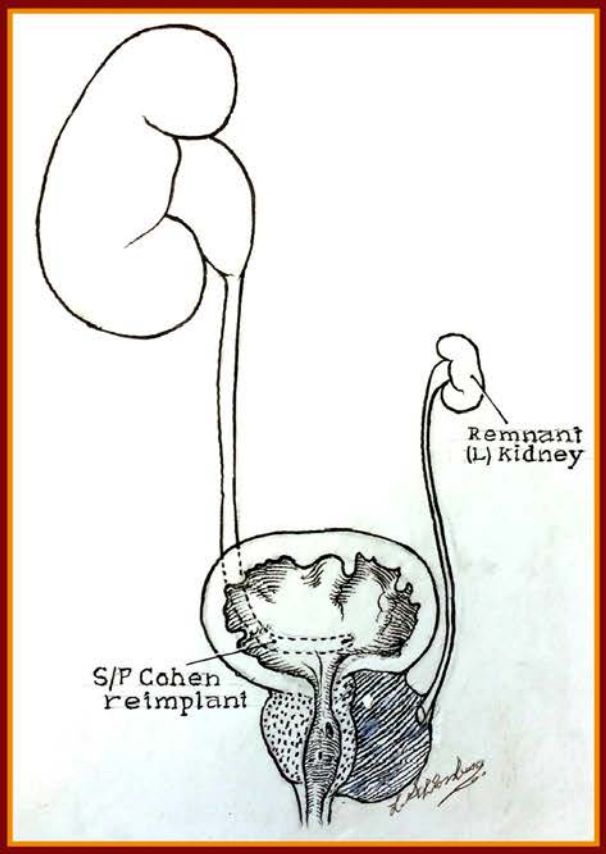
THE KELALIS-KING-BELMAN TEXTBOOK OF CLINICAL PEDIATRIC UROLOGY

SIXTH EDITION



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The Kelalis–King–Belman

Textbook of Clinical Pediatric Urology

Sixth Edition

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Textbook of Clinical Pediatric Urology

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Videos

Videos pertaining to this book can be accessed online at www.crcpress.com/cw/Docimo. The content of these videos can be broken into two categories: those cited and captioned in the text of the book itself, and those comprising a separate Atlas created by Pippi La Salle.

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4.2	Strategy to deconstruct normal ultrasound images.
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Preface

We are honored to again have the opportunity to edit the Sixth Edition of the "Kelalis, King and Belman," the standard text in Pediatric Urology for four decades. The title of the Fifth Edition was changed to *The Kelalis–King–Belman Textbook of Clinical Pediatric Urology* to commemorate the original editors. Our great friends and mentors Barry Belman and Lowell King were very helpful in orienting us to the prior edition. We are saddened at the loss since then of Dr. King, who with the late Panayotis Kelalis cannot see the current fruits of their original vision. We hope that the current text continues to build on that vision in ways that would make them proud.

The specialty of pediatric urology continues to change rapidly, and we hope that the new format of the text, with an emphasis on web-based resources, will reflect that. Much open surgery that was transitioned to laparoscopic or endoscopic surgery is now approached using the surgical robot. Availability of "big data" that crosses institutions, states and nations is allowing sophisticated health services researchers in our field to understand trends, identify risk factors, and provide advice for new pathways of care. This provides the potential to get the right care only to those who need it, increasing effectiveness and decreasing cost. Advances in understanding of hormone receptor signaling and urothelial-mesenchymal interactions are suggesting new forms of preventive therapy for developmental anomalies in the future. Emergence of population health thinking is forcing us to reconsider the ways that we evaluate and treat common conditions, such as urinary tract infection and prenatally detected hydronephrosis. In short, our field is beginning to look rather sophisticated.

We kept the general organization of the prior edition, starting with chapters of general interest, and then proceeding through each of the systems or anatomical areas of interest to urologists, and including chapters on basic science research to point the way to future clinical applications. New to this edition, and nearly unique in scope, we have added a video-based surgical atlas, edited by Joao Luiz Pippi Salle, which can be viewed as a stand-alone compendium or linked from the individual chapters. As in the prior edition, we are indebted to our returning authors and to our many new authors who have infused the text with their energetic contributions.

The text will again be accompanied by a study guide. We hope that this will prove helpful to urology and pediatric urology trainees, but also to all of us who need to prepare for certification or recertification examinations in Pediatric Urology—a subspecialty certification that was only in the planning stages when our last Edition was published. We would like to thank the authors and editors for contributing to these questions, which add significant effort above and beyond completing a chapter.

As always, this is intended as a reference work, but not necessarily the last word. We have tried to present controversy where it exists, but in the end all recommendations are made based on the experience and best belief of the authors. The authors have been chosen in every case for their expertise, experience and rationality. Although we, as editors, may not have agreed with everything our authors have stated, we consider each of them a master in their area, and have tried to minimize our influence on their message.

The change that has had the most profound impact on the Sixth Edition is the addition of a group of editors to the team who represent the best and brightest in Pediatric Urology. These are the individuals who worked directly with the authors, primarily edited the manuscripts, chased down the videos and assured appropriate formatting, and dealt with the many technical potholes that characterized this long journey. Our hats are off to Drs. Austin, Coplen, Copp, Herndon, Lorenzo, Merguerian, Ost, Park, Pohl, and Shukla, without whose efforts this book does not exist.

We are especially indebted to our publisher, Ms. Miranda Bromage of Taylor & Francis, who picked up the pieces of a technical disaster, and with the able help of Cherry Allen reassembled this complicated project from beginning to end to make it something better than it would have been in the first place. We also thank Kyle Meyer at CRC Press/Taylor & Francis and Nick Barber at Nova Techset for their professional work on this book.

