Common Pediatric Surgical Conditions

Chuck Leys, MD, MSCI
Assistant Professor of Surgery
Indiana University School of Medicine

Common Pediatric Surgical Conditions
- Community acquired MRSA
- Inguinal & scrotal conditions
- Neck masses
- Minimally invasive pediatric surgery

Questions
- Which lymph node characteristic is NOT consistent with neoplasia:
  A. Large
  B. Fixed
  C. Tender
  D. Supraclavicular
  E. None of the Above

Questions
- True/False:
  - Optimal timing for repair of undescended testicle is 6-12 months
- True/False:
  - Minimally invasive techniques are considered unsafe in neonatal surgery

Community Acquired MRSA Infections

Presentation Varies
Presentation

Spectrum of Presentation

First reported in 1968
CA-MRSA noted in 1989
Estimates of affected children 33-40%
Buttocks & axillary sites predominate
  - extremity involvement more commonly MSSA

Presentation....

Methacillin Resistance

Health-Associated MRSA Colonization

Antibiotics in the last 60 days
Hospitalization within the last year
Multiple surgical procedures
Indwelling lines (intravascular and intratracheal)

Community Acquired-MRSA

Bacteria can live in environment for 21 days
Can be isolated from soil
**CA-MRSA**
- Occurring in healthy children without associated risk factors
- Usually involve skin and soft tissues
- Pneumonia
- Septic arthritis
- Osteomyelitis
- Respiratory failure and death associated with toxic shock syndrome

**Vanderbilt Study, 2003**
- 500 school children screened
- Primary reservoir was anterior nasal passage
- Risk factor for being a carrier: family member working in a hospital system

**Health Care Workers as Vectors**
  - 89 infants from 2001-2004: 61 MRSA
  - 65/89 patients were male
  - Symptoms developing 7-12 days after discharge from nursery
  - H/o previous maternal infection in 13/61 MRSA vs. 1/28 MSSA
- Outbreak in a NICU of HA-MRSA halted with treatment of nurse with mupirocin (Pediatr Inf Dis 2006;557-9)
- Handwashing in any setting the front line for prevention

**Nasal Carrier State**
- Antibiotic Ointment application twice daily for 1-7 days
  - Mupirocin
  - Bacitracin
  - Polymixin B
- Resistance develops with repeated courses

**Surgical Therapy**
- Incision and drainage in OR
- IV antibiotics when systemic sequelae noted
- Oral antibiotics for 7 days after discharge
- Lever 2000 baths
- Dilute bleach baths
- Bleaching of cloths/bedding/toys
- Elimination of carrier states in family members with recurrences

**Loop Drain Technique**
**Drainage**

- Loop Drain Technique
  - Drain is removed in 5-7 days
  - Oral antibiotics following discharge

**Breast Abscess in Infant**

- 1mo old infant with right breast tenderness and fever
- Admitted, IV anti-staph coverage
- Increase in size, fever persisted, fluctuance
- Operative drainage
- Cultures MRSA+

**Hernia repair with post-op necrotizing fascitis**

- Hernia repair uncomplicated
- Fever 18 hours after surgery
- Erythema, swelling

**Riley Data**

- Billing codes evaluated over three year period
  - During that time I&D increased from 85/yr to 270/yr
  - Rare to find a MSSA isolate in those cultured
- Results of drain technique (Ladd AP J Ped Surg 2010)
  - 128 pts over 14 months
  - No recurrences
  - Mean LOS 1.5 days (30 outpatient)

**Effective Antibiotic Therapy**

- Clindamycin
- TMP/SMZ
- Vancomycin reserved for associated systemic sequelae (pneumonia, septic pulmonary emboli)
  - Vancomycin-resistant organisms being isolated across the country
- Linezolid
- Oral therapy: <2 months old - only clindamycin and linezolid are approved to be used orally
Are antibiotics needed?

