

HANDBOOK OF  
**Pediatric**  
**Surgery**



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# Handbook of Pediatric Surgery

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# Contents

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Cover image

Title page

Copyright

Dedication

Preface

Contributors

## **Section 1 Management of the Pediatric Surgical Patient**

---

Chapter 1 Evaluation and Examination of the Pediatric Surgical Patient

Historical Background

The Examination

Special Considerations

References

Chapter 2 Fluids and Electrolytes in Children

Assessment of Fluid Status

Goals of Fluid Therapy

Causes of Fluid Loss

Estimated Fluid Needs for Infants and Children

Maintenance Electrolytes

Changes in Maintenance Needs

References

## Chapter 3 Surgical Nutrition and TPN in the Pediatric Patient

Introduction

Physiology

Indications for Parenteral Nutrition

How to Prescribe Parenteral Nutrition

Monitoring

Complications

References

## Chapter 4 Pediatric Anesthesia

Relevant Anatomy and Physiology

Pharmacologic Differences

Induction Techniques

Tracheal Intubation

Further Considerations

References

## Chapter 5 Central Venous and Arterial Access in the Pediatric Patient

Relevant Anatomy

Venous Catheters

Percutaneous Technique

Techniques to Confirm Venous Access

Arterial Catheters

Hemodialysis Catheters

Management of Common Complications

References

## Chapter 6 Common Pediatric Drug Dosing

Pharmacokinetics of the Pediatric Patient

Common Antibiotics

Venous Thromboembolism Prophylaxis

Pain Management

Postoperative Nausea and Vomiting

References

## **Section 2 Pediatric Trauma Surgery**

---

### Chapter 7 The Approach to the Pediatric Trauma Patient

Trauma Resuscitation

Primary Survey

Secondary Survey

Tertiary Survey

Signs of Child Abuse

Injury Prevention

References

### Chapter 8 Abdominal and Pelvic Trauma

Initial Management

Indications for Laparotomy

Bowel Injury

Splenic Injury

Liver Injury

Bladder Injury

Pancreatic Injury

References

## Chapter 9 Thoracic Trauma

Relevant Anatomy and Physiology

Epidemiology and Etiology

Common Injury Patterns

Imaging Findings

Surgical Management

References

## Chapter 10 Common Fractures in Children

Bone Physiology

Healing and Remodeling

Distal Radius

Digits

Supracondylar Fractures

Clavicle

Tibia

References

## Chapter 11 Management of the Pediatric Burn Patient

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation and Initial Evaluation

Fluid Management  
Medical and Surgical Treatment  
Postoperative Care  
References

## Chapter 12 Head Trauma in Children

Relevant Anatomy and Physiology  
Epidemiology and Etiology  
Initial Evaluation: History  
Clinical Presentation  
Diagnostic Imaging  
Medical and Surgical Management  
Common Injuries  
References

## Chapter 13 Diagnosis and Management of Child Abuse Injuries

Relevant Anatomy  
Epidemiology and Etiology  
Clinical Presentation  
Screening  
Diagnosis  
Management  
References

## **Section 3 Common Pediatric Surgical Problems**

---

### Chapter 14 Hypertrophic Pyloric Stenosis



Historical Background  
Relevant Anatomy (Figure 14.1)  
Epidemiology and Etiology  
Clinical Presentation  
Diagnosis  
Surgical Management  
Operative Intervention  
Postoperative Care  
References

## Chapter 15 Omphalocele and Gastroschisis

Relevant Anatomy and Terminology  
Etiology and Epidemiology  
Diagnosis  
Preoperative Management  
Surgical Approach  
Postoperative Care  
References

## Chapter 16 Mesenteric, Omental, and Duplication Cysts

Duplication Cysts  
Epidemiology and Etiology  
Clinical Presentation  
Diagnosis  
Surgical Management  
Mesenteric and Omental Cysts  
Epidemiology and Etiology

Clinical Presentation  
Diagnosis  
Surgical Management  
Postoperative Care  
References

## Chapter 17 Gastroesophageal Reflux Disease

Relevant Anatomy  
Epidemiology and Etiology  
Clinical Presentation  
Diagnosis  
Medical Management  
Surgical Management  
Postoperative Care  
References