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Dr. Steven G. Docimo, MD, MMM, earned his MD from the Johns Hopkins University School of Medicine, trained in general surgery and urology at Naval Hospital, Bethesda, Georgetown University, and the Harvard Program in Urology at the Brigham and Women's Hospital, and completed an AUA Scholars Research Fellowship in the Department of Urology at the Children's Hospital, Boston. He completed pediatric urology training at the Johns Hopkins School of Medicine, where he remained on faculty and was named Professor with Tenure. He was later chief of the Division of Pediatric Urology at the University of Pittsburgh School of Medicine for 11 years and founded the Pittsburgh pediatric urology fellowship program. He served as chief medical officer for the Children's Hospital of Pittsburgh of UPMC (University of Pittsburgh Medical Center), a position he held for more than 10 years, while also serving as vice president for Pediatric Subspecialty Services within the University of Pittsburgh Physicians, and President of Children's Community Pediatrics. He is currently senior vice president, Clinical Operations for National Relationships for the Children's Hospital of Philadelphia. He has authored more than 300 papers, abstracts, videos, books, and book chapters.

Douglas A. Canning, MD, is chief of the Division of Urology at Children's Hospital of Philadelphia and a professor of urology in surgery at the Perelman School of Medicine at the University of Pennsylvania. He holds the Leonard and Madlyn Abramson endowed chair in pediatric urology.

Dr. Canning earned his medical degree from Dartmouth Medical School. He completed his general urological residency training at the National Naval Medical Center in Bethesda, Maryland. He then completed his pediatric urological fellowship training at The James B. Brady Urological Institute at the Johns Hopkins Hospital. Following a four-year military tour during which he was director of pediatric urology at the Naval Medical Center, San Diego, he returned to the east coast and joined the urology staff at CHOP in 1992. In 1997, Dr. Canning was appointed director of the Division of Urology at CHOP. Shortly after his appointment, he was named to the Leonard and Madlyn Abramson chair in pediatric urologic research.

He is author or coauthor of more than 100 peer-reviewed publications, three textbooks, and more than 500 editorials in urology. He is a member of the Urological Survey Editorial Committee for the *Journal of Urology*. He is an internationally recognized expert in all areas of pediatric reconstructive urology with a particular interest in the care of children with complex urological conditions such as bladder and cloacal exstrophy, hypospadias, posterior urethral valves and genital anomalies in both sexes.

Dr. Antoine Khoury, MD, FRCSC, FAAP, is the chief of pediatric urology and, with more than 25 years of experience, leads the CHOC (Community Housing Opportunities Corporation) Children's Urology Center. He is a professor of urology at University of California, Irvine (UCI) and the Walter R. Schmid endowed chair in pediatric urology at UCI.

Dr. Khoury completed his residency training at the University of Toronto and did his fellowship training in pediatric urology at The Hospital for Sick Children in Toronto, under Dr. B. Churchill. Dr. Khoury has also spent time at the University of Calgary carrying out research in infection and biomaterials. His work there resulted in several publications and a patent award on the bioelectric mechanism to eliminate bacterial biofilms. He then joined the faculty of the division of urology at the Hospital for Sick Children in Toronto and was the division head from 1995 to 2008 before coming to CHOC Children's Urology Center.

Dr. Khoury has published more than 200 peer-reviewed publications and 60 book chapters. He has delivered over 160 lectures as a visiting professor or invited speaker at both international and national levels.

Dr. Joao Luiz Pippi Salle is the division chief of urology at Sidra Medical and Research Center in Doha, Qatar. He was the former chief of urology of the Montreal Children's Hospital as well as at the Toronto Sick Kids Hospital, in Canada. He was the inaugural chair of urology and regenerative medicine at Sick Kids Hospital, University of Toronto. Dr. Pippi Salle is a pediatric urologist with special interest in genito-urinary reconstruction. He is an innovative surgeon who developed new techniques for the correction of urinary incontinence, differences of sex development, exstrophy/epispadias complex, and hypospadias. He published numerous papers and book chapters and has been a visiting professor in 35 countries. He is dedicated to teaching having completed the Education Scholarship Program and served as the director of Continued Medical Education in the Department of Surgery at the University of Toronto. Dr. Pippi Salle is also committed to International teaching in several countries where he developed several successful workshops in reconstructive pediatric urology.

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Section 1

Evaluation of the Pediatric Urologic Patient

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CHAPTER 1

History and Physical Examination of the Child

Anton Wintner and T. Ernesto Figueroa

HISTORY

General Considerations

The path to caring for a patient and offering a solution to a medical condition begins with a thorough medical history, and subsequent physical examination. These are the most basic elements in medical care, and when properly conducted, they allow for understanding and appreciation of the medical condition, and the ability to initiate appropriate care for the patient. The extensive progress in medical technology has given the physician new tools for the diagnosis and treatment of most medical conditions; however, no technological advance can replace the sympathetic and discriminating ear of the physician, or the gentle and perceptive hand during the physical examination. In the diagnostic process, history accounts for 80% of the information, physical examination for 15%, and special investigations for 5%.[1] A thorough history is clearly the most enlightening component of the diagnostic process.[2]

The field of pediatrics is a rather unique branch of medicine in that the medical history is usually obtained from a person other than the patient, this being the mother, the father, other relatives, or a foster parent.[3] It is important to identify the person giving the history, and to clarify the relationship to the patient. As the physician first encounters the child and the parent, it is essential to introduce oneself and offer one's services to the patient and the family. In the complex environment of modern healthcare, the family is likely to come into contact with several members of the medical team besides the pediatric urologist that they are there to see, and it can be rather confusing for the family to identify the role of each member. Many medical organizations have promoted the concept of Acknowledge–Introduce–Duration–Education–Thank you (AIDET) to encourage healthcare providers to clarify their role in the service line of the patient.[4] The accompanying adult should be asked about his or her relationship to the patient. In order to protect the patient's confidentiality and privacy, physicians have the professional obligation to define the relationship of the accompanying adult to the patient, and to determine who will be the recipient of the medical information related to the pediatric patient.[5] Current federal regulations establish limitations on the medical information that can be shared with individuals other than the patient, and there can be serious penalties for ignoring this federal directive.[6] The physician should not assume that the accompanying adult has legal custody of the child.