Dallas Children's Hospital followed 69 patients over 6 months who had CA-MRSA requiring I&D (Pediatr Inf Dis 2004:123-7)
- 58 patients initially given abx not covering MRSA
- In 21 who had abx changed, no difference in recurrence rates over 6 mo observation period
- Concluded that antibiotics not needed after I&D
- Jan 2007 Int J Dermatology (46:1-11) suggests that therapy should include I&D of abscess, systemic antibiotics, and adjuvant topical antimicrobials

Changing Sensitivities

Dallas series reported from Baylor in 2006
- Percentage of CA-MRSA isolated from cultures remained consistent over a 3 year period (approx 62%)
- HOWEVER clindamycin resistance increased from 4-13%}

Other issues

- What do we do with the patient seen in follow-up with MR infections?
- Terminally clean all rooms between patients?
- Who should be isolated?
- Should health care workers be screened?

Inguinal and Scrotal Conditions: Timing of Surgery

UNDESCENDED TESTIS

Definitions

- Undescended Testis (UDT)
  - Palpable
    - Intracanalicular
    - Ectopic
    - Retractile Testis
  - Non-palpable
- Acquired Undescended Testis
Definitions

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Incidence

- Premature birth 33%
- Term birth 4-5%
- By 3 months 1-2%

Risks:
  - Prematurity
  - Intrauterine growth retardation
  - Excessive estrogen exposure
  - Inadequate production of androgens/genetic
  - Abdominal Wall defects

Biology of Descent

JM Hutson, 1985-2005

- Transabdominal Phase
  - 8-15 wks gestation
- Inguinoscrotal Phase
  - 25-35 wk gestation

Does UDT Impact Fertility?

Measurement?
- Testicular volume
- Testicular Biopsy
- Sperm density
- Serologic markers?
- Paternity

Testicular Volume

- Puri et al, 1990
  - Intervention ~9 years age; Follow-up at 24 years
  - Cryptorchid testes smaller 4.9 ml vs. 21.1 ml
- Taskinen, 1997
  - UDT 11 ml vs. 20 ml
  - No correlation with age of treatment or original location

Testicular Histology

- Hadziselimov, 1975
  - Ultrastructural changes of Sertoli Cells
  - Degeneration of mitochondria
  - Loss of ribosomes and smooth endoplasmic reticulum
- Hadziselimov, 1987
  - Biopsy analysis of intra-abdominal testes
  - Histologically normal up to 6 months age
  - Empty interstitium (Sertoli cells) after 2 years
  - Complete lack of germ cells in 64% when >3 years
Sperm Density
- Puri et al, 1988
  - ~25 years age with orchiopexy at 7-14 years
  - 74% of the normal density if unilateral
  - 68% if unilateral—non-palpable
  - 30% bilateral cryptorchidism
  - 0% bilateral—non-palpable

Fertility
- Ludwig et al, 1975
  - 90% Fertility if operated within the first 2 years of life
  - 50% when operated between 3 and 4 years
  - 30% for those operated between 9 and 12 years
  - Unknown positional data

Endocrine Function of UDT
- Unknown impact of orchiopexy on endocrine function of testis (Leydig cells)
- Presumed normal
- No reported studies on impact to pubertal development

Deductions: Timing of Intervention
- Normal descent by 3-4 months of age
- Normal transformative process of spermatocytes 6-12 months
- Salvage 90% fertility if repair by 2 years age
- Change in Histology after 6 months age
- Loss of Germ cell population by 3 years
- RECOMMENDATION: repair 6-12 mo of age

Malignancy with UDT
- Relative risk of between 4 and 8 times more than for normally descended testes
  - Alteration of primordial gonocyte
- Greatest risk within intra-abdominal testes
- Risk maintained even after orchiopexy

INGUINAL HERNIA & HYDROCELE
Etiology: Inguinal Hernia
- Arrested Embryologic development
- Failed obliteration upon completion of gubernaculum extension and descent
- Processus Vaginalis is present by 12th week gestation
- Obliteration often occurs 36th-40th week of gestation
- Caudal-Cranial obliteration
- Continues post-natally

Processus Vaginalis Patency
- 40% of Patent PV close during first months of life
- Another 20% close by 2 years
- Closure initiates on the left
  - Testicular descent