## Chapter 18 Bariatric Surgery in Children

Historical Background  
Definitions  
Epidemiology and Etiology  
Patient Selection  
Preoperative Workup and Evaluation  
Medical Management  
Surgical Management  
Perioperative Management  
Surgical Interventions  
Postoperative Care

References

## Chapter 19 Gallbladder Disease in Children

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 20 Choledochal Cyst

Historical Background

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 21 Appendicitis

Relevant Anatomy

Etiology and Epidemiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

References

## Chapter 22 Intussusception

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 23 Meckel Diverticulum

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

References

## Chapter 24 Intestinal Atresia

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Epidemiology and Etiology

Postoperative Care

References

## Chapter 25 Malrotation

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 26 Necrotizing Enterocolitis

Historical Background

Pathophysiology

Clinical Presentation

Diagnosis

Initial Management

Operative Treatment

Goals of Operative Treatment

Surgical Technique

Postoperative Care

References

## Chapter 27 Inflammatory Bowel Disease

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

Complications

References

## Chapter 28 Pediatric Abdominal Wall Hernias

Inguinal Hernias

Embryology

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Operative Intervention

Postoperative Care

Umbilical Hernias

Embryology

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Operative Intervention

Postoperative Care

References

## Chapter 29 Meconium Ileus

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Management

Postoperative Care

References

## Chapter 30 Hirschsprung Disease

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

Complications

References

## Chapter 31 Anorectal Malformations

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

References

## Chapter 32 Tracheoesophageal Fistula

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

Complications

References

## Chapter 33 Foreign Body Ingestion

Relevant Anatomy

Epidemiology

Clinical Presentation

Diagnosis

Management

References

## Chapter 34 Congenital Chest Wall Disorders

Pectus Excavatum

Etiology

Symptoms

Management

Open Repair of Pectus Excavatum: (Ravitch Procedure)

Minimally Invasive Repair of Pectus Excavatum: (Nuss Procedure)

Pectus Carinatum

Etiology

Symptoms

Management

Other Congenital Sternal Defects

Ectopia Cordis

Sternal Cleft (aka Bifid Sternum)



References

## Chapter 35 Pulmonary Sequestration

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

References

## Chapter 36 Congenital Diaphragmatic Hernia

Epidemiology and Etiology

Diagnosis

Medical Management

Surgical Approach

Postoperative Care

References

## Chapter 37 Torticollis

Pathophysiology

Clinical Presentation and Diagnosis

Treatment

References

## Chapter 38 Thyroglossal Duct Cysts and Branchial Cleft Cysts

Differential Diagnosis of Head and Neck Masses in Children (Figure 38.1)

Thyroglossal Duct Cyst

Epidemiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

Branchial Cleft Cysts

Epidemiology

Clinical Presentation

Diagnosis

Surgical Management

References

## Chapter 39 Thyroid and Parathyroid Disease

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 40 Cleft Lip and Palate

Relevant Anatomy (Figure 40.1)

Etiology and Epidemiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

Complications

References

## Chapter 41 Breast Disorders and Gynecomastia

Embryology

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

Breast Masses

References

## Chapter 42 Testicular Torsion

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 43 Undescended Testicle

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Operative Intervention

Postoperative Care

References

## Chapter 44 Circumcision

Relevant Anatomy

Epidemiology

Indications and Benefits

Contraindications and Risks

Surgical Management

References

## Chapter 45 Ovarian Torsion

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 46 Extracorporeal Membrane Oxygenation (ECMO)

History of ECMO

Extracorporeal Membrane Oxygenation System

Multiorgan System Management During ECMO

Complications Related to ECMO

Weaning ECMO

References

## Section 4 Pediatric Surgical Oncology

---

### Chapter 47 Wilms Tumor

- Relevant Anatomy
- Epidemiology and Etiology
- Clinical Presentation
- Diagnosis
- Medical and Surgical Management
- Postoperative Care
- Complications
- References

### Chapter 48 Neuroblastoma

- Epidemiology and Etiology
- Embryology
- Pathology
- Risk Factors
- Clinical Presentation
- Diagnosis and Staging
- Treatment
- References

### Chapter 49 Pancreatic Tumors in Children

- Relevant Anatomy
- Epidemiology and Etiology
- Clinical Presentation
- Diagnosis

Surgical Management

Operative Intervention

Postoperative Care

References

## Chapter 50 Hepatic Neoplasms in Children

Epidemiology and Etiology

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 51 Adrenal Tumors in Children