Upon approaching an examination room, it is important to remember that small children will often move about the room, as the family waits for the physician. Prior to entering the room, the physician should first knock gently on the door to alert the parents to pick up the child who could be sitting behind the door, and then open the door cautiously. When first encountering the child and accompanying adult, and after introducing oneself to the patient and family, it is helpful to ask what the child likes to be called, and address the child in that manner. Also, it is beneficial to find an area of interest that will show patients that we care and are interested in them, such as asking what type of play they enjoy, offering supportive commentary about their clothes, or inquiring about their interests in sports or other activities. The child should feel that they are the primary interest of the interaction, and regardless of the age, the physician should look at the child and talk to him or her in words that the child can understand at various times during the encounter. A soft and courteous tone of voice and a sympathetic look are essential in developing a trusting relationship with the child, assuring the patient and the family that the physician is concerned with his or her condition. Abrupt, pressing, and hurried interfaces often have a profoundly negative effect on the initial, and subsequent, patient–physician interactions. The physician should convey a willingness to listen, and demonstrate empathetic understanding for the information being gathered.[2] If a young child is not receptive to the interaction and is disruptive during the history taking, it is helpful to seek distraction techniques, such as a toy box, coloring books, formula or snacks, or removal from the examination room, to allow adequate history gathering. A comfortable environment can enhance communication.[3] In essence, it is important to convey to the parent the interest in the child as well as the illness.[7]

History of Present Illness

The pediatric urologic history should be tailored to the condition of the patient. Some conditions are immediately evident, such as the healthy newborn with hypospadias or undescended testis, and these require a more focused and limited approach to the history. Other conditions, such as combined diurnal and nocturnal enuresis in an older patient, are likely to require a more detailed and comprehensive assessment of the medical history. Thus, not every patient seen by a pediatric urologist will require an extensive medical history with a need to cover all the items traditionally listed in the medical history of a child. However,

the role of the pediatric urologist is to determine what key questions are necessary to formulate the most accurate description of the patient's genitourinary condition.

A good approach to history taking is to begin by asking broad-based, open-ended questions in order to ascertain the chief complaint—the main reason why the patient is in the office—in the patient's (or parent's) own words. A simple option is to begin by asking, "What brings you in today?" or "How can I help you?" This is crucial because if the patient's chief complaint is not addressed, no matter how trivial it may seem or how great the care the physician provides otherwise, the patient (and parents) will not be satisfied. For example, an adolescent patient with mild hypospadias may be more concerned with the appearance of excessive dorsal foreskin than the location of the meatus. Once a clear chief complaint is established, the physician may narrow his or her questioning to keep the patient focused and gather specific details. The patient and family should always be questioned about possible associated genitourinary symptoms, including flank pain, abdominal pain, dysuria, hematuria, incontinence, frequency and urgency, difficulty with urination, previous urologic surgery, and scrotal pain and swelling. Other symptoms, such as malaise, fever, weight loss, constipation, vomiting, or body posturing, should be reviewed as part of the history of present illness (HPI) when they are pertinent to the differential diagnosis.

Age-Related Considerations

In the evaluation of children, certain age-related, well-recognized behavioral characteristics affect how children respond to the interaction with a physician or other healthcare providers. There is an ample bibliography on this topic in the pediatric and psychological literature, but for the purposes of this chapter, the following outline of age competencies[8] can be useful to the pediatric urological care provider:

1. Infants (birth to 1 year)
   a. Characteristics
      i. Parents or primary caregivers are most important.
      ii. Sense of trust and security develop.
      iii. Fear of the unfamiliar. Stranger anxiety evident at 6–8 months.
      iv. Major source of pleasure is oral activities, such as sucking, biting, and chewing.
      v. Learns by imitation and repetition.
2. Toddlers (1–4 years)
   a. Guidelines
      i. Allow choices if possible. Prepare before a procedure.
      ii. Give one direction at a time.
   b. Characteristics
      i. Asserts independence and develops a sense of will. Has temper tantrums.
      ii. Fear of separation between 2 and 2½ years.
      iii. Learns cause and effect.
      iv. Discovers ability to explore and manipulate environment.
      v. Constructs three- to four-word sentences.
      vi. Short attention span.
3. Preschoolers (4–6 years)
   a. Guidelines
      i. Offer badge of courage (stickers) and praise.
      ii. Use dolls or puppets for explanation when performing procedures and involve child when possible.
   b. Characteristics
      i. Fears include bodily injury and mutilation, castration (males), and the dark.
      ii. Physically aggressive.
      iii. Masters and acquires new skills.
      iv. Major skill is conversation.
      v. Speaks in eight-word sentences by age 5.
      vi. Understands numbers and can count.
      vii. Questions why.
4. School age (6–12 years)
   a. Guidelines
      i. Provide privacy and explain procedures in advance using correct terminology.
      ii. Clearly define and reinforce behavior limits.
   b. Characteristics
      i. Important to belong and gain approval of peer group.
      ii. Rule-bound.
      iii. Greatest fear is loss of control.
      iv. Distinguishes between right and left side at age 7.
      v. Develops personal standards of right and wrong at age 9.
      vi. Play, simple instruction, repetition, books, visual aids, and examples are ways that an 8-year-old learns.
5. Adolescents (13–17 years)
   a. Guidelines
      i. Provide privacy and allow maintaining control.
      ii. Involve them in decision making and care.
      iii. Present them with their "rights."
      iv. Discuss virginity, prevention of sexually transmitted diseases, and pregnancy.
   b. Characteristics
      i. Development of identity.
      ii. Rapid growth of skeletal muscle mass, adipose tissue, and skin.
      iii. Common fears include loss of control, not being accepted by peers, and separation from peers.
      iv. Think they are invincible and bad things will not happen to them.
      v. May criticize parents.
      vi. Identity is threatened by hospitalization, and they are concerned with bodily changes and appearance.