Natural History PPV
- Present in 20-40% by 2 years
- 12% by adulthood
  - 5.5 year follow-up
  - 12% development of inguinal hernia
  - Rate of hernia development 4x non-patent PV
- Unknown mechanism for PPV obliteration
- Genetic preponderance: Relative Risk
  - Sisters of female patient: 17.8
  - Brother/sister of male patient: 4.5

Spectrum of Pathology
- Congenital Hydroceles
  - Often resolve by 2 years of life
    - No increased presence of PPV
  - If communicating hydrocele
    - Consider treatment as a hernia

Rationale for Intervention
- Risk of Incarcerated Inguinal Hernia in a General Pediatric Population
  - 6-18% with hernia
- Elevated risk of incarceration during Infancy
  - 30%
Morbidity of Surgery

- Recurrence Rate: 1.2
- Wound Infection: 1.2
- Testicular atrophy: 0.3
- Decreased Testicular Size: 2.7-13
- Iatrogenic cryptorchidism: 0.6-2.9
- Injury to Vas Deferens: 1.6
- Injury to Fallopian tubes/Ovary: ?

Recurrence Rate

Wound Infection

Testicular atrophy

Decreased Testicular Size

Iatrogenic cryptorchidism

Injury to Vas Deferens

Injury to Fallopian tubes/Ovary

Not a question of if, but when...

Stylianos, et al. 1993
- 15 year study period
- 908 consecutive cases of inguinal hernias
- 9% incidence of incarceration
- 30 (35%) previously diagnosed with hernia
- 25 scheduled
- 85% were under 1 year age

Stylianos et al. J Pediatr Surg
1993;28(4) 582

Prematurity Considerations

- 33% risk of respiratory complications
- Infants weighing less than 3 kg and under 10 weeks age
- Allen et al
  - Risk of intra-operative narcotics and relaxants
  - Incidence of postoperative apnea or bradycardia if < 60 weeks gestation
- Warner
  - Elevated risk with history of apnea or respiratory distress syndrome

Prematurity Considerations

- Anesthetic risk inversely proportional to post-conceptual age
- General recommendations with regards to risk post-operative anesthetic event
- Recommendations for age ranging greater than 40-60 weeks
- Overnight Observation
Inpatient/NICU considerations

- Increased surgical morbidity in premature infant
  - Anesthetic risks
  - Increased incidence of testicular atrophy
  - Increased risk of recurrent hernias
  - Difficulties with hernia sac
  - Higher risk of injury to vas deferens/vessels

- No standardized approach

Antonoff, 2004
- Survey of Surgical Section, AAP
- 63% repaired hernias of preterm infants before discharge
- 10% after 50 weeks post-conceptual age and > 3 kg
- 5% after 60 weeks post-conceptual age
- 5% when convenient

Contralateral Assessment

- Recognition of possible contralateral hernia 7-15%
- Awareness of probable PPV in up to 60%
  - Rowe, 1969 2764 pts
    - Overall patency rate 48%
    - If < 2 months, 63%
    - If > 2 years, 41%
  - Sparkman, 1962
    - Natural History PPV
    - Development of contralateral hernias 15.8%
- Historical dogmatic decision tree: Age, Gender, Size

Contemporary Technology
- Assessment at time of repair
- Assessment as diagnostic intervention
- High Sensitivity/Specificity
- Repair for identification of PPV or hernia
Inguinal Hernia Summation

- Identification of Inguinal Hernia
  - Refer/Intervene—even if asymptomatic
- Non-communicating Hydrocele
  - Observe up to 2 years
- Communicating Hydrocele
  - Refer for repair
- History of Prematurity AND < 50 week post-conception
  - Refer/Repair
  - Observational stay

Neck Masses in Children

MIDLINE MASSES

- Thyroglossal Duct Cyst
- Dermoid Cyst
- Lymph Node
  - Lymphoma
  - Metastatic CA
- Median Ectopic Thyroid

MIDLINE MASSES

- Ultrasound
- Thyroid Scan
- CT Scan
- MRI

MIDLINE MASSES

- Thyroglossal Duct Cyst
  - Most appear between 2-10 yrs
  - May occur anywhere from base of tongue to sternal notch
  - May become infected
    - H flu, Staph Aureus most common
  - May develop carcinoma
    - Papillary, Squamous
THYROGLOSSAL DUCT CYST