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Operative Intervention

Postoperative Care

References

## Chapter 52 Mediastinal Tumors

Anterior Mediastinum

Middle Mediastinum

Posterior Mediastinum

Most Common Neoplasms

Overview

Presentation

Surgical Intervention

Overview

Presentation

Surgical Intervention

Overview

Presentation

Overview

Presentation

Surgical Intervention

Overview

Presentation

Surgical Intervention

References

## Chapter 53 Tumors of the GI Tract in Children

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Epidemiology and Etiology

Clinical Presentation

Medical and Surgical Management  
Epidemiology and Etiology  
Clinical Presentation  
Medical and Surgical Management  
Epidemiology and Etiology  
Clinical Presentation  
Medical and Surgical Management  
Epidemiology and Etiology  
Clinical Presentation  
Medical and Surgical Management  
Epidemiology and Etiology  
Clinical Presentation  
Medical and Surgical Management  
Other Intestinal Polyps  
References

## Chapter 54 Testicular Tumors in Children

Epidemiology and Etiology  
Clinical Presentation  
Diagnosis  
Medical and Surgical Management  
Surgical Management  
Postoperative Care  
References

## Chapter 55 Ovarian Tumors in Children

Relevant Anatomy



Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Postoperative Care

References

## Chapter 56 Pediatric Orthopedic Tumors

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Osteosarcoma

Ewing Sarcoma Family of Tumors

Osteochondroma

Giant Cell Tumors

Osteoblastoma

Osteoid Osteoma

References

## Chapter 57 CNS Tumors in Children

Relevant Anatomy

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Surgical Management

Preoperative/Perioperative Considerations

Postoperative Care

References

## Chapter 58 Rhabdomyosarcoma

Epidemiology and Etiology

Clinical Presentation

Diagnosis

Medical and Surgical Management

Postoperative Care

References

## Chapter 59 Nevi and Melanoma in Children

Relevant Anatomy

Common Dermatologic Terms

Nevi

Melanocytic Nevi

Melanoma

Risk Factors

Diagnosis

Surgical Approach

Postoperative Care

References

Index

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# Dedication

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*To my family, for always supporting me,*

*To my friends, for always keeping me grounded,*

*To my mentors, for always inspiring me, and*

*To anyone who's ever told me "you can't," for giving me the opportunity to prove "I can."*

***Jessica L. Buicko, MD***

# Preface

---

The treatment of the surgical disorders that affect children is one of the most important and challenging fields in medicine. Children present with symptom complexes and conditions that can be difficult to diagnose and treacherous to manage. Any misdiagnosis or mismanagement of the surgical diseases of pediatric patients can result in decades of disability and a lifetime of unfulfilled potential.

Pediatric surgery is a rapidly evolving field focused on the modern treatment of ancient ailments of children. Only by understanding the applied anatomical and physiological basis of the mechanisms of disease of these maladies can the surgeon deliver the appropriate medical and surgical interventions to correct them. This book is a product of the thoughtful work of the residents and faculty of the Department of Surgery of the University of Miami at the JFK Medical Center in Palm Beach County, Florida, and the members of the Seacrest Surgical Society from around the country.

The book is dedicated to providing a contemporary and comprehensive source of information regarding the care of the pediatric surgery patient. It is focused on being an efficient and readily available resource for surgical residents, pediatric residents, emergency physicians, and medical students. It provides a thorough discussion of the presentation and management of all the major pediatric surgical diseases.

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## SECTION 1

# Management of the Pediatric Surgical Patient

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## CHAPTER 1

# Evaluation and Examination of the Pediatric Surgical Patient

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Nicholas Cortolillo

- Assessment of the pediatric surgical patient requires in-depth knowledge of surgical diseases in children as well as an understanding of the spectrum of pediatric physiology and its derangements across several ages from newborns to infants, children, and adolescents.
- Surgeons and their trainees must also be aware of the unique challenges embedded into pediatric medicine.
- The care plan must take into account the patient, the problem, the anticipated prognosis, and the child's caretaker.<sup>1</sup>
- Substantial anxiety is usually present with the surgical evaluation of a child.
- Trust building with patients and their parent or guardian lays the foundation for an effective evaluation.
- Establishing rapport begins at the initial encounter and continues into the postoperative stages.
- Fears and knowledge gaps should be elicited and addressed by the pediatric surgeon through communication and education.
- Reviewing images, explaining models, and freehand drawings may be helpful toward this goal.
- Surgeons should be prepared to explain topics such as embryologic development, genetics, and oncology in layperson's

terms.