Privacy and Confidentiality of the Adolescent Patient

Adolescence is a time of rapid and significant physical, emotional, and psychological change. Although the adolescent patient may represent a challenging patient for the pediatric urologist, this encounter also represents an opportunity for the urologist to educate the patient about the bodily changes (puberty), as well as about

sexuality, safe sexual practices, and sexually transmitted diseases. Many adolescents are reserved about their medical conditions, and as a group, they tend to place a greater value on peer relationships than parental or adult relationships. Gathering information from adolescents is particularly challenging, and many will not seek medical care for fear of anticipated shame and embarrassment, loss of autonomy, and fear of not being understood.[9] When facing an adolescent patient, part of the history should be obtained in the presence of a parent or guardian, but the patient should also be queried about urinary symptoms and sexual matters in a private setting. The transition from the history-gathering portion of the medical encounter to the physical examination is a good opportunity to isolate the adolescent patient from the parent to obtain additional pertinent information. Prior to proceeding with the examination, the adolescent patient should be asked if he or she prefers a private room or the presence of a parent or chaperone during the exam. Legally, minors cannot consent to medical care, so the request to examine the patient should be made in the presence of the parent. Any information obtained during this interaction should be considered confidential. There are federal guidelines regarding the confidentiality and privacy of medical information of minors, although there is variation of guidelines and privacy laws of minors from state to state.[10,11] Any healthcare provider caring for adolescent patients is encouraged to become familiar with the local (county or hospital), state, and federal guidelines regarding the privacy and confidentiality of minors, and should not hesitate to involve social services when the information poses legal and ethical ambivalence.

Past Medical History

A thorough past medical history is vital for the care of the pediatric patient. Since the history often cannot be directly solicited from the young patient, history previously recorded by another physician may be incomplete or contain inaccuracies. As such, the family should be allowed adequate opportunity to communicate their perspective of the course of events that have transpired in the life of the child. The accuracy of the past medical history is crucial because many pediatric conditions are age dependent, and therefore the physician's suspicion (and consequently the condition's position on the differential diagnosis) may depend on the age at which a particular complaint began.

The past medical history should include as much information as possible about previous hospital and emergency room visits. The patient and family should be asked about all the diagnoses that the child carries, at what age they were diagnosed, and how each diagnosis came about. Any procedures or surgeries that the child has undergone, as well as their timing, should be recorded.

The physician should ensure that the surgical history is concordant with physical exam findings, such as scars, as there is large variability among families in the degree of sophistication of their medical knowledge. This is even more important if future surgery is a possibility, and if any uncertainty arises, the previous surgeon should be consulted.

The urologist should keep in mind that many nonurological conditions may have urologic sequelae, and thus a complete understanding of the child's medical history is imperative. For example, a child may present to the urologist with new-onset hematuria, and assessment may show that the child had gastrointestinal symptoms of vomiting and diarrhea before progressing to hematuria, suggesting the possibility of hemolytic uremic syndrome. Moreover, many conditions that are not typically treated by the urologist may affect the urogenital tract, and thus may be first diagnosed by the urologist. As an example, scrotal pain and swelling may be the initial presentation of Henoch–Schönlein purpura.[12]

Prenatal History

The past medical history should include information about the prenatal history and pregnancy. The urogenital tract is the most common location for congenital malformations, many of which may be directly identified by prenatal screening. Examples include conditions such as hydronephrosis, multicystic dysplastic kidney, unilateral renal agenesis, bladder exstrophy, prune belly syndrome, posterior urethral valve, and spina bifida. Other urological conditions may be indirectly diagnosed. For example, imperforate anus (with its urological sequelae) may present with bowel calcifications on prenatal ultrasound. Still other conditions, such as congenital heart disease and Down's syndrome, may be diagnosed prenatally, raising suspicion for the urologic conditions with which they are commonly associated.

The prenatal history should also include any illness or medications to which the mother was exposed during pregnancy. Viruses and medications (both prescription and nonprescription drugs) may be teratogenic, providing insight into the etiology of some congenital anomalies.

The child's gestational age at birth should also be noted, as premature children tend to have a more complex medical history than full-term infants. Lung immaturity is also much more common in premature infants and may impact the way the child's responds to anesthesia.

Review of Systems

The review of systems (ROS) is an opportunity for the physician to ask questions about symptoms that the patient may not consider to be important, or even related to the main complaint. Yet often these symptoms are both important and related, and provide invaluable insight into the patient's condition. The ROS may also serve to ensure that the physician has not overlooked any symptoms the patient may be experiencing. The comprehensiveness of a formal ROS varies from physician to physician, but the key is to ensure that it is completed in as consistent of a manner as possible.

The ROS should begin with a few general questions about the growth and development of the child. A comprehensive developmental history is not crucial, although a general awareness about the patient's ability to reach developmental milestones is important.

Next, broad questions about heart conditions, heart murmurs, visits to cardiologists, and any pulmonary conditions, such as asthma, will help give insight into the patient's risk factors for general anesthesia.

Questions about the gastrointestinal tract are often pertinent to the urologist. Particularly in children, poor defecation habits and constipation have long been recognized to contribute to a number of urological conditions, from urinary tract infections to voiding symptoms and urinary incontinence.[13,14] The term *constipation* implies various meanings to patients and healthcare providers, and it is beneficial to define what we mean by the term *constipation*, including hard and painful defecation, and infrequent defecation of less than three bowel movements per week.[15]

General questions about the genitourinary tract and voiding should be asked of all patients presenting to the urologist, even if these questions are not directly related to the patient's chief complaint. The patient and family should be questioned about previous kidney problems, and pain in the area of the low back. The patient's voiding history should be taken, and the patient and family asked about symptoms of frequency, urgency, day and night incontinence, dysuria, and hematuria. Young male patients in particular should be questioned about their urinary stream. A double stream may indicate an accessory urethra or urethrocutaneous fistula, while a high-pressure, deflected stream with prolonged voiding time is characteristic of meatal stenosis.

Review of the neurological history of the patient should include questions about seizure history, as most first-time seizures occur in childhood. The child and family should also be questioned about dizziness and fainting, as well as any numbness, weakness, or difficulty running or playing.

Finally, the physician should screen the child for symptoms of depression and anxiety. The time around puberty is especially stressful, and this stress may be compounded in children with urological abnormalities or medical conditions in general. Children who are depressed or suffering from severe anxiety should be appropriately referred. Failure to address psychiatric concerns will likely lead to worse medical outcomes, as depressed patients are less likely to be compliant with treatment.[16]

Medications

Any previous or current medications should be documented. The physician should also note the reason for each medication, the dosage, the typical schedule, how long the child has been taking the medication, and any recent changes. The patient and family should also be asked in a delicate manner about the degree of compliance to each medicine, and whether they perceive it to be effective.