RECURRENT THYROGLOSSAL DUCT CYST

RECURRENT THYROGLOSSAL

DERMOID/EPIDERMOID CYSTS
- FOUND IN MIDLINE OR LINES OF FUSION
- SLOWLY ENLARGE WITH TIME
- MAY BECOME INFECTED
- EXCISION RECOMMENDED

DERMOID CYST

BRANCHIAL REMNANTS
- MAJORITY FROM 2ND ARCH/CLEFT
- LOCATED ALONG BORDER SCM
- FISTULA
- SINUS
- CYST
- CARTILAGINOUS REMNANT
BRANCHIAL REMNANTS

- Fistulas often present at birth
- Cysts often present with sudden swelling after URI
- May become infected
- May develop carcinoma (adults)
- Treated by excision

BRANCHIAL CLEFT FISTULA

BRANCHIAL CLEFT CYST

BRANCHIAL REMNANT
**Cystic Hygroma**

- Most often in posterior triangle
- Apparent at birth or soon after
- Usually asymptomatic
- May become infected
- May have associated chest component
  - CXR required

**Neuroblastoma**

- Presents in infants/toddlers
- Firm, fixed mass
- May have Horner’s syndrome
- May have regional adenopathy

**Adenopathy**

- Inflammatory vs neoplastic
- Viral - most common
- Bacterial
- Atypical Mycobacteria
- Tuberculosis
- Cat scratch (Bartonella)
ATYPICAL MYCOBACTERIA

CAT SCRATCH

SUSPECTED BACTERIAL ADENITIS

ANTIBIOTICS

RESOLUTION

FLUCTUANCE

PERSISTENCE

NEOPLASTIC NODES

- LARGE
- FIXED
- NONTENDER
- NO CONTRIBUTORY HISTORY
- SUPRACLAVICULAR LOCATION
- ASSOCIATED
- HEPATO/SPLENOMEGALY
- ABNORMAL CXR

IMPORTANCE OF CXR WITH CERVICAL/SUPRACLAVICULAR NODES
Minimally Invasive Pediatric Surgery: What can be done? What should be done?

Laparoscopy/Thoracoscopy
- Accepted
- Cholecystectomy
- Appendectomy
- Nissen
- Splenectomy
- Pyloromyotomy
- Benign ovarian
- Thoracoscopy: biopsy, empyema, mass

+/
- Imperforate anus
- Choledochal cyst
- Congenital Diaphragmatic hernia
- Duodenal atresia
- Esophageal atresia

Minimally Invasive Surgery: Important Considerations
- Patient selection important
- Same procedure as open
- Physician experience, learning curve
- MIS is a tool, but just one tool – it may not be the best tool for everything

ESOPHAGEAL DUPLICATION CYST
Thoracoscopic resection, released POD #1

Morgagni Diaphragmatic Hernia
Laparoscopic Repair, Released POD #2

6 yo, pneumonia, mass

Favorable Histology Neuroblastoma, no further treatment, Released POD#2
Thoracoscopic decortication vs tube thoracostomy with fibrinolysis for empyema in children: a prospective, randomized trial

- 12Fr chest tube, 4mg tPA in 40ml saline q24hrs X 3
- 3(16.6%) fibrinolysis group required VATS
- 2 VATS post op vent support
- No difference LOS, days until afebrile or off of oxygen
- 84% of tPA avoided VATS; VATS>$

St. Peter J Pediatr Surg 2009
Laparoscopic Pyloromyotomy

Mucosal Perforation 0-3.3%
Incomplete Pyloromyotomy 0-2.7%
Institutional Learning Curve

Practice makes Perfect: Progressive Improvement of Laparoscopic Pyloromyotomy Results, with Experience

N=185
OR time: 29 – 21.5 minutes
Post Op LOS: 26 – 24.5 hours
Total LOS – 45 hours

Complications
4 – incomplete pyloromyotomies (3 in first 43)
1 – mucosal perforation (immediate repair)
1 – delayed duodenal perforation – 4 days