- The size of the incision, the intervention, and the expected postoperative course should all be discussed.

## Historical Background

- An adequate history involves input from both the child and parents and forms the foundation of the relationship to follow.
- The chief complaint (CC) represents the reason why the patient presented for care.
- A history of present illness (HPI) should be methodical and include symptom onset, acuity, progression, severity, associated symptoms, and aggravating or alleviating factors.
- Pertinent positives and negatives should be documented in a thorough review of systems.<sup>2</sup>
- Birth history, developmental milestones, medical conditions, and previous surgeries, or interventions should be listed separately.
- Diligently note any unusual bleeding episodes or known bleeding disorders. Inquire about any previous exposure to anesthesia.<sup>3</sup>
- Review scheduled medications, “as needed” medications, and supplements that the child takes.
- Drug allergies, food allergies, and symptoms that occur with these reactions are important.
- For children with genetic diseases, congenital malformations, or malignancies, the social and family histories are requisite for a complete pediatric presentation.

## The Examination

- Every examination begins and ends with handwashing.
- Not only does this form the foundation for infection control, the routine also nonverbally reassures the parent that the surgeon

promotes hygiene.

- It also helps to warm the surgeon's hands before touching the child.
- The physical examination may be performed according to a standard routine in older and more cooperative children.
- Improvisation and flexibility are required in the approach to young children and infants who may not cooperate.<sup>4</sup>
- Portions of the examination for young children and toddlers may occur within their parents' laps.
- It is advisable to perform the abdominal, rectal, and genital examinations on an examination table.
- Having the parent close by will help to reduce the child's anxiety (Figure 1.1). Infants should always be evaluated on the examination table.



**FIGURE 1.1** The child may feel more secure if the caregiver stays with the child during the physical examination.

(Reprinted with permission from Hatfield NT, Kincheloe CA. *Hatfield*

## Skin

- The pediatric surgeon is frequently asked to evaluate lumps and bumps and skin lesions.
- Complete description of any lesion includes size, shape, mobility, circumscription, and consistency.
- The remaining skin must be assessed for similar lesions, surgical scars, or rashes, which can key into autoimmune disorders or vasculitides.
- Bruises, redundant or irregular scars, and well-defined burns should raise concern for child abuse.<sup>5</sup>

## Lymphatics

- In children, lymphadenopathy is most commonly infectious; therefore, searching for a source of infection in the examination is prudent.<sup>6</sup>
- Bacterial, viral, fungal, and protozoal culprits should be considered.
- Enlarged lymph nodes may represent primary malignancy (acute lymphoblastic leukemia [ALL] and Hodgkin and non-Hodgkin lymphoma) or metastatic malignancy.
- The axillary, cervical, inguinal, and epitrochlear basins are the most frequent locations for lymphadenopathy.

## Head, Ear, Eyes, Nose, and Throat

- Physical examination findings among these organ systems are high-yielding in the pediatric population.



- Scleral icterus may suggest hepatic dysfunction, biliary obstruction, or hemolysis.
- Micro- or macrocephaly may signify an intracranial process.
- Abnormal fusion of coronal sutures is not considered normocephalic.
- Otitis media may be excluded if the tympanic membranes are clear and landmarks are visible.
- An inflamed oropharynx in the setting of rhinorrhea may signify an upper respiratory infection.
- Loose teeth are important to acknowledge for children who are to receive anesthesia.<sup>7</sup>

## Chest Wall

- The evaluation of pectus excavatum (concave) and pectus carinatum (convex) is accompanied with heart and lung examinations.
- Ascertaining the degree of deformity and assessing its psychosocial effects are required.<sup>8</sup>
- Breast tissue is common in infants of both sexes because of a slow decline in maternal hormones in circulation.
- Male adolescents may also experience gynecomastia because of high hormonal activity during puberty.<sup>9</sup>
- In preadolescent girls, breast growth occurs at different rates, so one must be able to distinguish a breast mass from a breast bud.

## Cardiovascular

- Age-appropriate exercise activity and feeding provide functional clues to the child's cardiac status.
- Rate and rhythm should be compared against age-appropriate norms.