The physician should consider the possible interactions and side effects of the patient's current medications and any new medicines to be prescribed. Many medications have cholinergic or anticholinergic properties, which may affect voiding and urinary function. Particularly in children, the physician should carefully weigh the pros and cons of beginning any new medications and discuss these with the family.

In order to reduce the occurrence of medication errors and patient harm, the Joint Commission introduced the concept of "medication reconciliation" in 2006.[17] When admitting a patient to the hospital, their medication regimen should be carefully reconciled to avoid duplications and omissions. Abrupt or accidental changes in medication may not only confuse the clinical picture but also cause direct harm to the child through overdose or withdrawal. Upon discharge, the patient's preadmission medication regimen should be carefully reviewed, as some medications may have been stopped or altered at the time of admission. It is the responsibility of the discharging physician to ensure that all preadmission medications are restarted at the time of discharge, if required.

Allergies

One of the greatest dangers in starting a new medication is an allergic reaction, which in the worst case may be anaphylactic. This may be avoided in most cases with a careful allergy history, as initial exposure to a medication rarely results in life-threatening anaphylaxis. Typically, life-threatening anaphylaxis follows immune system sensitization to a particular antigen, often accompanied by an initial mild reaction. However, many children have no prior documented history of exposure, and can progress to anaphylaxis and a risk of dying from the event.[18] Patients and their family should be asked about which medicines they are allergic to, what type of reaction they have, and when they were last exposed. Patients should also be asked about nonmedicine allergies, such as shellfish and latex. Seasonal allergies rarely have direct crossover with medications, although children with seasonal allergies may be more prone to reactive airway disease. The family should be questioned about other members having allergies to medications, specifically antibiotics and penicillin.

Most young children have had little exposure to medications, and it may be that their first allergic reaction results from antibiotics used to treat or prevent a urinary tract infection. Newborn children with known urinary tract abnormalities are often placed on antibiotic prophylaxis in the first few days of life as their first medication.[19] The risk of anaphylaxis with penicillin has been estimated at 0.015%, with a fatality rate of 0.002%.[20] If a reaction does occur, the pediatric urologist or pediatrician should immediately stop the medication and document the reaction. Signs of respiratory compromise or anaphylaxis mandate emergency treatment.

Subacute Bacterial Endocarditis

Genitourinary surgery was, in the past, one of the common indications for subacute bacterial endocarditis (SBE) prophylaxis in patients with some types of congenital heart disease.

According to the 2007 American Heart Association guidelines, however, "antibiotic prophylaxis solely to prevent infective endocarditis is no longer recommended for patients who undergo a gastrointestinal or genitourinary tract procedure, including patients with the highest risk of adverse outcomes due to infective endocarditis."[21]

Despite these recommendations, the urologist may be well served to have a conversation with the child's cardiologist about the need for SBE prophylaxis, as some cardiologists may not be completely comfortable with this approach.

Family History

The importance of a detailed family history must be emphasized. Pediatric patients are young, and therefore have had much more limited environmental exposure than older individuals. This greatly increases the likelihood that a given disease has a genetic component. Examples of genetic disorders include autosomal recessive polycystic kidney disease, von Hippel–Lindau disease, and renal tubular acidosis. Even diseases that are not strictly heritable, or in which no specific genetic mutation has been identified, may have a familial tendency. Examples of such diseases include vesicoureteral reflux, urinary tract infections, voiding disorders, and hypospadias.

Gathering of the family and genetic history for urologic conditions may prove challenging for several reasons. First, many genetic disorders have incomplete penetrance, making affected individuals harder to identify. For example, a patient with moderate hypospadias may have an affected grandfather who was never diagnosed because the grandfather's hypospadias was mild and did not cause the grandfather concern. Second, urologic conditions, particularly genital disorders, are often not openly discussed, making it more difficult to identify affected relatives.

Social History

Sexual History

A sexual history should be gathered in all adolescent and preadolescent patients. The history should always be taken in a quiet, private place where the patient will be more likely to answer questions openly and honestly. A carefully presented, nonjudgmental assessment of sexual history should be part of the medical history of every pubertal patient. It is essential that the patient is allowed all latitude to feel comfortable in discussing this most personal aspect of their medical history. An introductory description from the physician explaining that this is an integral part of medical care, and that all patients go through this evaluation, may help alleviate the expected apprehension from the patient.[22]

Patients should be asked about their sexual habits (number of partners, use of contraceptives, etc.) and should be appropriately counseled about safe sex practices. Furthermore, patients should also be questioned about symptoms of sexually transmitted infection so that they may be treated appropriately if required. Patients should be asked about genital itching, sores, discharge, dyspareunia, and previous history of sexually transmitted infection. The urologist should always keep in mind that many patients with complex medical conditions, such as spina bifida, may not have the peer support groups and educational opportunities of the rest of the healthy population, and these encounters with the healthcare provider are unique opportunities to offer teaching and answers to the silent questions that many of these patients have about sexuality.[23]

Substance Use

Both the family and the child should be questioned about substance use. Most studies show that patients who are addicted to tobacco and alcohol become addicted before adulthood. Tobacco and alcohol may lead to marijuana and other drug use in adolescence and later life, and have significant morbidity in and of themselves.[24] Patients should be counseled about these dangers and offered resources for quitting if required.

Families should also be questioned about adult substance use in the home. This must be done in a gentle, nonaccusatory manner. Risks such as secondhand smoke, which are obvious to the physician, may not be obvious to some parents. If the parents express interest in quitting an addictive substance, they too should be appropriately referred.

Environmental Exposure

Families should be asked about parental vocations and living situations, as certain industrial chemicals carry health risks to both the parents and child. If these risks can be identified early on, a strategy to mitigate them may be devised. There is mounting evidence on the effect of environmental agents on the incidence of hypospadias and cryptorchidism.[25]

School and Home

As part of the social history, the child should be asked about school and his or her social environment. Does the child have friends at school? Is he or she progressing well in his or her academics or struggling to pass the current grade? Has he or she been held back a year? Asking about school not only helps build a therapeutic alliance with the child and family, but also provides insight into social and mental development.

If not already obtained during the initial interaction, an assessment of the social history should include the marital status of the parents; who cares for the children if the mother is employed; number of siblings; progress at school; recent stressful experiences, such as moving or loss of a family member; and the type of interactions with other children (play dates, sports teams, etc.). Sometimes this information may elicit a diagnostic path possibly unrelated to the initial complaint of the patient.