Evaluation of Surgical Approaches to Pyloromyotomy: A Single Center Experience

RUQ(119); Umbilical(64); Lap(9)
Mucosal Perf: RUQ 3.3%; Umb 1.5%; Lap 11.1% - missed, multiorgan failure


Open vs Laparoscopic Pyloromyotomy for Pyloric Stenosis: A Prospective Randomized Trial

200 pts (after surgeon’s learning curve)
No difference OR time, length of recovery
Laparoscopy less post op pain and emesis


Laparoscopic vs Open Pyloromyotomy: A systematic Review and Meta-Analysis

625 pt, 6 prospective (5 level 1, 1 level 2)
302 lap, 322 open
Lap Pyloric: lower wound infection, shorter time to full feeds (11.5hrs), shorter LOS (5.7hrs)
Lap, more incomplete pyloromyotomies (6/302, 2%)

Sola J Pediatr Surg 2009
Riley Hospital for Children
(140/year)
- Mucosal perforation rate < 1%
- Incomplete pyloromyotomy: None in 20+ years
- Open 6/8 surgeons; Laparoscopic 2/8

Laparoscopic Adrenalectomy

Adult Studies
- Decreased Pain
- Decreased Complications
- Decreased Length of Stay

Children
- Case Reports
- Anecdotal – useful, short LOS

Laparoscopic Antireflux Procedure - Nissen
- Excellent for children and adolescents
- In infants – hard to identify an advantage, i.e., open Nissen and G-tube, feed, POD #1
- Some reports have identified a higher recurrence rate with laparoscopy
Laparoscopic vs Open Nissen

**Laparoscopic**
- Decreased diaphragm excursion in OR, promotes atelectasis;
- Less pain, earlier feedings

**Open**
- Upper abdominal midline incision
- More post-operative pain; post operative atelectasis

No postop IV narcotic, only Tylenol with codeine elixir.
Feeds started night of surgery
Released POD #2

### Case Controlled Comparison

<table>
<thead>
<tr>
<th>Splenectomy</th>
<th>Open N=32</th>
<th>Laparoscopic N=50</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>Acc Spleens</td>
<td>8 (25%)</td>
<td>9 (18%)</td>
<td>.578</td>
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<tr>
<td>IV Narcotics</td>
<td>100%</td>
<td>51%</td>
<td>&lt;.0001</td>
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<tr>
<td>Morphine Dose (mg/kg)</td>
<td>0.48</td>
<td>0.239</td>
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<td>OR time (min)</td>
<td>83</td>
<td>115</td>
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<tr>
<td>Length of Stay</td>
<td>2.5±1.43</td>
<td>1.4±.97</td>
<td>.001</td>
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<tr>
<td>Cost $</td>
<td>6564</td>
<td>5713</td>
<td>.117</td>
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</table>
Laparoscopic Splenic Procedures in Children: Experience in 231 Children

- Total Splenectomy 211; Partial 12
- Splenic Cystectomy 6
- Splenopexy 2
- Conversion rate 1.7%
- Accessory spleen 19%

Ann Surg. 2007

Laparoscopic Colectomy/J Pouch
Laparoscopic Colectomy/J pouch

Perforated Duodenal Ulcer

MIC-KEY

BARD

Lap video
Laparoscopically Assisted Anorectal Pull-Through for High Imperforate Anus—A New Technique

By Keith E. Geppertson, Thomas H. Inge, and Craig T. Altman
Birmingham, Alabama and San Francisco, California

Laparoscopic MACE
Laparoscopic Appendectomy

Ovarian Cyst – 2mo old, detected prenatally, increased in size

Detorsion, partial oophorectomy
Released POD #1

MIS – Ovarian Masses
NOTES: Natural Orifice Translumenal Endoscopic Surgery

Questions

Which lymph node characteristic is NOT consistent with neoplasia:
A. Large
B. Fixed
C. Tender
D. Supraclavicular
E. None of the Above
Questions

- True/False:
  - Optimal timing for repair of undescended testicle is 6-12 months

- True/False:
  - Minimally invasive techniques are considered unsafe in neonatal surgery

Thank You!

Pediatric Surgical Associates

1-877-KID-SURG
1-877-543-7874