

# APSA Rural Surgery Training Curriculum

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## Introduction and Methodology

The Rural Surgery Subcommittee of the Education Committee is tasked with the development of rural surgery curriculum for practicing general surgeons who are likely to encounter urgent pediatric surgical conditions in remote areas and without prompt access to pediatric subspecialty care.

We drew heavily upon the “Right Child, Right Surgeon Initiative,” as described in the consensus statement published in 2020.<sup>1</sup> The overriding goal of the curriculum was to improve access to pediatric surgical care, while preserving quality in the face of limited resources. This is a complex issue, and therefore, the committee feels it would be beneficial to explain our methodology. Multiple stakeholders and controversies surround this issue, and extensive modifications are expected. Therefore, the curriculum as written is very modular to allow for these amendments.

In order to establish concrete training needs, the committee set out to categorize the environments of care in which our potential trainees would find themselves. “Rural surgery” is a broad topic and describes a plethora of circumstances. We solicited comments from military surgeons and members of the American College of Surgeon’s Advisory Council for Rural Surgery in this step.<sup>2,3</sup> Finally, we considered the consensus statement of a rural surgery initiative involving Canada, Scotland, Australia, and the United States.<sup>4</sup>

It became apparent quickly that training needs were going to vary across a large spectrum of clinical practices. To address that, the committee decided on three (3) “levels” of training. Training duration, resources, patient exposures, and entrusted professional activities (EPAs) vary significantly based upon training needs, and there should be room for individualization to enhance efficiency.

The levels listed below are based on progressively cumulative training needs, with surgeons at level 1 likely requiring the most abbreviate amount of training, progressing through level 2 to level 3 (remote/austere environment with no potential for transfer) where the highest level of training and preparation would be required.

### **Level 1: Critical Access Hospital**

CMS defines these facilities as being more than 35 miles from the nearest alternate hospital and having 25 or fewer inpatient beds. However, routine outpatient surgical procedures on relatively healthy patients are commonly done at such facilities with good outcomes.<sup>6</sup> Although the specific resources available at such facilities vary greatly, for the purpose of this curriculum, the assumptions made regarding this environment are:

- Lack of inpatient pediatric hospitalists.
- Lack of pediatric anesthesia.
- Lack of pediatric radiology.
- Limited access to interventional radiology.
- Limited pediatric nursing support.
- While there may be some obstetric capability at such facilities, access to a neonatal ICU or pediatric ICU level of care is highly unlikely.

## Level 2: Remote Community Hospital

The assumption made here is a community hospital with robust resources, to include:

- An inpatient pediatric ward with pediatric hospitalist support.
- Interventional radiology support.
- Pediatric anesthesia support for newborn/infant surgery.
- Pediatric radiology support.
- Ideally, strong clinical and referral relationships would exist with a children's hospital.

## Level 3: Humanitarian/Deployed Environment

This environment is one where:

- Resources are limited.
- The potential for transfer to a higher level of care is not feasible.
- Local standards for care are different.
- The likelihood of caring for a high-risk patient, such as the chronically immunosuppressed or a preterm infant, is not expected.
- Access to pediatric specialty equipment will likely also be limited.

The committee then determined training goals for each level of care based on procedures and disease processes. These are listed in the training matrix.

In order to do this, we determined pediatric surgery emergency conditions the trainee should master regardless of level.

For urgent conditions where transfer was potentially feasible, a literature search was done to assess for published outcome differences between community facilities and children's hospitals, here in the United States and in Europe and Australia. The results are summarized below:

**Appendicitis:** Multiple retrospective studies worldwide have demonstrated that surgical care of this disease, even in young children, can be safely done by general surgeons.<sup>6-15</sup> In some studies, care provided to older children by general surgeons was more cost effective than that of pediatric surgeons at children's hospitals.<sup>8</sup> Despite this, many rural surgeons expressed significant reticence to perform these procedures, mostly due to medicolegal concerns and concerns regarding pediatric support at their institution.<sup>3</sup> It is the committee's belief that improving training and comfort level with this disease process, in addition to trauma, would likely have the biggest impact in improving surgical care for children. Our recommendations are listed in the training matrix.

**Pyloric Stenosis:** Numerous studies demonstrate inferior outcomes for pyloromyotomy to include major morbidity and hospital stays when performed by general surgeons in community hospitals as opposed to pediatric surgeons. One consideration mentioned in several papers is that subspecialty training is not as important as volume in ongoing practice.<sup>15-36</sup> This is an important consideration because the overall incidence of pyloric stenosis appears to be decreasing and skills maintenance in low volume practice is likely to be challenging. Given that this is not an emergent procedure, and the anesthesia expertise needed to safely perform this

procedure, the committee concluded that training outside of level III or a very robust level II without transfer ability should be limited to stabilization and resuscitation only. This is reflected in the training matrix

**Intussusception:** As with pyloric stenosis, numerous studies demonstrate inferior outcomes and higher rates of surgery when this is managed at facilities without pediatric surgical and radiology support.<sup>37-41</sup> However, given that this condition can present with advanced bowel ischemia and necrosis, and that long transfer times can also affect outcomes, the committee felt more comprehensive training was justified but stressed that transfer should be considered whenever feasible and timely.

**Cholecystectomy:** There is no data to support regionalization for performance of this procedure in children. General surgeons seem to be more than capable of performing this proficiently for all age groups, and additional training is likely not needed aside from familiarity with laparoscopy in smaller patients<sup>42</sup>.

**Hernia:** There is limited data regarding the impact of subspecialty training and volume on pediatric hernia repair. The most recent large-scale study was out of Canada and utilized outcome data from 1993 to 2000. The findings were that pediatric surgeons performed most hernia repairs in children under age two (2), and had lower complication rates overall. However, recurrence rates, in general, were low. This does underscore the fact that training alone will not be able to compensate for a low-volume practice in terms of quality of care.<sup>43-45</sup>

Further data on elective hernia and circumcision is being performed in community hospitals in the United Kingdom and Australia. These report good outcomes; however, these studies primarily involve pediatric surgeons and urologists traveling to these facilities on a rotating basis. The committee thought that elective hernia repair should be taught at all levels in the event that a provider had to care for an acute incarceration. However, in general, reduction and transfer of infants with incarceration should be stressed as preferable whenever possible.

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	<b>LEVEL 1:</b> Critical access hospital with limited pediatric nursing, anesthesia, radiology, and pediatrics support	<b>LEVEL 2:</b> Community hospital with inpatient pediatric services, anesthesia, and radiology with pediatric experience	<b>LEVEL 3:</b> Limited resources but no other option for child's care (humanitarian/deployed)
<b>Urgent Conditions</b>			
Appendicitis > 5 years	Yes; preop/postop/OR	Yes; preop/postop/OR	Yes; preop/postop/OR
Appendicitis < 5 years	Diagnostic evaluation/ preop resuscitation	Yes; preop/postop/OR	Yes; preop/postop/OR
Pyloric stenosis	Diagnostic evaluation/ preop resuscitation	Diagnostic evaluation/ resuscitation/open pyloromyotomy	Yes; diagnostic evaluation/ resuscitation/open pyloromyotomy
Incarcerated hernia > 2 years	Reduction, preop resuscitation	Yes; preop/postop/OR	Yes; preop/postop/OR
Incarcerated hernia < 2 years	Reduction, preop resuscitation	Yes; preop/postop/OR	Yes; preop/postop/OR
Gastroschisis: initial management	Preop resuscitation, silo	Preop resuscitation, silo	Yes; preop/postop/OR/silo
Omphalocele	Paint/transfer	Paint/transfer	Assessment/repair vs. paint
Trauma	TRIK/ATLS	TRIK/ATLS	TRIK/ATLS
Neonatal bowel obstruction (HD, IA, atresia, etc.)	Preop resuscitation/ transfer	Preop resuscitation/transfer	Yes; preop/postop/OR
Hirschsprung's enterocolitis	Recognition/resuscitation/ irrigations	Recognition/resuscitation/ irrigations	Recognition/resuscitation/ irrigations/ostomy if needed
Central venous access	Yes	Yes	Yes
Meckel's diverticulum	Preop management (bleeding)/operative management in older children	Yes; preop/postop/OR	Yes; preop/postop/OR
Malrotation(+/- volvulus)	Yes; preop/postop/OR	Yes; preop/postop/OR	Yes; prop/postop/OR
Necrotizing enterocolitis (NEC)	No	Yes; drain placement/ resuscitation	No
Testicular torsion	Yes; preop/postop/OR	Yes; preop/postop/OR	Yes; preop/postop/OR
Intussusception	Preop resuscitation/ transfer	Yes; preop/postop/OR	Yes; preop/postop/OR
Critical care	Yes	Yes	Yes
<b>Elective Conditions</b>			
Circumcision	Yes	Yes	Yes
Umbilical hernia > 5 years	Yes	Yes	Yes
Non-incarcerated hernia > 2 years	Yes	Yes	Yes
Non-incarcerated hernia < 2 years	No	No	Yes
UDT < 18 months	No	No	Yes
Gastrostomy tube management	Yes	Yes	No
Cholecystectomy > 5 years	Yes	Yes	Yes

# APSA Rural Surgery Training Curriculum:

## Appendicitis

### All Levels of Care

**EPA: Recognize the clinical signs of appendicitis in children under age five (5) and over age five (5).**

Clinical Components of Presentation:

Pediatric Appendicitis score, Alvarado score.

Physical Examination of Children under Age Five (5): Distraction techniques, comfort, parental presence.

Utility of Laboratory Evaluation: CBC, CMP, inflammatory markers.

Pitfalls: Differential diagnosis — viral gastroenteritis, constipation, strep pharyngitis, pyelonephritis, pneumonia.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829047/all/Appendicitis>

Imaging: Role of plain X-ray, ultrasound, CT scanning, and risks/benefits of each.

Resources:

[https://www.pedsurglibrary.com/apsa/citation/31964758/all/Cost\\_effectiveness\\_of\\_Imaging\\_Protocols\\_for\\_Suspected\\_Appendicitis](https://www.pedsurglibrary.com/apsa/citation/31964758/all/Cost_effectiveness_of_Imaging_Protocols_for_Suspected_Appendicitis)

[https://www.pedsurglibrary.com/apsa/view/PedSurg%20Resource/1884019/all/Resident\\_and\\_Student\\_Handbook#2](https://www.pedsurglibrary.com/apsa/view/PedSurg%20Resource/1884019/all/Resident_and_Student_Handbook#2)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute\\_Abdominal\\_Pain](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute_Abdominal_Pain)

**EPA: Appropriately direct preoperative care for a patient of any age with presumed appendicitis.**

Fluid resuscitation, pain management, antibiotic administration.