Medical Insurance

Children without appropriate insurance coverage should not be turned away. Many states have social programs that cover children, particularly from low-income families. If a child does not have insurance, the family should be referred to a hospital case manager or other such worker who can aid them in attaining appropriate coverage.

PHYSICAL EXAM

Approach to the Examination of the Pediatric Patient

An important component of the physical examination of the pediatric patient occurs while obtaining the medical history and observing the patients and their relationship with their family. While listening to the family, the physician can assess the level of comfort of the child and his or her overall physical health, and anticipate the approach to the physical examination. Certain behaviors, of which the child may not even be aware, may become evident during this short observation period. These behaviors can provide the physician with invaluable insight into the etiology of the chief complaint. For example, the characteristic posturing of a child, Vincent's curtsy, may point to a child's attempt to temporarily prevent incontinence due to an inability to inhibit bladder contraction[26] (Figures 1.1 and 1.2).

When the time comes for the examination, the child should be informed in simple terms that are understandable to him or her that an examination is to take place. With younger children, having the parents stand or sit next to them during the examination can help reduce the fear of the experience. Young children, less than 1 year of age, can occasionally be examined while they recline in their mother's lap. Every effort should be taken to minimize separation anxiety in these children, common in children younger than 3 years of age. Preschoolers, ages 4–6 years, fear the possibility of bodily injury and mutilation, possibly castration, so the genital examination usually produces significant anxiety in this age group. In older children, and adolescents, privacy is very important, and respecting that privacy during the examination is vital, by asking the family members to look aside or to step out of the room. Examination of the adolescent should always be handled with sensitivity to avoid unnecessary embarrassment and preserve the dignity of the patient.[27]

Prior to placing hands on the patient, the examining physician should wash his or her hands, and repeat the hygiene practice at the end of the examination. A cold pair of hands can tense the patient unexpectedly. The physician owes the patient the courtesy of a warm pair of hands during the examination.[27]

Upon placing the patient on the examining table, the pediatric urologist can determine if the child will cooperate with the examination. In a cooperative child, the physical exam should be as thorough as possible, as there is no guarantee that the child will remain cooperative at future appointments. If the child remains cooperative, the various abnormalities identified during the examination should be demonstrated to the parents as part of their education into the child's urologic condition.

FIGURE 1.1 Vincent's curtsy.

FIGURE 1.2 Vincent's curtsy.

Age-Pertinent Factors

1. The uncooperative child and toddler
   a. When the child is uncooperative, the physician may rely on distraction techniques, such as allowing him or her to play with a penlight or toys or hold an otoscope, to console the child. It is noteworthy that many patients who are uncooperative probably have had a negative experience with a healthcare provider in the past. If the child remains uncooperative or fearful, one should try to make the best of the situation, but never force an examination on the combative child. If an acute surgical condition is suspected, and the child is uncooperative, persevering with the examination with the use of assistants to gently restrain the combative child may be necessary. A useful technique to examine the abdomen and genitalia of anxious young children is to have the mother embrace, and gently pin down, the upper torso of the child against the examination table, while an assistant places the palms of their hands on the patient's thighs, at midthigh, to keep the body in place against the examination table. The mother's body shields this child's head from the examination. This allows the examining physician to conduct a quick and effective examination while the child is reassured by the closeness to the mother.
2. The role of the chaperone
   a. The examination of the pediatric patient, whether an infant, toddler, child, or adolescent, should always be performed in the presence of a parent or guardian. In situations when the parent or guardian is not available, or when their presence may be detrimental to the patient, the presence of a chaperone as an adult member of the healthcare team should be offered to all pediatric patients undergoing potentially embarrassing or psychologically stressful examination, such as examination of the anogenital areas, reproductive organs, or breast of the adolescent female. The role of the chaperone is to "reinforce the professional nature of the interaction and content of the examination and to provide a witness in case of misunderstanding."[28] The American Academy of Pediatrics updated its policy on use of a chaperone for pediatric patients in 2011.[29]

Vital Signs

Importance of Vital Signs

A patient's vital signs are the most basic and broadly applied component of the physical exam. The four basic vital signs are heart rate, respiratory rate, temperature, and blood pressure. These signs provide a wealth of information about both the acuity of the patient's condition and its etiology. Vital signs are particularly useful because they can be followed over time, allowing a dynamic view of the course of the patient's illness. Due to their objectivity and quantitative nature, they have lower interobserver variability than many other physical exam findings, making them useful in situations in which the physician must assume care of a patient with whom he or she is not familiar—a scenario ever more common with today's resident work hour restrictions and handoffs.[30,31] Vital signs are often the deciding factor in what is perhaps the physician's most important decision—whether it is safe to send the patient home.[32]

Despite the immense value of vital signs, in a world where physicians are asked to do more in less time, the responsibility for taking vital signs often falls on other healthcare professionals, techs, or medical assistants with varying degrees of medical knowledge. Ultimately, therefore, if the physician cannot take vital signs himself or herself, he or she should ensure that the vital signs are congruent with the patient's history and other clinical findings. If any doubt arises as to the reliability of the patient's vital signs, they should be repeated.

Temperature

The median temperature in the adult population is 98.6°F, and fever is generally considered to be a temperature of >100.6°F when it is consistent with other clinical findings. Unlike other vital signs, these figures are not significantly different in the pediatric population, although the variation in normal temperature may be greater in children than in adults.

In newborn infants, the nervous system is not yet fully myelinated, limiting their ability to effectively regulate and respond to changes in core body temperature and resulting in larger temperature shifts than might be expected in other patients. Moreover, newborns do not have the ability to shiver as do older children and adults, but must rely on the metabolism in order to increase their core body temperature. Infants also struggle with thermoregulation because their ratio of surface area to mass is more than three times that of a normal adult, making them more susceptible to temperature changes in their ambient environment. For example, a newborn may present with an above-average temperature swaddled by his or her mother in a blanket, while showing a lower-than-normal temperature after lying undressed in an air-conditioned exam room for several minutes.

