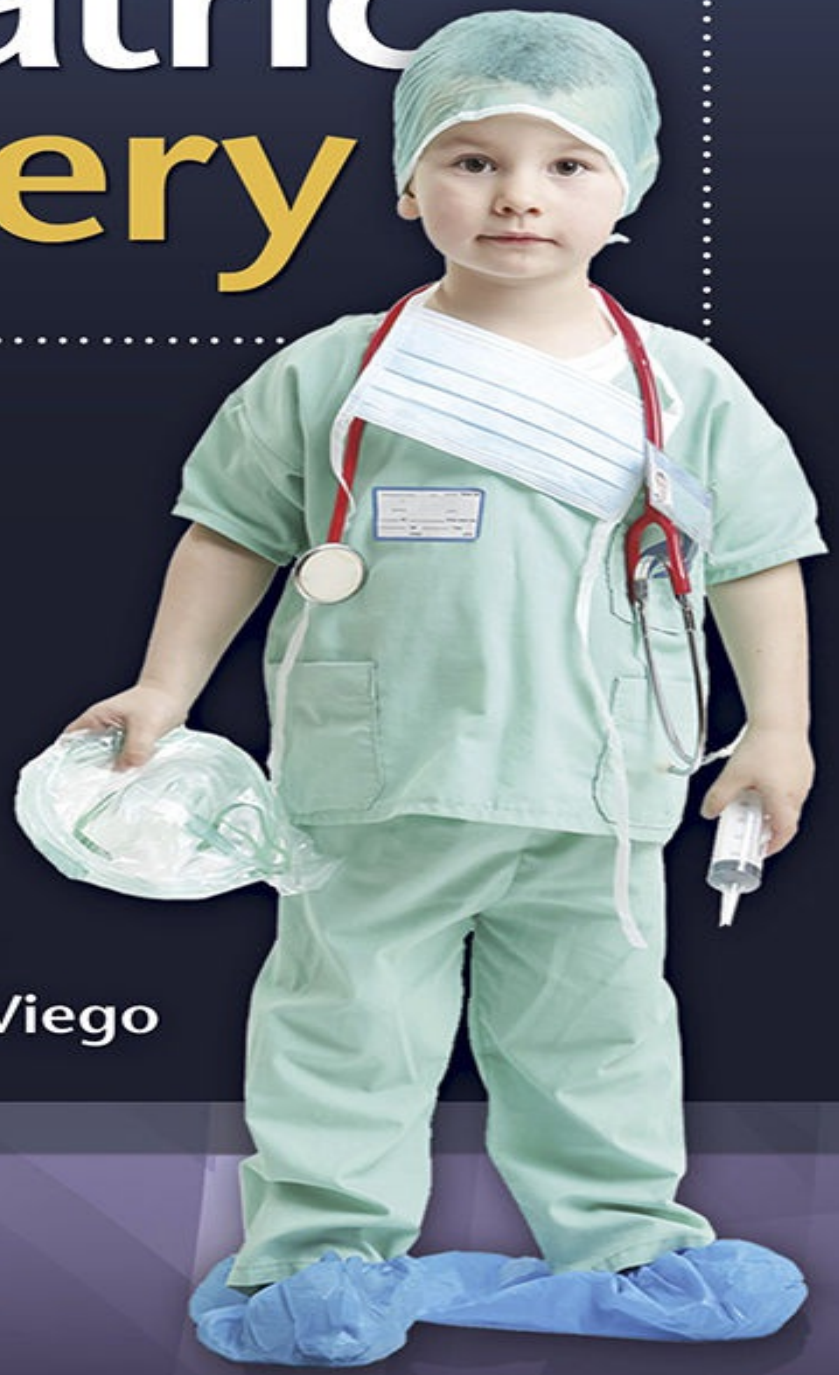
# HANDBOOK OF
# Pediatric Surgery



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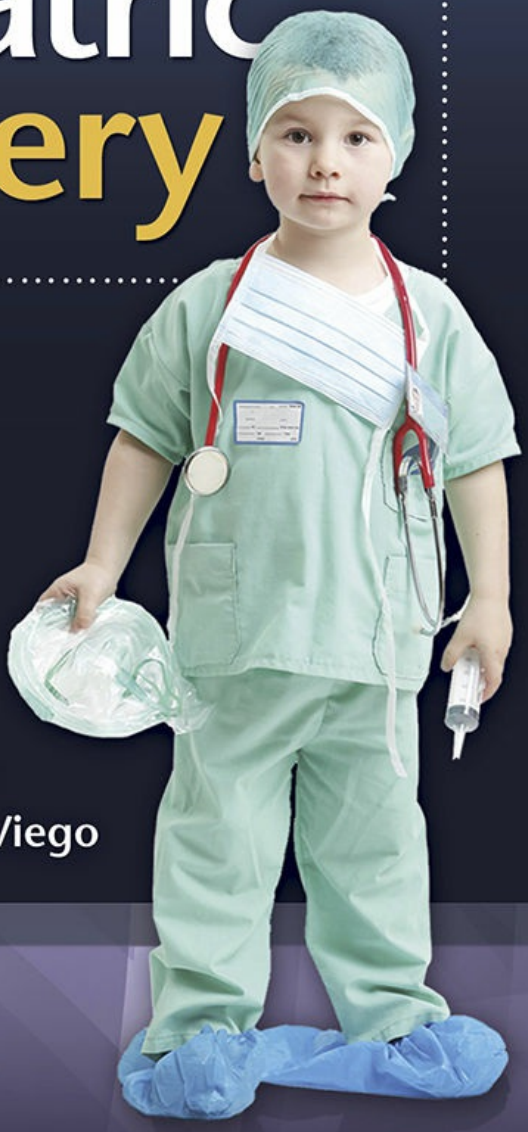

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# Handbook of Pediatric Surgery


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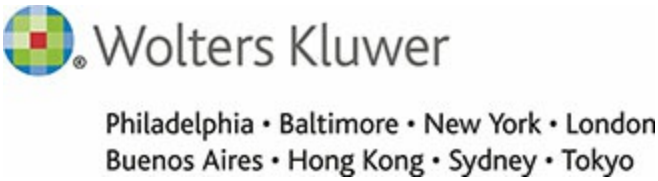

# Contents

## Section 4 Pediatric Surgical Oncology

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# Dedication

*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

CHAPTER 1

# Evaluation and Examination of the Pediatric Surgical Patient

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.[1]
- 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.[2]
- 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.[3]
- 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.[4]
- 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.

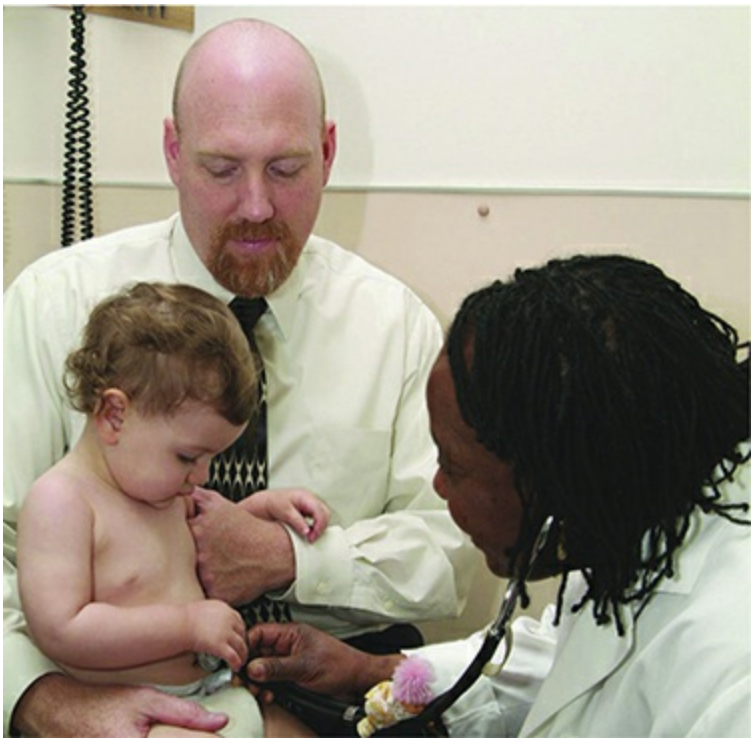

**FIGURE 1.1** The child may feel more secure if the caregiver stays with the child during the physical examination.
(Reprinted with permission from Hatfield NT, Kincheloe CA. *Hatfield*

*Introductory Maternity and Pediatric Nursing*. 4th ed. Philadelphia, PA: Wolters Kluwer; 2018.)

## 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.[5]

## Lymphatics

- In children, lymphadenopathy is most commonly infectious; therefore, searching for a source of infection in the examination is prudent.[6]
- 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.[7]

## 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.[8]
- 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.[9]
- 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 of 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.[10]

## 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.[11]
- 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.

(Reprinted with permission from Anrig CA, Plaugher G. *Pediatric Chiropractic*. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2011.)

## 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.[12]

## 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.[13]
- 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.[14]
- 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.[15]
- 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.[16]

## Nervous and Psychiatric System

- A child who plays and interacts may be considered neurologically intact.[17]
- 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.