Treatment Options: Medical vs. surgical (articulate risks and benefits of both for perforated and nonperforated appendicitis).

Resources:

[https://www.pedsurglibrary.com/apsa/citation/30720508/all/Antibiotic\\_Treatment\\_and\\_Appendectomy\\_for\\_Uncomplicated\\_Acute\\_Appendicitis\\_in\\_Adults\\_and\\_Children:\\_A\\_Systematic\\_Review\\_and\\_Meta\\_analysis](https://www.pedsurglibrary.com/apsa/citation/30720508/all/Antibiotic_Treatment_and_Appendectomy_for_Uncomplicated_Acute_Appendicitis_in_Adults_and_Children:_A_Systematic_Review_and_Meta_analysis)

<https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829047/all/Appendicitis>

<https://www.pedsurglibrary.com/apsa/view/PedSurg%20Resource/1884003/all/Appendicitis>

**EPA: Appropriately direct postoperative care for a patient of any age with nonperforated appendicitis.**

Clinical Considerations:

Many of these patients can be discharged home from the recovery room if doing well.

Understand appropriate dosing of nonsteroidal anti-inflammatory pain medication.

Understand appropriate use of narcotics in the postoperative appendicitis patient (rarely required).

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

Understands appropriate postoperative wound care and activity restrictions (rarely required).

Resource: <https://www.youtube.com/watch?v=20VkoimbJ8I>

**EPA: Appropriately direct postoperative for a patient of any age with perforated appendicitis.**

Clinical Considerations:

Appropriate intravenous fluids (dextrose-containing isotonic fluids).

Appropriate multimodal pain management with limited use of narcotics.

Management of nasogastric losses in patients with an ileus, appropriate use of laboratory tests, appropriate antibiotic administration.

Appropriate time frame to image for abscess.

Appropriate time frame to consider TPN in cases of prolonged ileus.

Transfer considerations.

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

**EPA: Recognize and treat complications of appendicitis:**

Need for interval appendectomy in non-operatively managed patients with complicated appendicitis.

Signs and Symptoms of Abscess Formation: Medical treatment alone vs. percutaneous drainage.

Wound complications.

Clostridium difficile colitis:

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829028/all/Antibiotic\\_Associated\\_Colitis?q=clostridium](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829028/all/Antibiotic_Associated_Colitis?q=clostridium)

## **Level of Care: Critical Access Hospital**

**EPA: Safely perform open or laparoscopic appendectomy in a pediatric patient over age five (5) with appendicitis (perforated and nonperforated).**

### Clinical Steps:

Three-port or modified one-port appendectomy utilizing adult-size laparoscopic instruments and trocars.

Obtain comfort with limited working space. Extracorporealization of appendix vs. intracorporeal appendectomy.

Understand appropriate settings for the CO2 insufflation and troubleshooting for loss of pneumoperitoneum.

Open appendectomy as above.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and observation/assisting in five (5) cases in children under five (5).

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829180/all/Appendectomy>

## **Level of Care: Community Hospital**

**EPA: Safely perform open or laparoscopic appendectomy in a pediatric patient over age five (5) and under age five (5) with appendicitis (perforated and nonperforated).**

### Clinical Steps:

Three-port or modified one-port appendectomy utilizing adult-size laparoscopic instruments and trocars or 3 mm instruments.

Obtain comfort working in limited operating space.

Understand appropriate settings for the CO2 insufflation and troubleshooting for loss of pneumoperitoneum.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and observation/assisting in five (5) cases in children under five (5).

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829180/all/Appendectomy>

## **Level of Care: Humanitarian/Deployed Environment**

**EPA: Safely perform an open appendectomy in a pediatric patient with appendicitis (perforated and nonperforated).**

Clinical Steps: Placement of incision; handling of appendiceal stump; drainage of purulent and feculent peritonitis; and management of skin closure.

Level of Supervision: Successful completion under direct supervision with two (2) cases in older children and two (2) cases in children under five (5).

Resources: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829180/all/Appendectomy>

[https://www.pedsurglibrary.com/apsa/ub;jsessionid=CA91329D3652C03DB0B4DA2BBA1BCD92?ptid=apsapeds&amod=login&cmd=repview&type=682-58&name=16\\_1884020\\_PDF](https://www.pedsurglibrary.com/apsa/ub;jsessionid=CA91329D3652C03DB0B4DA2BBA1BCD92?ptid=apsapeds&amod=login&cmd=repview&type=682-58&name=16_1884020_PDF)

# APSA Rural Surgery Training Curriculum:

## Pyloric Stenosis

### All Levels of Care

#### EPA: Recognize the clinical signs of pyloric stenosis.

Clinical Components of Presentation:

History: ~6-8 w/o, projectile vomiting

Physical Examination of Infants: Palpation of pylorus — “olive” (99% PPV for places without access to ultrasound), relaxed abdominal wall, flexed hips.

Utility of Laboratory Evaluation: CBC, BMP.

Pitfalls: Differential diagnosis — gastroenteritis, reflux, milk protein allergy.

Imaging: Role of plain X-ray, ultrasound, fluoroscopy, and risks/benefits of each.

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829037/all/Hypertrophic Pyloric Stenosis?q=pyloric+stenosis](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829037/all/Hypertrophic_Pyloric_Stenosis?q=pyloric+stenosis)

<http://www.amcresidents.com/Lectures/Peds/CA2/pyloric%20stenosis.pdf>

Medical Aspects of Care:

Understand the physiology behind electrolyte derangements.

Evaluation of fluid and electrolyte deficits.

Fluid resuscitation.

Treatment Options: Surgical (laparoscopic vs. open), non-operative treatment.

Level of Supervision: Successfully participate in the evaluation and resuscitation of five (5) infants with pyloric stenosis.

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829037/all/Hypertrophic Pyloric Stenosis?q=pyloric+stenosis](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829037/all/Hypertrophic_Pyloric_Stenosis?q=pyloric+stenosis)

<http://www.amcresidents.com/Lectures/Peds/CA2/pyloric%20stenosis.pdf>

### Level of Care: Critical Access Hospital

Perform assessment, resuscitation and transfer for surgical management

## **Level of Care: Humanitarian/Deployed Environment or Robust Community Hospital**

### **EPA: Safely resuscitate and perform an open pyloromyotomy.**

Critical Steps: Placement of incision; pyloromyotomy; adequacy of distal and proximal myotomy; and management of skin closure.

Level of Supervision: Successful completion under direct supervision with three (3) cases open.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829171/all/Pyloromyotomy>

### **EPA: Recognize and treat complications of pyloromyotomy.**

Incomplete myotomy — recognize and treat with repeat myotomy.

Perforation — recognize and close myotomy +/- new myotomy 180 deg.

Wound Complications: Infection and dehiscence.

Apnea monitoring/pulse oximetry for 24 hours.

### **EPA: Appropriately direct postoperative care for a patient after pyloromyotomy.**

Clinical Considerations: Feeding ad-lib vs. postop feeding protocol.

Resource: <https://www.jpedsurg.org/action/showPdf?pii=S0022-3468%2813%2900763-X>

# **APSA Rural Surgery Training Curriculum: Incarcerated Inguinal Hernia > 2 Years**

## **All Levels of Care**

### **EPA: Be able to diagnose incarcerated inguinal hernia in boys and girls.**

History and physical examination of pediatric patients as key components for diagnosis.

Evidence of obstruction or ischemic bowel.

Determine when ultrasound imaging is required.

Distinguish hydrocele/hydrocele of the cord from incarcerated inguinal hernia.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

### **EPA: Attempt reduction of incarcerated inguinal hernia without sedation.**

Clinical Steps: Positioning; use of distraction methods; and correct reduction technique.

Level of Supervision: Attempt reduction under direct or indirect supervision in one (1) pediatric patient.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

### **EPA: Attempt reduction of incarcerated inguinal hernia with sedation.**

Clinical Steps: Positioning; adequate IV access; appropriate providers for sedation; and correct reduction technique.

Level of Supervision: Attempt reduction under direct or indirect supervision in one (1) pediatric patient.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

**EPA: Discuss and coordinate management of successfully reduced incarcerated inguinal hernia in pediatric patients.**

Need for admission and observation.

Risk of repeat incarceration.

Timing of surgery.

Determine need for transfer.

**EPA: Management of unsuccessfully reduced incarcerated inguinal hernia.**

Determine risks and benefits of transfer vs. operation.

Appropriate IV fluid administration, NGT/OGT placement, appropriate pain medication.

**EPA: Discuss differences in etiology and management of pediatric hernias compared to adult hernias**

Patent processus vaginalis.

Repair with high ligation and no mesh.

Need to explore the contralateral groin at the time of repair.

Discuss risk of incarceration and timing of repair.

Understand risks and benefits of hernia repair.

**EPA: Manage postoperative care following inguinal hernia repair.**

Recognize wound complications, hematoma, and recurrent hernia.

Determine the appropriate postoperative pain regimen and dosing (no narcotics).

Determine the appropriate activity restrictions.

**Level of Care: Critical Access Hospital**

**EPA: Safely perform an open inguinal hernia repair in a pediatric patient.**

Clinical Steps: Placement of incision; identify the correct layers; dissect hernia sac and cord structures; isolate hernia sac with dissection up to the internal ring; open and inspect hernia sac; high ligation; and management of distal sac/hydrocele.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and five (5) cases in children under age five (5).

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal Hernia and Hydrocele Repair?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal%20Hernia%20and%20Hydrocele%20Repair?q=hernia+incarcerated+inguinal)

## **Level of Care: Community Hospital**

### **EPA: Safely perform an open inguinal hernia repair in a pediatric patient.**

Clinical Steps: Placement of incision; identify the correct layers; dissect hernia sac and cord structures; isolate hernia sac with dissection up to the internal ring; open and inspect hernia sac; high ligation; and management of distal sac/hydrocele.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and five (5) cases in children under age five (5).

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal Hernia and Hydrocele Repair?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal%20Hernia%20and%20Hydrocele%20Repair?q=hernia+incarcerated+inguinal)

### **EPA: Safely perform contralateral groin exploration.**

Clinical Steps: Laparoscopic exploration through inguinal hernia sac using 5 mm or 3 mm trocar and scope, identifying contralateral inguinal hernia.