When considering a patient's temperature, particularly when considering short-term trends or multiple temperature readings taken close together, it is important to ensure that all temperatures were taken by the same modality (oral, rectal, tympanic, etc.).

Rectal temperature is the most reliable measure of core body temperature since it is least influenced by the ambient temperature. It is especially ideal in small children, who may have difficulty holding an oral thermometer in their mouth for the full 60 seconds that is generally required for an accurate reading. In general, oral temperatures tend to be approximately 1°F lower than rectal temperatures. This difference may be exaggerated by recent ingestion of cold substances, such as popsicles, or with an increase in respiratory rate. Thus, the physician must be aware that a tachypneic patient with a normal oral temperature may actually be febrile by rectal temperature.

Other common modalities for measuring temperature include tympanic membrane, temporal artery, and axillary. Tympanic membrane temperatures may more accurately reflect core body temperature than do oral

temperature measurements, but just like oral temperature measurements, they may at times be volatile. Obstruction of the tympanic membrane by a foreign body or, more commonly, cerumen may artificially decrease tympanic membrane temperature readings.[33]

The accuracy of temporal artery core temperatures correlates well with rectal temperature in determining fever in pediatric patients, but is less invasive and thus causes less discomfort. This modality has been extended to premature infants in the neonatal intensive care unit (NICU) setting, with the variation of placing the probe on the neck behind the ears.[34]

Lastly, axillary temperatures, although popular in the lay population, are inaccurate and should be used on a very limited basis by healthcare providers.

Heart Rate

Normal heart rate can vary widely in the pediatric population, depending on age. Normal heart rate can range from 55 bpm in the teenager to 170 bpm in a premature infant. It is therefore crucial for the pediatric urologist to consider the age of the child when analyzing heart rate.

The two main causes of tachycardia in a pediatric outpatient setting are infection and physical activity (such as a fussy or crying infant, hyperactive toddler, or anxious child). Increased sympathetic stimulation resulting from fear or medication (e.g., stimulants) may also increase heart rate. Likewise, medications such as anticholinergics may limit the ability to increase heart rate, thus masking a potential infection.

The most common location for taking a patient's pulse is the radial artery, and this is usually done by counting the beats in a 10-second period and then multiplying this figure by 6 to get the beats per minute. Alternatively, in infants and small children, where the radial pulse may be difficult to palpate, a carotid or femoral pulse may be taken instead.

Blood Pressure

Blood pressure also varies with age, although unlike the heart rate, this relationship is positively correlated with age. It is difficult to precisely define the normal blood pressure range at a given age due to differences in the rate of development. Therefore, small deviations from the expected range for a given age are usually not as significant as deviation from previous blood pressure patterns of a particular patient.

When measuring blood pressure in pediatric patients, it is crucial to use an appropriately sized cuff. A cuff that is too large will result in an artificially low blood pressure, while a cuff that is too small will result in an overestimate. Artificially low blood pressure readings can also occur due to excessive pressure with the stethoscope by the examiner, resulting in a tamponade effect on the brachial artery. This is particularly important in pediatric patients, whose blood pressures tend to be lower than those of the adult population, requiring a gentler touch.

Respiratory Rate

Similar to heart rate, the respiratory rate decreases with age, approaching an adult rate of 12–18 breaths per minute near the time of puberty. Respiratory rate may be increased by exercise or fussiness in the pediatric patient, but should return to normal within several minutes of cessation of physical activity. A persistently elevated respiratory rate with normal heart rate and blood pressure may be a sign of respiratory compensation for a metabolic acidosis, while a decreased respiratory rate may compensate for a metabolic alkalosis. Increased respiratory rate combined with increased heart rate and decreased blood pressure may be a sign of hypovolemic or septic shock. Most ominous, however, is the finding of a child with increased work of breathing and accessory muscle use, as this may signal impending respiratory failure.

Examination of the Chest, Breast, and Axilla

Examination of the Chest

As part of the physical exam, the pediatric urologist should auscultate the heart and lungs. Although this may only rarely produce novel findings, it is particularly pertinent in patients with a known cardiac anomaly or in patients with syndromic findings. It is also important in evaluating a patient's readiness for surgery, as heart conditions, thoracic cage abnormalities, or respiratory compromise may predispose the patient to anesthetic complications.

Clinical Breast Exam and Gynecomastia

In evaluating the development of a pediatric patient, the breast and axilla should be examined, as they provide key information about the effect of sex hormones on the patient's development. In the adult population, a clinical breast exam is conducted mainly on females, for the purpose of screening for breast cancer. In the pediatric population, however, a breast exam should be conducted on both males and female.

In males, the aim of the breast exam is to evaluate for gynecomastia. Gynecomastia is characterized by ductal proliferation. It is common in neonates due to an excess of maternal estrogens, in adolescents due to an imbalance in the production of estrogens or androgens, and in obese children due to excessive peripheral conversion of steroids to estrogens by adipose tissue aromatase. Pathologic conditions associated with gynecomastia include estrogen-producing adrenal gland and germ cell tumors, diabetes, and hyperthyroidism. It may also be caused by some medications.

In females, the clinical breast exam is most useful for evaluating sexual development (Tanner stage). Thelarche is the first sign of puberty in the female. It occurs, on average, between 9 and 10 years of age, and begins with elevation of the papilla (see "Growth, Development, and Tanner Stage" for complete Tanner staging). Adrenarche, the onset of androgen-dependent development of axillary hair, follows thelarche.

In pediatric female patients without a specific complaint, the clinical breast exam may be limited to inspection for the purpose of defining the developmental stage. If a gross abnormality of the breast is visible, palpation may be required, and should proceed in a manner similar

to that used in adults. Prior to beginning palpation, the procedure should be explained and permission should be asked of both the parent and the child.

In the pediatric male patient in whom gynecomastia is a concern, the breast exam should begin with inspection, although palpation is always required. This is because true gynecomastia must be distinguished from pseudogynecomastia. In true gynecomastia, breast enlargement occurs as a result of glandular and epithelial proliferation of breast tissue due to the effect of excess estrogen. In pseudogynecomastia, however, breast enlargement is purely the result of increased adipose tissue. Therefore, if true breast tissue cannot be palpated, then gynecomastia cannot be diagnosed no matter the size of the breast.[32]

Examination of the Axilla

In the pediatric patient, the axillary exam consists of inspection and palpation. Inspection of the axilla is useful for establishing the type and density of axillary hair in determining the Tanner stage. Axillary hair in a young patient may be the first sign of precocious puberty.