- Color and respiratory effort should be assessed.
- The neck should be examined for prominent vessels, abnormal pulsations, and bruits.
- The lungs should be auscultated for crackles or wheezing, features which suggest cardiac asthma or congestive heart failure.
- Likewise, the abdomen should be assessed for hepatomegaly or ascites.
- Capillary refill should be under 3 seconds.
- Pulses in all 4 extremities should be strong and equal; any discrepancy warrants vascular evaluation.
- Many children will have a murmur between infancy and adolescence, most of which are innocent.
- Red flags that increase the likelihood of a pathologic murmur include a holosystolic or diastolic murmur, grade 3 or higher murmur, harsh quality, an abnormal S2, maximal murmur intensity at the upper left sternal border, a systolic click, or increased intensity when the patient stands.<sup>10</sup>

## Lungs

- As in the cardiovascular examination, no layers of clothing should be present between the stethoscope and skin.
- All breath sounds should be clear and equal.
- Wheezes, rhonchi, and crackles are abnormal.

## Abdomen

- A plethora of major pathology may be found here; thus a systematic approach is needed.
- First inspect the abdomen for scars and for shape.
- Scaphoid abdomens may occur in the setting of underfeeding or giant diaphragmatic hernias.

- Abdominal distention can occur secondary to ascites, tumor, intestinal obstruction, or organomegaly.
- Next, auscultate for bowel sounds.
- These may be diminished in peritonitis or high pitched in intestinal obstruction.<sup>11</sup>
- After auscultation, an efficient strategy is to assess for any tenderness with the stethoscope.
- Assess all 4 quadrants starting with the area farthest away from the reported pain.
- Use gentle palpation as you assess for peritoneal signs of rebound and guarding.
- Facial expressions, behavior, and tone or pitch of crying may signify the severity of these findings more so than verbal reports.
- Overly aggressive examination maneuvers may create fear in the child and compromise the remainder of the examination.



**FIGURE 1.2** Examination for an umbilical hernia.

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## Inguinal Region

- Concurrent with abdominal and genital examination, the umbilical and bilateral inguinal regions should be associated for hernia and hydrocele (Figure 1.2).
- Valsalva maneuvers can be created with coughing or straining and increase the sensitivity of finding a hernia on examination. Infants often perform Valsalva with crying.<sup>12</sup>

## Genital Region

- For boys, examination of this region is necessary for hydrocele, undescended testes, and hernia.
- Lying down or standing are acceptable positions.
- Note the shape and size of the both testicles and the presence of any fluid in the scrotum. Be aware that retractile testes may mimic undescended testes.<sup>13</sup>
- Transillumination may assist with visualizing scrotal contents but should not form the basis of a diagnosis, especially in infants.
- Performing a female examination is relevant in the diagnosis of imperforate hymen, fused labia, and vaginal or perineal bleeding, among other diseases.
- Vaginal tears or vaginal discharge should raise concern for abuse or sexually transmitted infection.<sup>14</sup>
- Modesty is present in children as early as 2 years of age; therefore, special respect should be given to this point during the examination.
- A chaperone of the same sex as the child must be present.
- Note that for many patients this may be their first genital examination with lasting psychosocial consequences.

## Rectum

- Speed and thoroughness are essential for this stressful portion of the examination.
- Explaining the process to the parent and the child may help to assuage intense fears.
- Spreading and inspection is enough to assess external pathology —such as skin tags, fissures, fistulas, and other lesions.
- Condyloma accuminata should raise concern for sexual abuse.
- Next, apply gentle pressure externally as you communicate to the patient; this may cause a transient relaxation in sphincter tone and facilitate passage into the anal canal.<sup>15</sup>
- Sphincter tone may be diminished after anoplasty, after traumatic injury to the sphincter, or after spinal cord injury.
- Palpate 360° within the anal canal and note the size and locations of any masses.
- Attempts should be made to differentiate discomfort from the examination from pain with examination, as can be seen with a low-lying inflamed appendix.<sup>16</sup>

## Nervous and Psychiatric System

- A child who plays and interacts may be considered neurologically intact.<sup>17</sup>
- A thorough neurologic examination may be performed in short time with practice.
- Cranial nerves should be assessed in any child with disease of the head and neck. Cognition is frequently impaired in the acutely ill child.
- Motor and sensory reflexes require baseline assessment.

## Spine and Back

- Vertebral tenderness may indicate trauma.