Level of Supervision: Successful completion under direct supervision with two (2) cases in older children and two (2) cases in children under age five (5).

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal Hernia and Hydrocele Repair?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal%20Hernia%20and%20Hydrocele%20Repair?q=hernia+incarcerated+inguinal)

## **Level of Care: Humanitarian/Deployed Environment**

### **EPA: Safely perform an open inguinal hernia repair in a pediatric patient**

Clinical Steps: Placement of incision; identify the correct layers; dissect hernia sac and cord structures; isolate hernia sac with dissection up to the internal ring; open and inspect hernia sac; high ligation; and management of distal sac/hydrocele.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and five (5) cases in children under five (5).

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal Hernia and Hydrocele Repair?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal%20Hernia%20and%20Hydrocele%20Repair?q=hernia+incarcerated+inguinal)

### **EPA: Safely perform contralateral groin exploration**

Clinical Steps: Laparoscopic exploration through inguinal hernia sac using 5 mm trocar and scope, identifying contralateral inguinal hernia.

Level of Supervision: Successful completion under direct supervision with two (2) cases in older children and two (2) cases in children under five (5).

# **APSA Rural Surgery Training Curriculum: Incarcerated Inguinal Hernia < 2 Years**

## **All Levels of Care**

### **EPA: Be able to diagnose incarcerated inguinal hernias in boys and girls.**

History and physical examination of pediatric patients as key components for diagnosis.

Evidence of obstruction or ischemic bowel.

Determine when ultrasound imaging is required.

Distinguish hydrocele from incarcerated inguinal hernia.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

### **EPA: Attempt reduction of incarcerated inguinal hernia without sedation.**

Clinical Steps: Positioning; use of distraction methods; and correct reduction technique.

Level of Supervision: Attempt reduction under direct or indirect supervision in one (1) pediatric patient.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

### **EPA: Attempt reduction of incarcerated inguinal hernia with sedation.**

Clinical Steps: Positioning; adequate IV access; appropriate providers for sedation; and correct reduction technique.

Level of Supervision: Attempt reduction under direct or indirect supervision in one (1) pediatric patient.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

**EPA: Discuss and coordinate management of successfully reduced incarcerated inguinal hernia in pediatric patients.**

Need for admission and observation vs. transfer vs. outpatient management.

Risk of repeat incarceration.

Timing of surgery.

Determine need for transfer.

**EPA: Management of unsuccessfully reduced incarcerated inguinal hernia.**

Determine risks and benefits of transfer vs. operation.

Appropriate IV fluid administration, NGT/OGT placement, appropriate pain medication.

**EPA: Discuss differences in etiology and management of pediatric hernias compared to adult hernias.**

Patent processus vaginalis.

Repair with high ligation and no mesh.

Need to explore the contralateral groin at the time of repair.

Discuss risk of incarceration and timing of repair.

Understand risks and benefits of hernia repair.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+incarcerated+inguinal)

**Level of Care: Critical Access Hospital**

Perform assessment, resuscitation and transfer for surgical management

**Level of Care: Humanitarian/Deployed Environment or Robust Community Hospital**

**EPA: Safely perform an open inguinal hernia repair in a pediatric patient with inguinal hernia.**

Clinical Steps: Reduction of hernia under anesthesia; placement of incision; identify the correct layers; dissect hernia sac and cord structures; isolate hernia sac with dissection up to the internal ring; open and inspect hernia sac; high ligation; and management of distal sac/hydrocele.

Level of Supervision: Successful completion under direct supervision with five (5) cases in children under two (2) years old.

**EPA: Safely perform an open inguinal hernia repair in a pediatric patient with persistent incarcerated inguinal hernia.**

Clinical Steps: Open sac to assess bowel viability; determine need to make a counter incision (abdomen) to help with reduction; and perform bowel resection and anastomosis.

Level of Supervision: Successful completion under direct supervision of bowel resection and anastomosis in five (5) cases in children.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal\\_Hernia\\_and\\_Hydrocele\\_Repair?q=hernia+incarcerated+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal_Hernia_and_Hydrocele_Repair?q=hernia+incarcerated+inguinal)

**EPA: Manage postoperative care following inguinal hernia repair.**

Recognize wound complications, hematoma, and recurrent hernia.

Determine the appropriate postoperative pain regimen and dosing (no narcotics).

Determine the appropriate activity restrictions.

# APSA Rural Surgery Training Curriculum:

## Gastroschisis

### All Levels of Care

#### EPA: Recognize the clinical presentation of gastroschisis vs. omphalocele.

##### Clinical Components of Presentation:

An abdominal wall defect with eviscerated intestine without a sac, to the right of the umbilical cord; understand how this differs from an omphalocele (omphalocele has a sac and frequently has other associated anomalies).

Understand that a child with gastroschisis is malrotated but has an overall better prognosis than omphalocele due to lack of associated anomalies.

Understand that 10-15% of children with gastroschisis have an associated intestinal atresia, and this may not be obvious on initial evaluation of the intestines.

Physical Examination: Inspection of the intestines, looking for signs of an atresia or ischemia that may require enlarging the defect; understand that the exposed viscera should be covered to avoid heat and fluid losses.

Utility of Laboratory Evaluation: CBC, CMP, coags.

##### Pitfalls: Differential Diagnosis:

Omphalocele with a ruptured sac.

Not recognizing bowel ischemia from a tight ring.

Not obtaining good IV access for resuscitation and immediate coverage for the intestine.

Imaging: Not much of a role

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829060/all/Gastroschisis>

#### EPA: Medical resuscitation on initial presentation.

Exposed viscera should be covered, warm, and moist (placed in a bowel bag or plastic wrap); bowel should be monitored to assure mesentery is not kinked; child can be placed on his or her side to facilitate better perfusion.

Fluid Resuscitation: Good IV access obtained; will need PICC/TPN, if available.

Normal saline bolus of 10 ml/kg followed by maintenance at standard rate; close monitoring of urine output (understand that historically large volume resuscitation was recommended, but new data shows that this is counterproductive).

Resource: Jansen LA, Safavi A, Lin Y, MacNab YC, Skarsgard ED; Canadian Pediatric Surgery Network (CAPSNet). Preclosure fluid resuscitation influences outcome in gastroschisis. Am J Perinatol. 2012 Apr;29(4):307-12. doi: 10.1055/s-0031-1295639. PMID: 22094919.

**EPA: Options for bowel coverage on initial presentation.**

Initial Silo Placement: Understand that silo is indicated when primary closure is not possible; decompress the stomach with OGT and decompress colon manually; technique for initial silo placement (preformed spring-loaded or hand-sewn to fascial edges from silastic sheeting); technique for manual reduction while in the silo on initial presentation and serial silo reduction over the following days.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829195/all/Gastroschisis\\_Repair](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829195/all/Gastroschisis_Repair)

**Level of Care: Critical Access Hospital**

**EPA: Appropriately resuscitate child, place bowel into a silo, transfer level of care.**

Exposed viscera should be covered, warm, and moist (placed in a bowel bag or plastic wrap); bowel should be monitored to assure mesentery is not kinked; child can be placed on his or her side to facilitate better perfusion.

Fluid Resuscitation:

Good IV access obtained; will need PICC/TPN if available.

Normal saline bolus of 10 ml/kg followed by maintenance at standard rate and close monitoring of urine output (understand that historically large volume resuscitation was recommended, but new data shows that this is counterproductive).

How is a silo placed? Preformed, spring-loaded vs. suturing silastic to the fascial edges.

Suspect silo above patient so as not to compromise blood supply.

Transfer to higher level of care.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829195/all/Gastroschisis\\_Repair](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829195/all/Gastroschisis_Repair)

**Level of Care: Community Hospital**

**EPA: Appropriately resuscitate child, place bowel into a silo, transfer level of care.**

Same as above.

## **Level of Care: Humanitarian/Deployed Environment**

### **EPA: Appropriate initial bowel coverage followed by choice of definitive surgical repair.**

Initial silo reduction followed by closure.

Serial silo reductions followed by closure.

Closure Technique Options:

Formal fascial closure with absorbable suture — understand that this is an option, but it can cause abdominal compartment syndrome that might compromise perfusion and/or ventilation.

Sutureless closure — umbilical cord remnant can be placed over the bowel once it is reduced, followed by a nonstick dressing and an adhesive on top. Steri strips are another option that can be used to close the skin defect as well.

### **EPA: Appropriately direct postoperative care after closure.**

Understand the importance of parenteral nutrition; intestinal motility is significantly impaired in these children, and time to full feeds averages three (3) weeks in the “simple” gastroschisis patient. Also, understand that initiating enteral feeds as soon as possible has been shown to reduce hospital length of stay.

### **EPA: Recognize and treat complications after closure.**

Clinical Considerations:

Abdominal compartment syndrome — how to prevent it and what to do if you are concerned about it.

Suspected atresia — understand initial management is the same as above. Get bowel covered and abdominal wall closed. Can perform laparotomy to repair the atresia one (1) month later. If not suspected but child is not having appropriate bowel function by three (3) to four (4) weeks, investigation with contrast studies (if available) or laparotomy would be indicated.

Recognizing necrotizing enterocolitis (NEC) — 10-15% of these babies may develop NEC; bowel rest and antibiotics vs. surgical indications.

# APSA Rural Surgery Training Curriculum:

## Omphalocele

### All Levels of Care

#### EPA: Recognize the clinical presentation of gastroschisis vs. omphalocele.

##### Clinical Components of Presentation:

An abdominal wall defect in the midline with herniated contents that are covered by a membrane.

The umbilical cord inserts into the omphalocele rather than directly into the abdominal wall.

##### Physical Examination:

Omphalocele should be examined for location, size, and position on the abdominal wall and integrity of the membrane.

One should understand the association of other congenital anomalies and how to work up the child (cardiac, chromosomal, pentalogy of Cantrell), including the association with pulmonary hypoplasia.

##### Differential Diagnosis and Variants:

Hernia of the umbilical cord, giant omphalocele, ruptured omphalocele, associated ectopia cordis.

Understand that the presence of associated anomalies is the strongest predictor of morbidity and mortality.

Understand how to evaluate the child for sufficient, or more likely insufficient, adjacent tissue coverage of the omphalocele.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829059/all/Omphalocele?q=omphalocele>

#### EPA: Medical treatment.

Preoperative Workup: Echocardiogram looking for congenital heart disease, chromosomal analysis.

