Newborn with Birth Trauma
complex scrotal collection

Right

Left
Testicular Injury and Breech Delivery*

- 166 Male breech deliveries
  - 13 C-Sections → No genital trauma
  - 19/134 Vaginal delivery → scrotal, buttock injury
  - 10/19 Vaginal delivery → testis trauma

- Long term Followup: 3/10 babies → normal testes
  - 6/10 babies → abnl testes

- Injury more likely with BW > 2500 grams

*Tiwary CM, Urology (1989) 34: 210-212
Newborn following Breech Delivery
--Outside US
Newborn following Breech Delivery
5 days later
Newborn following Breech Delivery

2wks later
Painful Scrotum-Henoch-Schonlein Purpura
Acute Idiopathic Scrotal Edema

6 yo boy
Unusual Scrotal Masses
? Varicocele

Testis

Courtesy of Carrie Donaldson, MD, Chicago
Filarial Dance

Testis

Adult filarial worms (W bancrofti)

Courtesy of Carrie Donaldson, MD, Chicago
9 yo with Left Scrotal Mass
Splenogonadal Fusion

Mass

Testis

Long

Trans
Polyorchidism
Newborn Scrotal Mass - Meconium Peritonitis
Whats new in testicular microlithiasis?
Significant association between TM and testicular neoplasia
- Risk of developing testicular neoplasia in the setting of TM is unknown

TM: 1097 /37865 (2.9%)

139 germ cell tumors (86 malignant)
Malignant germ cell tumors
2.8% with TM
0.12% without TM

*Trout A, et al, IPR 2016, Chicago, IL
Testicular Microlithiasis and Germ Cell Tumor
Testicular Microlithiasis in Children

? Pre-malignant*

- Multi-Institutional study of 26 patients
- Mean age - 12.3 years
- Avg. F/U = 27.6 mos. (1 mo-7 yrs)
- No tumors detected
- Testicular biopsy in 9, tumor markers in 15

Finale

- Gray scale and Doppler Technique important
  Know thou equipment

- Testicular Torsion
  Doppler
  Twisted Cord
  Displaced Epididymus

- Scrotal Masses
  Good to know about

- Testicular Microlithiasis
  Associated with testicle tumors
  likely low risk factor for developing tumor