Understand that the presence of associated anomalies is the strongest predictor of morbidity and mortality.

Non-operative techniques allow an eschar to develop over the sac.

“Paint and wait” approach when appropriate; using silver sulfadiazine, povidone-iodine solutions, silver-impregnated dressings, and neomycin and polymyxin ointments.

**EPA: Options for a ruptured sac.**

Small tears can be sutured or glued with Dermabond.

Large disruptions may require preformed or surgeon-designed silo covering.

**Level of Care: Critical Access Hospital**

**EPA: Appropriately resuscitate child, handle any life-threatening ventilator issues, and transfer level of care.**

**EPA: Options for a ruptured sac.**

See above.

**Level of Care: Community Hospital**

**EPA: Appropriately resuscitate child, handle any life-threatening ventilator issues, and transfer level of care**

See above.

**Level of Care: Humanitarian/Deployed Environment**

**EPA: Understand the medical (“paint and wait”) option vs. formal abdominal wall closure.**

Small to medium-size defects can be closed primarily after birth, while a large (giant) omphalocele may benefit from “paint and wait.”

Immediate Primary Closure: Excise the sac and close the fascia and skin over the abdominal contents. Special care must be taken to avoid injuring the hepatic veins, which may be stuck to the sac superiorly. One must be able to assess for abdominal compartment syndrome and associated worsening ventilation, and know that “paint and wait” is an option.

If liver is out, kinking of hepatic veins upon reduction can lead to cardiovascular collapse, and again, “paint and wait” may be the superior option.

“Paint and Wait”: Sac is painted daily with your choice of escharotic material (silver dressings can be changed every two (2) to three (3) days).

Enteral feeding can be started when appropriate.

Once eschar has formed, the omphalocele and abdomen can be wrapped with a compression bandage to help with slow reduction of abdominal contents back into the abdomen. The resulting large hernia can be addressed years later with component separation techniques and or mesh placement.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829194/all/Omphalocele\\_Repair](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829194/all/Omphalocele_Repair)

# APSA Rural Surgery Training Curriculum:

## Trauma Surgery

### All Levels of Care

**EPA: Recognize, assess, and provide initial management for pediatric patients who are traumatically injured; rapidly recognize the need for transfer to higher level of care as indicated.**

Perform thorough physical examination of pediatric patients.

Demonstrate knowledge of early signs of clinical deterioration and management options.

Demonstrated knowledge of advanced trauma life support (ATLS) and trauma resuscitation in kids (TRIK) principles in the management of pediatric trauma patients.

Assess and prioritize problems for management based upon acuity.

Recognize one's own limitations as well as limitations of the hospital system and seek assistance/transfer as needed.

**EPA: Perform initial trauma resuscitation of traumatically injured children.**

Demonstrate ability to perform a primary survey and resuscitate a pediatric patient focused on the ABCDE principles (airway, breathing, circulation, disability, exposure).

Recognize use of the Broselow tape or other adjuncts for ensuring appropriate size of adjuncts as well as weight-based medication administration.

Demonstrate appropriate knowledge of vital signs by age.

Demonstrate appropriate knowledge of noninvasive hemodynamic monitoring.

Demonstrate appropriate knowledge of initial laboratory evaluation.

Demonstrate appropriate knowledge of initial trauma radiographs (c-spine, CXR, pelvis).

Demonstrate appropriate knowledge of endpoints of resuscitation/stability of patient.

**EPA: Perform initial airway management of traumatically injured children.**

Demonstrate knowledge of physical examination of the airway in pediatric patients.

Demonstrate understanding of signs/symptoms of airway obstruction in pediatric patient.

Demonstrate knowledge of adjuncts, indication for and ability to use for treatment of airway obstruction (nasopharyngeal airway/oropharyngeal airway/bag-valve mask/endotracheal tube/tracheostomy).

Perform at least five (5) of each of these procedures.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of management of traumatically injured pediatric patients with respiratory failure (breathing).**

Perform appropriate focused physical examination.

Obtain and interpret appropriate lab (ABG, chemistry, etc.).

Obtain and interpret appropriate radiographs and ancillary studies (CXR, CT scan, eFAST).

Recognize need for supplemental oxygen and mechanisms available for provision based upon age.

Recognize need for assisted ventilation and show ability to provide assisted ventilation.

Demonstrate knowledge of adjuncts, indications for and ability to use for treatment of respiratory failure in a traumatically injured child (needle decompression, tube thoracostomy).

Recognize appropriate endpoints of resuscitation.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of management of traumatically injured pediatric patients with circulatory failure.**

Perform appropriate focused physical examination.

Recognize and treat life-threatening sources of hemorrhage.

Demonstrate knowledge of adjuncts, indications for and use of adjuncts for circulatory failure (pelvic binder, application of pressure for bleeding, use of tourniquet).

Obtain and interpret appropriate lab (ABG, chemistry, CBC, etc.).

Obtain and interpret appropriate radiographs and ancillary studies as available at your institution (echocardiogram, eFAST, Doppler, ankle/brachial index).

Recognize shock and be able to differentiate between types of shock (neurogenic, cardiogenic, hypovolemic, septic/distributive).

Understand and demonstrate ability to treat shock based upon etiology.

Recognize appropriate endpoints of resuscitation.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of management of traumatically injured pediatric patients with traumatic brain injury (TBI) and neurologic deficits.**

Perform appropriate focused physical examination (GCS based upon age).

Demonstrate ability to initially manage patients with mild, moderate, or severe TBI.

Demonstrate knowledge of when to perform CT scan.

Demonstrate initial management of intracranial hypertension (intubation, sedation, paralysis, hypertonic saline).

Recognize appropriate endpoints of resuscitation.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of fluid resuscitation and transfusion in traumatically injured pediatric patients**

Demonstrate proper knowledge of and ability to obtain large-bore intravenous/intraosseous access in critically ill children.

Demonstrate appropriate knowledge of fluids available for pediatric resuscitation and indications for use.

Demonstrate appropriate understanding of blood products available for pediatric resuscitation and indications for use.

Demonstrate understanding of massive transfusion protocol and indications in pediatric patient.

Demonstrate appropriate volumes of resuscitation based upon weight.

Obtain and interpret appropriate labs (CBC, electrolytes, ABG).

Demonstrate knowledge of complications of fluid resuscitation and transfusion and initial management (electrolyte abnormalities, fluid overload, pulmonary complications, transfusion reactions, etc.).

Demonstrate knowledge of appropriate endpoints of resuscitation.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate appropriate knowledge of secondary survey of traumatically injured patients**

Perform complete physical examination of pediatric trauma patient as part of a secondary assessment.

Obtain and interpret appropriate radiographic studies based upon hospital capabilities (CT scan of abdomen/pelvis, CT scan of chest, etc.).

Demonstrate appropriate use of adjuncts (cervical collar) and ability to clear c-spine when clinically indicated.

Demonstrate knowledge of management of long-bone fractures and ability to stabilize fractures until definitive orthopedic care.

Demonstrate knowledge of appropriate endpoints of resuscitation.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate appropriate knowledge of management of patient for transfer to trauma center**

Demonstrate ability to clearly communicate recognized injuries with accepting trauma center

Demonstrate ability to ensure stability of patient for transfer

Level of Supervision: Participation in the resuscitation of 25 trauma activations.

Resource: ATLS Version 10; Trauma Resuscitation in Kids (TRIK) course.

# APSA Rural Surgery Training Curriculum:

## Neonatal Bowel Obstruction

### All Levels of Care

#### **EPA: Evaluate and diagnose a newborn with obstructive symptoms.**

Differential Diagnosis: Esophageal atresia, duodenal atresia, jejunoileal atresia, colonic atresia, anorectal malformation, Hirschsprung's disease, meconium ileus.

Elements of History: Timing, color of emesis, stool history, maternal exposures, family history.

Elements of Exam: Abdomen, anus, associated VACTERL findings, nasogastric tube.

Utility of Imaging Evaluation: X-ray, ultrasound, UGI, contrast enema.

Pitfalls: Urgency of evaluation for malrotation with volvulus.

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829035/all/Esophageal Atresia and Tracheoesophageal Fistula](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829035/all/Esophageal+Atresia+and+Tracheoesophageal+Fistula)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829038/all/Congenital Duodenal Obstruction?q=atresia+duodenal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829038/all/Congenital+Duodenal+Obstruction?q=atresia+duodenal)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829039/all/Jejunoileal and Colonic Atresia](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829039/all/Jejunoileal+and+Colonic+Atresia)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829049/all/Anorectal Malformations?q=atresia+duodenal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829049/all/Anorectal+Malformations?q=atresia+duodenal)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829048/all/Hirschsprung Disease](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829048/all/Hirschsprung+Disease)

<https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829040/all/Meconium%20Ileus>

#### **EPA: Appropriately direct preoperative care for a newborn with obstructive symptoms.**

Fluid resuscitation, pain management, antibiotic administration.

Transfer Criteria: Considering clinical condition of infant, available resources at institution and duration of transfer.

Treatment Options: Medical vs. surgical for meconium ileus.

**EPA: Appropriately direct postoperative care for a newborn with obstructive symptoms.**

Understand appropriate dosing of nonsteroidal anti-inflammatory pain medication.

Understand appropriate use of narcotics in the postoperative appendicitis patient (rarely required).

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

**EPA: Recognize and treat complications.**

**Level of Care: Humanitarian/Deployed Environment**

**EPA: Safely perform an esophageal atresia repair.**

**EPA: Safely perform a duodenal atresia repair.**

**EPA: Safely perform a jejunoileal or colonic atresia repair.**

**EPA: Safely perform a colostomy for a patient with an anorectal malformation or Hirschsprung's disease.**

**EPA: Safely perform an ileostomy for a patient with meconium ileus.**

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829035/all/Esophageal Atresia and Tracheoesophageal Fistula](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829035/all/Esophageal_Atresia_and_Tracheoesophageal_Fistula)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829038/all/Congenital Duodenal Obstruction?q=atresia+duodenal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829038/all/Congenital_Duodenal_Obstruction?q=atresia+duodenal)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829039/all/Jejunoileal and Colonic Atresia](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829039/all/Jejunoileal_and_Colonic_Atresia)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829049/all/Anorectal Malformations?q=atresia+duodenal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829049/all/Anorectal_Malformations?q=atresia+duodenal)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829048/all/Hirschsprung Disease](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829048/all/Hirschsprung_Disease)

<https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829040/all/Meconium%20Ileus>

# **APSA Rural Surgery Training Curriculum: Hirschsprung's-Associated Enterocolitis**

## **All Levels of Care**

**EPA: Recognize the clinical signs of Hirschsprung's enterocolitis and apply common grading strategies to guide management.**

History and physical examination findings.

Understand infants and children at risk (even postoperatively).

Importance of digital rectal exam.

Consider transfer in the appropriate clinical scenario.

Resuscitation, appropriate utilization of antibiotics, supportive care.

Resource: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5395325/>

**EPA: Perform rectal irrigations promptly for a patient with Hirschsprung's enterocolitis.**

Resource: <https://www.youtube.com/watch?v=UytWybcziUk>

# **APSA Rural Surgery Training Curriculum:**

## **Central Venous Access**

### **Vascular Access**

#### **All Levels of Care**

**EPA: Be able to identify vascular anatomy in pediatric patients and variants. Be able to identify size variation in vessels based upon age and appropriate catheter size.**

Physical examination of pediatric patients.

Size and patency of vessels based upon age. Variation in size of catheters.

**EPA: Be able to identify appropriate catheter type (PICC, Broviac, Hickman, port-a-cath, percutaneous catheter) and indications for use in pediatric patients.**

Understand risks and benefits of various central lines available for pediatric use.

Recognize need for coordination with ancillary services, including hematology/oncology, based on long-term needs of patients.

Recognize size variation in available catheters.

**EPA: Be able to identify and rapidly diagnose complications associated with central line placement and provide appropriate treatment (pneumothorax, bleeding, arterial placement).**

Recognize pneumothorax both intraoperatively with ventilator changes/anesthesia concerns finding on fluoroscopy or postoperatively using chest radiograph.

Recognize and treat bleeding from catheter insertion site and proper use of hemostatic agents.

Recognize arterial placement of central line intraoperatively and prompt removal of wire/line; use of pressure to control arterial insertion site or need for vascular control; and need for consideration of other vein for central line placement.

**EPA: Appropriately direct preoperative assessment for any pediatric patient who requires a central venous line.**

Demonstrate a thorough pediatric history and physical examination with focus on vascular anatomy.

Preoperative Labs: CBC, coagulation profile as indicated by underlying medical condition.

Preoperative Radiographs: Ultrasound to evaluate patency of veins or aberrant venous anatomy as indicated by history.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829031/all/Central%20Venous%20Catheters#28>

**EPA: Appropriately manage postoperative care for any pediatric patient with a central line placed and obtain appropriate adjunct studies.**

Demonstrate appropriate pain control measures.

Demonstrate appropriate knowledge of heparin/saline flushes to maintain line patency.

Demonstrate appropriate use of intraoperative/postoperative radiographs to ensure appropriate placement and rule out complications.

**EPA: Appropriately manage complications while line is in place, including but not limited to infection, bleeding from catheter insertion site, catheter fracture/break, and inability to draw off line or flush.**

Demonstrate appropriate knowledge of TPA or other thrombolytic per institutional policy and modification in pediatric patients.

Demonstrate management of central line infection, including use of appropriate antibiotics, ethanol locks, and/or removal of line as clinically indicated.

Demonstrate use of topical hemostatic agents or other adjuncts to treat late bleeding from central line and workup of bleeding disorders/line dysfunction.

Demonstrate proper use of central line repair kits as clinically indicated and/or needed for line replacement.

Demonstrate knowledge of fibrin sheaths, radiographic studies to evaluate line patency, and migration of line.

Demonstrate understanding of need for central line removal/replacement due to patient growth and noncentral placement.

**EPA: Safely perform a central line placement in a pediatric patient.**

Clinical Steps:

Determine need for sedation/anesthesia/local medication.

Demonstrate proper understanding of anatomy and location of vessels.

Demonstrate appropriate use of adjuncts, including ultrasound and fluoroscopy.

Demonstrate appropriate incision sites based upon type of central line placed.

Demonstrate proper percutaneous/Seldinger technique with use of tunneller, peel-away sheath, and dilator.

Demonstrate understanding of cut-down technique and direct placement using a venotomy.

Demonstrate understanding of proper central line length and how to measure in the operating room.

Demonstrate appropriate methods to ensure line is working adequately.

Demonstrate proper skin closure techniques and fixation of central line.

Demonstrate knowledge of appropriate dressing.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and observation/assisting in five (5) cases in children under five (5).

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829156/all/Vascular\\_Access\\_Procedures](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829156/all/Vascular_Access_Procedures)

**EPA: Appropriately manage central line removal.**

Clinical Steps:

Determine need for sedation/anesthesia/local medication.

Determine need for dissection of cuff, removal of port, and counter incision.

Demonstrate appropriate wound closure.

Level of Supervision: Successful completion under direct supervision with five (5) cases in pediatric patients.

# APSA Rural Surgery Training Curriculum:

## Meckel's Diverticulum

### All Levels of Care

#### EPA: Recognize the clinical signs of Meckel's diverticulitis/hemorrhage.

Clinical Components of Presentation:

History: Painless bleeding, obstruction, diverticulitis, perforation, incidentally found diverticulum.

Physical examination of children, parental reassurance, recognition of peritonitis in child.

Utility of Laboratory Evaluation: CBC, CMP.

Pitfalls: Differential Diagnosis — peptic ulcer, IBD, viral gastroenteritis, intussusception, volvulus, perianal disease causing bleeding (fissures, fistulas), appendicitis, SBO.

Imaging: Role of plain X-ray, ultrasound, and Meckel's Tc99 scan and risks/benefits of each.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829064/all/Meckel\\_Diverticulum?q=meckels](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829064/all/Meckel_Diverticulum?q=meckels)

#### Preoperative Care:

Embryology, recognize other omphalomesenteric duct remnants (umbilical fistula, omphalomesenteric cyst, persistent fibrous cord, umbilical polyp).

Fluid resuscitation, transfusion requirements, pain management, possible antibiotic use.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829061/all/Umbilical\\_Disorders#1](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829061/all/Umbilical_Disorders#1)

#### Surgical Options:

Treatment options, Symptomatic: Surgical (laparoscopic vs. open) — diverticulectomy vs. segmental resection.

Treatment Options, Incidentally Found: Diverticulectomy vs. segmental resection.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel\\_Diverticulum\\_Excision](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel_Diverticulum_Excision)

## Level of Care: Critical Access Hospital

**EPA: Accurately diagnose and safely resuscitate a child with symptomatic Meckel's diverticulum.**

Clinical Steps:

Diagnosis (with labs +/- imaging if available).

Safely resuscitate with IVF and blood if needed, understand transfusion thresholds and requirements.

Know when stable to transfer to definitive care if under age two (2) or if patient exceeds the capabilities of the facility.

Surgical intervention in an older patient:

Level of Supervision: Successful resuscitation (+/- simulated cases) of two (2) cases of perforated or bleeding Meckel's diverticulum.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel\\_Diverticulum\\_Excision](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel_Diverticulum_Excision)

## Level of Care: Community Hospital

**EPA: Safely resuscitate and perform an open and/or laparoscopic diverticulectomy or segmental bowel resection in a child if needed.**

Consider transfer depending on age of the patient, local resources, condition of the patient, and timing of transfer.

Although most patients with bleeding from Meckel's present with anemia, most bleeding is intermittent, and patients are typically hemodynamically stable.

Critical Steps of Surgery: Placement of incision (port placement of laparoscopic); identify Meckel's; bring bowel extracorporeally (if laparoscopic); wedge diverticulectomy or segmental bowel resection; close enterotomy or hand-sewn bowel anastomosis; confirm patency; and management of skin closure.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel\\_Diverticulum\\_Excision](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel_Diverticulum_Excision)

**EPA: Appropriately direct postoperative care for a patient after surgical treatment of Meckel's diverticulum.**

Clinical Considerations: Advancement of diet, intravenous fluids, pain control.

Understands appropriate wound care and activity restrictions postop.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829017/all/Fluid\\_and\\_Electrolytes?q=fluids+intravenous#8](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829017/all/Fluid_and_Electrolytes?q=fluids+intravenous#8)

<https://apsaped surg.org/resources/resources/pain-management/>

**EPA: Recognize and treat complications of diverticulectomy/bowel resection.**

Ileus, small bowel resection, rebleeding.

Wound complications.

### **Level of Care: Humanitarian/Deployed Environment**

**EPA: Safely resuscitate and perform an open diverticulectomy or segmental bowel resection**

Clinical Steps: Placement of incision; identify Meckel's; wedge diverticulectomy or segmental bowel resection; close enterotomy or hand-sewn bowel anastomosis; confirm patency; and management of skin closure.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel\\_Diverticulum\\_Excision](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829198/all/Meckel_Diverticulum_Excision)

**EPA: Recognize and treat complications of diverticulectomy/bowel resection.**

Ileus, small bowel resection, rebleeding.

Wound complications.

# APSA Rural Surgery Training Curriculum:

## Malrotation

### All Levels of Care

**EPA: Evaluate bilious vomiting in a newborn or young child to determine if this represents intestinal malrotation.**

Clinical Signs of Malrotation: Bilious emesis, irritability.

Physical Exam: Assessment for peritonitis, evidence of sepsis/lethargy.

Differential Diagnosis: Distal newborn bowel obstruction, septic ileus, gastroenteritis.

Laboratory and radiology evaluation: Laboratory evaluation to determine electrolyte abnormalities requiring correction.

Plain X-ray to determine presence of distal intestinal obstruction (if found, would consider contrast enema first). If normal or gasless, would proceed with upper GI.

Upper GI to determine position of ligament of Treitz — false positives (distended stomach, etc.).

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829042/all/Malrotation#27>

### Level of Care: Critical Access Hospital and Community Hospital

**EPA:** Critically assess patient with malrotation and consider transfer vs. immediate surgery, taking into consideration the clinical status of the patient, the institutional resources available, and the time to transfer.

**EPA:** If needed, perform a laparotomy and detorsion of volvulus. Transfer patient postoperatively.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829176/all/Ladd\\_Procedure\\_for\\_Malrotation](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829176/all/Ladd_Procedure_for_Malrotation)

### Level of Care: Humanitarian/Deployed Environment

**EPA:** Perform a Ladd's procedure as indicated for a patient with malrotation/midgut volvulus.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829176/all/Ladd\\_Procedure\\_for\\_Malrotation](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829176/all/Ladd_Procedure_for_Malrotation)

**EPA: Manage postoperative care in an infant with malrotation/midgut volvulus.**

Pain control, bowel rest, and fluid replacement for NG losses.

Counsel family on long-term complications — adhesive bowel obstructions.

Resource: *APSA Handbook of Pediatric Surgical Critical Care*

[https://secureservercdn.net/192.169.220.85/l3a.3ad.myftpupload.com/wp-content/uploads/2020/09/APSAHandbookofSurgicalCriticalCare\\_Jun52014.pdf](https://secureservercdn.net/192.169.220.85/l3a.3ad.myftpupload.com/wp-content/uploads/2020/09/APSAHandbookofSurgicalCriticalCare_Jun52014.pdf)

# **APSA Rural Surgery Training Curriculum:**

## **Necrotizing Enterocolitis (NEC)**

**Note: Low Birthweight/Preterm infants not expected to have inpatient neonatal care at a critical access hospital or in a deployed/humanitarian environment**

### **Level of Care: Community Hospital**

#### **EPA: Recognize clinical signs and appropriate workup of NEC.**

Risk Factors for NEC: Maternal preeclampsia, inhibitors of gastric secretion, infection (sepsis, pneumonia, UTI) in very low birth weight population, prematurity, prolonged empirical antibiotic treatment, congenital heart defects, and transfusion-associated NEC.

Clinical Symptoms of NEC: Emesis, hematochezia, feeding intolerance, bradycardia or apnea episodes, temperature instability.

Physical Exam: Abdominal distension, tenderness to palpation, abdominal wall discoloration, visible bowel loops.

Utility of Lab Evaluation: CBC — neutropenia and thrombocytopenia; BMP, inflammatory markers — metabolic acidosis.

Differential Diagnoses: Pyloric stenosis, duodenal atresia, malrotation with or without midgut volvulus.

Imaging: Role of imaging and ability to recognize specific findings of NEC; abdominal KUB (anteroposterior and left lateral decubitus views); bowel distension; pneumatosis intestinalis; portal vein gas; pneumoperitoneum; intraperitoneal fluid; persistent dilated loops; ultrasound; and UGI.

#### **EPA: Appropriately direct non-operative management of NEC.**

Mainstay of Treatment: Bowel rest; TPN; bowel decompression with sump gastric tube; IV fluid resuscitation for seven (7) to 14 days; initiation of broad-spectrum antibiotics; + anti-fungal therapy if NEC treatment prolonged.

Serial Labs: CBC, BMP, blood gas, CRP.

Radiologic Studies: KUB every six (6) to eight (8) hours until stable and/or improving.

#### **EPA: Appropriately recognize indications for operative management.**

Be able to articulate the different absolute vs. relative indications for surgical intervention.

Understand and ability to explain risks and benefits of drain placement.

Transfer considerations.

**EPA: Safely perform placement of peritoneal drain in extremely low birth weight neonates with plan for post-procedure transfer to a pediatric surgeon/level III NICU.**

Clinical Steps: Placement of incision; placement of drain avoiding liver; and obtaining comfort with operating on low birth weight patients

Level of Supervision: Observe/assist in five (5) cases in patients < 1,500 g

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829043/all/Necrotizing\\_Enterocolitis](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829043/all/Necrotizing_Enterocolitis)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829044/all/Spontaneous\\_Intestinal\\_Perforation?q=NEC](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829044/all/Spontaneous_Intestinal_Perforation?q=NEC)

# APSA Rural Surgery Training Curriculum:

## Testicular Torsion

### All Levels of Care

**EPA: Be able to identify testicular anatomy in pediatric patients and variants. Be able to identify key structures, including epididymis and location of vessels, to ensure correction of torsion. Be able to identify bell-clapper anomalies and other variations in anatomy.**

Physical examination of pediatric patients.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829669/all/Acute\\_Scrotum](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829669/all/Acute_Scrotum)

**EPA: Be able to rapidly identify the signs and physical exam findings of an acute scrotum. Be able to recognize need for emergent imaging and the need for surgical intervention when imaging is not available or appropriate. Be able to differentiate testicular torsion from other causes of acute scrotum.**

Physical examination of an acute scrotum, including erythema, tenderness, and high-riding testicle.

Provide a differential diagnosis of acute scrotum.

Recognize use of ultrasound in the diagnosis of testicular torsion.

Resources: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829487/all/Testicular%20Torsion>

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829669/all/Acute\\_Scrotum](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829669/all/Acute_Scrotum)

**EPA: Be able to appropriately counsel families regarding the procedure as well as the associated risks.**

**EPA: Safely perform an orchiopexy and orchiectomy as indicated.**

Clinical Steps:

Determine need for anesthesia/local medication.

Demonstrate proper understanding of scrotal anatomy.

Demonstrate either single incision in median raphe or bilateral scrotal incisions.

Demonstrate initial approach and detorsion of affected testicle.

Demonstrate orchiopexy of contralateral testicle.

Demonstrate ability to differentiate ischemic/necrotic testicle and steps to improve blood flow.

Demonstrate either orchiectomy or orchiopexy, based upon findings.

Demonstrate appropriate closure of scrotal incisions.

Level of Supervision: Successful completion under direct supervision with five (5) cases.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829651/all/Scrotal Exploration for Torsion](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829651/all/Scrotal_Exploration_for_Torsion)

**EPA: Appropriately manage postoperative care for any pediatric patient who has undergone orchiectomy or orchiopexy for testicular torsion.**

Demonstrate appropriate pain control measures.

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

# APSA Rural Surgery Training Curriculum:

## Intussusception

### All Levels of Care

**EPA: Recognize the clinical signs and diagnose intussusception in children and the impact of age and location of the intussusception on management.**

Clinical Components of Presentation: Duration of symptoms.

Physical Examination of Children under Age Five (5): Distraction techniques, comfort, parental presence.

Utility of Laboratory Evaluation: CBC, CMP.

Pitfalls: Differential Diagnosis — viral gastroenteritis, appendicitis, ovarian torsion.

Imaging: Utilization of ultrasound — high specificity and sensitivity, can be done by general radiologist.

Resources: <https://www.uptodate.com/contents/intussusception-in-children>

<https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829041/all/Intussusception>

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute\\_Abdominal\\_Pain](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute_Abdominal_Pain)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute\\_Abdominal\\_Pain?q=ultrasound#13.7](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute_Abdominal_Pain?q=ultrasound#13.7)

**EPA: Demonstrate appropriate resuscitation and medical management of a child with intussusception.**

Fluid resuscitation, pain management, antibiotic administration (usually not needed).

Clinical assessment for peritonitis/intestinal perforation or necrosis; antibiotics and urgent surgery required.

**EPA: Understand how location of intussusception affects management**

Small-bowel/Small Bowel Intussusception: Often an incidental finding in children with viral infections. No intervention or follow-up imaging needed if clinically improves; however, if they do not improve, consider causes of pathologic lead points, such as Henoch-Schonlein purpura, Peutz-Jeghers syndrome, or Meckel's diverticulum. Surgery often required for these — laparoscopic vs. open reduction and diverticulectomy as appropriate.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829064/all/Meckel\\_Diverticulum](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829064/all/Meckel_Diverticulum)

**EPA: Understand how age of the patient of intussusception affects management.**

For children older than five (5), a pathologic lead point should be strongly considered (Meckel's diverticulum or intestinal lymphoma, usually B cell).

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829678/all/Gastrointestinal\\_Tumors](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829678/all/Gastrointestinal_Tumors)

**EPA: Understand need for transfer vs. need for immediate surgery based on location and limitations of your facility.**

Ileocolic intussusception can usually be treated non-operatively with enema reduction. More likely to be successful if done by pediatric radiologist. If one isn't available and the patient is stable, expeditious transfer should be considered.

For infants and toddlers, a pediatric anesthesiologist should perform general anesthesia for intestinal obstruction. If one isn't available, the patient is stable, and surgical intervention is likely, expeditious transfer should be strongly considered.

**EPA: Perform surgical management as needed on a patient with ileocolic intussusception.**

Open:

Consider location of incision — right lower quadrant vs. midline (consider if intussusception in transverse colon or beyond).

Technique of manual reduction — push vs. pull.

Assessment of bowel viability.

Appearance of mesentery — often thickened with enlarged nodes. Do not biopsy or remove

Assessment for pathologic lead point — look for Meckel's; in general, do not open bowel for IC intussusception unless resection required.

If resection needed, primary anastomosis usually possible; ileostomy creation rarely required.

Technique

Laparoscopic (depending on availability of equipment):

Laparoscopic reduction.

Inspection of viability of bowel laparoscopically.

Need for incidental appendectomy (not usually done).

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829041/all/Intussusception>

**EPA: Appropriately direct postoperative care for a child with intussusception.**

Understand risk of recurrence after operative/enema reduction.

Understand management of recurrence:

Repeat enema.

**Level of Care: Critical Access Hospital**

**EPA: Diagnose, resuscitate, and strongly consider transfer in a patient with intussusception to a higher level of care.**

Fluid resuscitation, antibiotics (if needed), diagnosis with ultrasound, clinical assessment for intestinal ischemia or perforation.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Abdominal%20Pain%20-%20infant%20\(one%20month%20to%20one%20year\)%2C%20toddler%20\(one%20to%20five%20years\)%2C%20preschooler#27](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Abdominal%20Pain%20-%20infant%20(one%20month%20to%20one%20year)%2C%20toddler%20(one%20to%20five%20years)%2C%20preschooler#27)

**Level of Care: Community Hospital**

**EPA: Safely perform open or laparoscopic reduction of intussusception in a pediatric patient, convert to resection if needed and if appropriate anesthesia and nursing support are available.**

Clinical Steps: See above for open procedure.

Generally three (3) ports for laparoscopic.

Utilization of laparoscopic instruments to reduce:

Intraoperative assessment of intestinal viability.

Conversion to open bowel resection if needed.

Obtain comfort working in limited operating space.

Understand appropriate settings for the CO2 insufflation and troubleshooting for loss of pneumoperitoneum in an infant or toddler.

Level of Supervision: Successful completion under direct supervision with two (2) cases.

**EPA: Postoperative management.**

Fluid management in infants and toddlers following laparotomy:

Replace nasogastric losses (if needed).

Maintenance fluids.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829017/all/Fluid\\_and\\_Electrolytes?q=fluids#8](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829017/all/Fluid_and_Electrolytes?q=fluids#8)

Pain management:

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

**Level of Care: Humanitarian/Deployed Environment**

**EPA: Safely perform an open exploration for intussusception/bowel resection as needed in a pediatric patient with intussusception.**

Clinical Steps:

Can consider on-the-table air enema to reduce partially and/or completely.

Right lower quadrant vs. midline incision depending on length of intussusception.

Push vs. pull to reduce.

Assessment of bowel and mesentery — thickened mesentery with enlarged nodes does not mandate resection.

If unable to reduce, then resect.

Primary Anastomosis: Technique.

Need for Appendectomy: Should consider this if a right lower quadrant incision is used.

Level of Supervision: Successful completion under direct supervision with one (1) case.

## **EPA: Postoperative management**

Fluid management in infants and toddlers following laparotomy:

Replace nasogastric losses (if needed).

Maintenance fluids.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829017/all/Fluid\\_and\\_Electrolytes?q=fluids#8](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829017/all/Fluid_and_Electrolytes?q=fluids#8)

Pain management:

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

# APSA Rural Surgery Training Curriculum:

## Critical Care

### All Levels of Care

**EPA: Recognize, assess, and provide initial management for pediatric patients who are critically ill. Rapidly recognize the need for transfer to higher level of care as indicated.**

Perform thorough physical examination of pediatric patients.

Demonstrate knowledge of early signs of clinical deterioration and management options.

Assess and prioritize problems for management based upon acuity.

Recognize one's own limitations as well as limitations of hospital system and seek assistance/transfer as needed.

**EPA: Perform initial resuscitation of critically ill children.**

Demonstrate ability to resuscitate a pediatric patient focused on the ABCs (airway, breathing, circulation).

Recognize use of the Broselow tape or other adjuncts for ensuring appropriate size of adjuncts, as well as weight-based medication administration.

Demonstrate appropriate knowledge of vital signs by age.

Demonstrate appropriate knowledge of endpoints of resuscitation/stability of patient.

**EPA: Demonstrate facility with initial procedures for management of critically ill children.**

Demonstrate appropriate knowledge of noninvasive hemodynamic monitoring.

Demonstrate facility with bag-valve-mask (BVM) ventilation.

Demonstrate facility with oropharyngeal airway/nasopharyngeal airway insertion.

Demonstrated facility with chest compressions and defibrillation.

Demonstrate ability to place intraosseous needle.

Demonstrate ability to place chest tube/tube thoracostomy.

Demonstrate ability to place central venous line.

Demonstrate ability to place arterial line.

Demonstrate ability to place Foley catheter.

Demonstrate ability to place nasogastric tube.

Perform five (5) of each with direct observation.

**EPA: Demonstrate knowledge of management of patients with respiratory failure.**

Perform appropriate focused physical examination.

Obtain and interpret appropriate lab (ABG, chemistry, etc.).

Obtain and interpret appropriate radiographs (CXR, CT scan).

Recognize need for supplemental oxygen and mechanisms available for provision based upon age.

Recognize need for assisted ventilation and show ability to provide assisted ventilation.

Begin initial therapy for underlying conditions that led to respiratory failure, including, but not limited to, cardiac disease, pneumonia, pneumothorax, and airway foreign body.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of management of patients with cardiac failure.**

Perform appropriate focused physical examination.

Obtain and interpret appropriate lab (ABG, chemistry, CBC, etc.).

Obtain and interpret appropriate radiographs and ancillary studies as available at your institution (CXR, CT scan, echocardiogram).

Recognize need for supplemental oxygen and mechanisms available for provision based upon age.

Recognize shock and be able to differentiate between types of shock (neurogenic, cardiogenic, hypovolemic, septic/distributive).

Understand and demonstrate ability to treat shock based upon etiology.

Understand the role of inotropes and vasopressors in the management of critically ill children.

Begin initial therapy for management of underlying conditions that led to circulatory failure.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of management of patients with sepsis.**

Demonstrate ability to accurately diagnose and recognize clinical signs of sepsis in children.

Demonstrate knowledge of management of septic children using Surviving Sepsis Campaign.

Demonstrate ability to obtain initial laboratory evaluation (blood culture, CBC, lactate, CRP, etc.).

Demonstrate ability to rapidly provide initial empiric antibiotic therapy within one (1) hour.

Demonstrate proper understanding and ability to provide fluid resuscitation.

Demonstrate proper understanding and ability to provide vasopressor therapy.

Recognize need for and ability to obtain source control when indicated.

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of fluid resuscitation and transfusion in pediatric patients.**

Demonstrate proper knowledge of and ability to obtain intravenous/intraosseous access in critically ill children.

Demonstrate appropriate knowledge of fluids available for pediatric resuscitation and indications for use.

Demonstrate appropriate understanding of blood products available for pediatric resuscitation and indications for use.

Demonstrate appropriate volumes of resuscitation based upon weight.

Obtain and interpret appropriate labs (CBC, electrolytes, ABG).

Demonstrate knowledge of appropriate endpoints of resuscitation.

Demonstrate knowledge of complications of fluid resuscitation and transfusion and initial management (electrolyte abnormalities, fluid overload, pulmonary complications, transfusion reactions, etc.).

Recognize need for transfer to higher echelon of care and ensure appropriate communication.

Recognize when patient is stable for transfer.

**EPA: Demonstrate knowledge of adjuncts of critical care management in pediatric patients.**

Demonstrate knowledge of basic trauma principles as appropriate (outline in Trauma EPA).

Demonstrate knowledge of sedative medications for pediatric patients and appropriate dosing and indications for use.

Demonstrate knowledge of analgesic medications for pediatric patients and appropriate dosing and indications for use.

Resource: *APSA Handbook of Pediatric Surgical Critical Care*

[https://securereservercdn.net/192.169.220.85/l3a.3ad.myftpupload.com/wp-content/uploads/2020/09/APSAHandbookofSurgicalCriticalCare\\_Jun52014.pdf](https://securereservercdn.net/192.169.220.85/l3a.3ad.myftpupload.com/wp-content/uploads/2020/09/APSAHandbookofSurgicalCriticalCare_Jun52014.pdf)

# APSA Rural Surgery Training Curriculum:

## Circumcision

### All Levels of Care

#### **EPA: Determine the indication for circumcision.**

History and physical examination of pediatric patients as key components for diagnosis.

Counsel families about the risks and benefits of circumcision.

Understand the anatomy and rule out additional disorders (hypospadias, corti, UDT, inguinal hernia, etc.).

#### **EPA: Discuss appropriate hygiene and medical management for uncircumcised boys.**

Use of topical steroids.

Proper retraction of foreskin.

#### **EPA: Safely perform circumcision**

Clinical Steps:

Determine appropriate setting for procedure (office vs. OR/procedure room).

Demonstrate use of Plastibell, Gomco clamp, or free-hand technique. Determine correct selection of technique based on patient's age.

Level of Supervision: Successful completion under direct supervision with two (2) cases in children.

#### **EPA: Manage postoperative care following circumcision.**

Recognize proper timing for Plastibell to fall off and/or sutures falling off.

Discuss postoperative care immediately following circumcision.

Recognize wound complications, hematoma, and retraction. Seek appropriate providers to assist with management of postoperative complications.

Level of Supervision: Assists with circumcision of at least five (5) boys.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829488/all/Circumcision?q=circumcision>

# APSA Rural Surgery Training Curriculum:

## Umbilical Hernia > 5 Years

### All Levels of Care

**EPA: Understand that umbilical hernias are quite common and should never be repaired before the age of four (4) or five (5) years, with the exception of a child who presents with a painful or incarcerated hernia.**

Clinical Components of Presentation:

History: Rarely incarcerate, rarely a cause of chronic abdominal complaints; often a source of parental anxiety; majority will close spontaneously by the age of four (4).

Physical Examination: How large is the fascial defect? Is there a large amount of excess overlying skin (proboscis) that may warrant correction from a cosmetic standpoint at the same time as hernia repair?

Utility of Laboratory Evaluation: None.

Imaging: None.

Pitfalls: Differential diagnosis — be able to identify an epigastric hernia and possibly a urachal remnant; Repair younger than four (4) is often unnecessary and has increased risk of recurrence.

Resources: [Umbilical Hernia | Pediatric Surgery NaT \(pedsurglibrary.com\)](https://www.pedsurglibrary.com/apsa/view/Pediatric-surgery-NaT/829062/all/Umbilical_Hernia)

[www.pedsurglibrary.com/apsa/view/Pediatric-surgery-NaT/829062/all/Umbilical\\_Hernia](https://www.pedsurglibrary.com/apsa/view/Pediatric-surgery-NaT/829062/all/Umbilical_Hernia)

APSA – Standardized Toolbox of Education for Pediatric Surgery (STEPS): Hernias  
[https://secureservercdn.net/192.169.220.85/l3a.3ad.myftpupload.com/wp-content/uploads/2020/10/STEPS\\_Hernias.pdf](https://secureservercdn.net/192.169.220.85/l3a.3ad.myftpupload.com/wp-content/uploads/2020/10/STEPS_Hernias.pdf)

**EPA: Safely perform an open umbilical hernia repair in a child older than four (4), understanding that this is elective.**

General anesthesia, pain management with direct infiltration vs. rectus sheath block.

Antibiotic Administration: None needed.

Clinical Steps: Curvilinear incision in a skin crease below the umbilicus; excision of the hernia sac; repair of the fascial defect with absorbable suture; and imbrication of umbilical skin.

Level of Supervision: Successful completion under direct supervision with two (2) cases.

Resources: Suresh S, Schaldenbrand K, Wallis B, De Oliveira GS Jr. Regional anaesthesia to improve pain outcomes in paediatric surgical patients: a qualitative

systematic review of randomized controlled trials. Br J Anaesth. 2014 Sep;113(3):375-90. doi: 10.1093/bja/aeu156. PMID: 24907283.

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829196/all/Umbilical\\_Hernia\\_Repair](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829196/all/Umbilical_Hernia_Repair)

Understand the best way to deal with the proboscis: Umbilicoplasty or not.

Resources: Southwell-Keely JP, Berry MG. Umbilical reconstruction: a review of techniques. J Plast Reconstr Aesthet Surg. 2011 Jun;64(6):803-8. doi: 10.1016/j.bjps.2010.11.014. PMID: 21145300.

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829196/all/Umbilical\\_Hernia\\_Repair](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829196/all/Umbilical_Hernia_Repair)

**EPA: Appropriately direct postoperative care.**

Clinical Considerations: Outpatient surgery that doesn't require narcotics.

Understand appropriate dosing of nonsteroidal anti-inflammatory pain medication.

Understand appropriate use of narcotics in the postoperative appendicitis patient (rarely required).

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

**EPA: Recognize and treat complications of umbilical hernia repair.**

Recurrence, wound infection, bowel injury.

## **APSA Rural Surgery Training Curriculum: Non-Incarcerated Inguinal Hernia > 2 Years**

### **All Levels of Care**

#### **EPA: Be able to diagnose inguinal hernias in boys and girls.**

History and physical examination of pediatric patients as key components for diagnosis:  
Jump/cough and other techniques to visualize hernia.

Determine when ultrasound imaging is required.

Reduce a non-incarcerated inguinal hernia.

Distinguish hydrocele from inguinal hernia.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal\\_Hernia?q=hernia+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal_Hernia?q=hernia+inguinal)

#### **EPA: Discuss differences in etiology and management of pediatric hernias compared to adult hernias**

Patent processus vaginalis.

Repair with high ligation and no mesh.

Need to explore the contralateral groin at the time of repair.

Discuss risk of incarceration and timing of repair.

Understand risks and benefits of hernia repair.

#### **EPA: Manage postoperative care following inguinal hernia repair**

Recognize wound complications, hematoma, ischemic orchitis, acquired cryptorchidism, and recurrent hernia.

Determine the appropriate postoperative pain regimen and dosing (no narcotics).

Determine the appropriate activity restrictions.

### **All Levels of Care**

#### **EPA: Safely perform an open inguinal hernia repair in a pediatric patient.**

Clinical Steps: Placement of incision; identify the correct layers; dissect hernia sac and cord structures; isolate hernia sac with dissection up to the internal ring; open and inspect hernia sac; high ligation; and management of distal sac/hydrocele.

Level of Supervision: Successful completion under direct supervision with five (5) cases in older children and five (5) cases in children under five (5).

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal%20Hernia%20and%20Hydrocele%20Repair>

### **Level of Care: Community Hospital**

**EPA: When indicated, also safely perform contralateral groin exploration.**

Clinical Steps: Laparoscopic exploration through inguinal hernia sac using 5 mm or 3 mm trocar and scope, identifying contralateral inguinal hernia.

Level of Supervision: Successful completion under direct supervision with two (2) cases in older children and two (2) cases in children under five (5).

# **APSA Rural Surgery Training Curriculum: Non-Incarcerated Inguinal Hernia < 2 Years**

## **All Levels of Care:**

### **EPA: Be able to diagnose inguinal hernias in boys and girls.**

History and physical examination of pediatric patients as key components for diagnosis:  
Ex-premature infant, EGA, jump/cough, and other techniques to visualize hernia.

Determine when ultrasound imaging is required.

Reduce a non-incarcerated inguinal hernia.

Distinguish hydrocele from inguinal hernia.

### **EPA: Discuss differences in etiology and management of pediatric hernias compared to adult hernias.**

Patent processus vaginalis.

Repair with high ligation and no mesh.

Need to explore the contralateral groin at the time of repair.

Discuss risk of incarceration and timing of repair.

Understand risks and benefits of hernia repair.

Discuss anesthetic concerns and criteria for overnight admission.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829066/all/Inguinal%20Hernia%252FHydrocele#27>

## **Level of Care: Critical Access Hospital**

**EPA:** Should transfer patients to the appropriate setting.

## **Level of Care: Humanitarian/Deployed Environment or Community Hospital**

**EPA: Safely perform an open inguinal hernia repair in an infant/toddler with inguinal hernia.**

Clinical Steps: Reduction of hernia under anesthesia; placement of incision; identify the correct layers; dissect hernia sac and cord structures; isolate hernia sac with dissection up to the internal ring; open and inspect hernia sac; high ligation; and management of distal sac/hydrocele.

Level of Supervision: Successful completion under direct supervision with five (5) cases in children under two (2) years.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal\\_Hernia\\_and\\_Hydrocele\\_Repair?q=hernia+inguinal](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829200/all/Inguinal_Hernia_and_Hydrocele_Repair?q=hernia+inguinal)

**EPA: Manage postoperative care following inguinal hernia repair.**

Recognize and manage complications, hematoma, ischemic orchitis, acquired cryptorchidism, and recurrent hernia.

Determine the appropriate postoperative pain regimen and dosing (no narcotics).

# **APSA Rural Surgery Training Curriculum: Undescended Testicle**

## **Level of Care: Critical Access Hospital or Community Hospital**

**EPA:** Should transfer patients to the appropriate setting.

## **Level of Care: Humanitarian/Deployed Environment**

**EPA: Be able to identify testicular anatomy in pediatric patients and variants. Be able to identify location of testicle based upon physical exam. Be able to recognize variants, including retractile testicle.**

Physical examination of pediatric patients.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829144/all/Undescended%20testis#28>

**EPA: Be able to recognize appropriate timing for repair of undescended testicles and ancillary studies.**

Recognize use of ultrasound in the management of undescended testicle.

**EPA: Be able to appropriately counsel families regarding the procedure as well as the associated risks.**

**EPA: Safely perform an orchiopexy and orchiectomy as indicated for inguinal undescended testicle.**

Clinical Steps:

Determine need for anesthesia/local medication.

Demonstrate proper understanding of inguinal and scrotal anatomy.

Demonstrate proper steps of inguinal orchiopexy.

Demonstrate proper understanding of testicular anatomy.

Demonstrate techniques for gaining length on the spermatic cord.

Demonstrate appropriate techniques for hernia repair.

Demonstrate appropriate techniques for fixation of the testicle in the scrotum.

Demonstrate appropriate technique for closure.

Demonstrate appropriate management for testicular remnant/nubbin.

Level of Supervision: Successful completion under direct supervision with five (5) cases.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829144/all/Undescended%20testis#28>

**EPA: Safely perform an intra-abdominal orchiopexy and orchiectomy as indicated for inguinal undescended testicle.**

Clinical Steps:

Determine need for anesthesia/local medication.

Demonstrate proper understanding of intra-abdominal, inguinal, and scrotal anatomy.

Demonstrate proper steps to obtain length of an intra-abdominal testicle.

Demonstrate knowledge of Fowler-Stevens technique.

Demonstrate appropriate techniques for hernia repair.

Demonstrate appropriate techniques for fixation of the testicle in the scrotum as appropriate.

Demonstrate appropriate technique for closure.

Demonstrate appropriate management for testicular remnant/nubbin.

Demonstrate knowledge of time period between stages and need for reoperation.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829144/all/Undescended%20testis#28>

**EPA: Appropriately manage postoperative care for any pediatric patient who has undergone elective orchiopexy for undescended testis.**

Demonstrate appropriate pain control measures.

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

# **APSA Rural Surgery Training Curriculum:**

## **Gastrostomy Tube: Chronic Management**

### **All Levels of Care**

#### **EPA: Understand the different types of gastrostomy devices.**

Distinguish a tube from a button.

Distinguish a gastrostomy from a gastrojejunostomy.

Distinguish inflatable from noninflatable gastrostomy.

#### **EPA: Understand the different insertion techniques for gastrostomy devices.**

Distinguish percutaneous, laparoscopic, and open.

Resource: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829159/all/Enteral\\_Access\\_Procedures](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829159/all/Enteral_Access_Procedures)

#### **EPA: Recognize and treat complications.**

Manage early or late accidental tube dislodgement.

Manage granulation tissue.

Manage buried bumper syndrome.

Manage leakage around the tube.

Manage gastrocutaneous fistula.

### **Level of Care: Critical Access Hospital and Community Hospital**

#### **EPA: Remove and replace a gastrostomy device.**

#### **EPA: Apply silver nitrate to granulation tissue.**

Resource:

[https://www.pedsurglibrary.com/apsa/view/PedSurg%20Resource/1884018/all/Enteral\\_Access?q=gastrostomy](https://www.pedsurglibrary.com/apsa/view/PedSurg%20Resource/1884018/all/Enteral_Access?q=gastrostomy)

# APSA Rural Surgery Training Curriculum:

## Cholecystitis

### All Levels of Care

#### **EPA: Recognize the clinical signs of cholecystitis in children over age five (5).**

Differential Diagnosis: Biliary colic, cholecystitis, choledocholithiasis, cholangitis.

Utility of Laboratory Evaluation: CBC, CMP.

Utility of Imaging Evaluation: Ultrasound, HIDA, MRCP, ERCP.

Pitfalls: Identification of common bile duct stones.

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829468/all/Gallbladder\\_Disease](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829468/all/Gallbladder_Disease)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829621/all/Biliary\\_Dyskinesia](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829621/all/Biliary_Dyskinesia)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute\\_Abdominal\\_Pain](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829151/all/Acute_Abdominal_Pain)

#### **EPA: Appropriately direct preoperative care for cholecystitis in children over age of five (5).**

Fluid resuscitation, pain management, antibiotic administration.

Treatment Options: Medical vs. surgical.

Resources: [https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829468/all/Gallbladder\\_Disease](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829468/all/Gallbladder_Disease)

[https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829621/all/Biliary\\_Dyskinesia](https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829621/all/Biliary_Dyskinesia)

#### **EPA: Appropriately direct postoperative care for cholecystitis in children over age of five (5).**

Understand appropriate dosing of nonsteroidal anti-inflammatory pain medication.

Understand appropriate use of narcotics in the postoperative appendicitis patient (rarely required).

Resource: <https://apsaped surg.org/resources/resources/pain-management/>

**EPA: Recognize and treat complications of cholecystitis.**

Management of bile leaks.

Management of retained stones.

Management of biliary stricture.

**Level of Care: Critical Access Hospital or Community Hospital**

**EPA: Safely perform laparoscopic cholecystectomy in a pediatric patient over age of five (5) with cholecystitis.**

Clinical Steps: Four-port cholecystectomy utilizing adult-size laparoscopic instruments and trocars.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829620/all/Cholecystectomy>

**Level of Care: Humanitarian/Deployed Environment**

**EPA: Safely perform an open cholecystectomy in a pediatric patient with cholecystitis.**

Clinical Steps: Placement of incision, dissection, and ligation of cystic duct.

Resource: <https://www.pedsurglibrary.com/apsa/view/Pediatric-Surgery-NaT/829620/all/Cholecystectomy>