Unlike in adults, in whom nontender axillary lymphadenopathy may signify breast cancer, nontender axillary lymphadenopathy in childhood is both common and generally benign. It may, however, be associated with lymphoproliferative disorders and may require further investigation based on history.

Growth, Development, and Tanner Stage

Growth and Development in the Infant and Child

A newborn infant will lose a portion of his or her body weight over the first few days of life, but is expected to return to birth weight by 2 weeks of age. After this initial weight loss, a weight gain of 30 g (1 oz.)/day is expected during the first 3 months of life, 20 g/day between 3 and 6 months, and 10 g/day between 6 months and 1 year. The daily rate of growth continues (as a percent of body mass) to decline until adolescence, when individuals undergo a growth spurt.

During well-child exams, pediatricians monitor child growth using standardized growth curves indicating "normal" values for 95% of children at a given age (specialized growth charts are also available for children with certain genetic disorders, such as Down's syndrome). Failure to thrive is a condition in which a child is not gaining as much weight as expected and is defined by the crossing of two major percentile lines (e.g., 90th percentile, 75th percentile, etc.) on the National Health Statistics Growth Chart.[33] Usually, weight is affected before height. Although most failure to thrive is caused by inadequate caloric intake or absorption, it may also be caused by systemic conditions. In addition to malignancy, urological conditions that may cause failure to thrive include recurrent urinary tract infections, chronic renal failure secondary to obstructive uropathy, renal tubular acidosis, or Fanconi syndrome.

In conjunction with growth pattern, the pediatric urologist should also make a note of the motor and cognitive development of the patient. Delayed milestones in these areas may be the result of central nervous system (CNS) injury or spinal cord dysfunction and may therefore have profound effects on urinary function, specifically dysfunctional voiding. Moreover, a child with delayed language skills may be referred to the urologist out of concern for daytime wetting when in fact the child may not yet be developmentally ready for toilet training.

Growth and Development of the Adolescent

Adolescence is a period of both rapid physical growth and sexual development. During the adolescent growth spurt, children gain as much as half of their adult weight and a quarter of their adult height. The growth spurt lasts 2–3 years and occurs 1–2 years earlier in females than in males.

True puberty is defined as the time during which the hypothalamic–pituitary axis matures, leading to an increase in luteinizing hormone (LH), follicle-stimulating hormone (FSH), and gonadal sex steroids (estrogen and testosterone). It is preceded by adrenarche—the onset of adrenal steroid synthesis—by 2 years.

In males, testicular enlargement is the first sign of puberty and occurs between 11 and 12 years of age. The growth of pubic hair occurs next and is followed by growth of facial or axillary hair 2 years later.

In females, puberty begins with thelarche (the development of breast buds) between 9 and 10 years of age. It is followed by pubic hair growth, and finally menarche between 12 and 13 years of age.

Tanner staging serves as a metric for monitoring the development of pubertal growth and sexual maturation. This staging system or scale is named after the British pediatric endocrinologist Dr. James M. Tanner, who examined a group of females every 3 months over two decades as a longitudinal study of pubertal growth. He went on to categorize these patients into five stages that represent a continuum of pubertal growth.[35] Tanner stages for both males and females are routinely used to assess normal and abnormal pubertal growth.[36] The Tanner stages as a classification of sexual progression define the changes of the external genital development in boys, breast development in girls, and pubic hair appearance in both boys and girls. The charting of these changes has been replicated in many references, and essentially can be summarized as follows:

Genital development (boys)

- *Stage I*: Prepubertal
- *Stage II*: Testes and scrotum enlarge and scrotal skin becomes thicker
- *Stage III*: Enlargement (elongation) of penis and further testicular growth
- *Stage IV*: Darker skin, increase in girth of glans and penis, continued growth of scrotum and testes
- *Stage V*: Adult genitalia

Breast development (girls)

- *Stage I*: Prepubertal
- *Stage II*: Elevation of breast and papilla (nipple) to produce a breast bud
- *Stage III*: Continued enlargement of the breast and areola with a smooth contour

- *Stage IV*: Papilla and areola form a secondary mound above the level of the breast
- *Stage V*: Adult stage with projection of papilla and recession of areola

Pubic hair (boys and girls)

- *Stage I*: Prepubertal (if hair is present, it is similar to abdominal wall hair)
- *Stage II*: Sparse appearance of pigmented hair, straight or curled; first noted at base of penis or along labia majora
- *Stage III*: Hair pattern is darker and curled, coarser, migrating to skin overlying symphysis pubis
- *Stage IV*: Hair is similar to adult distribution but in a slightly smaller area than for the adult
- *Stage V*: Adult hair distribution, more abundant

Abdominal Exam

General Abdominal Exam

Thorough examination of the abdomen requires inspection, palpation, and auscultation. In the abdomen, auscultation should always precede palpation, as palpation may decrease the tone of the bowel loops, resulting in decreased bowel sounds. Secondly, palpation of the abdomen is more irritating than auscultation, and in cases where the abdomen is acutely tender, the patient is more likely to decline further examination following palpation, rendering the abdominal exam incomplete. Detection of an abdominal mass may be the first manifestation of a pathologic or nonpathologic process, such as a distended bladder, a multicystic dysplastic kidney, a hydronephrotic kidney, or Wilms' tumor.[37]

When inspecting the abdomen, the physician should note both the contour of the abdominal wall and any skin markings. A scaphoid abdominal contour may indicate malnutrition or cachexia (malignancy), while a localized protuberance of the abdominal wall generally indicates distention of one or more intra-abdominal organs. For example, a protuberance in the hypogastrium may indicate distention of pelvic organs, such as the bladder (outlet obstruction or dysfunctional voiding). In infants or small children, a localized abdominal protuberance may also be the result of a solid tumor, such as neuroblastoma or Wilms' tumor.

In children with a history of constipation, urinary tract infection, or dysfunctional voiding, the abdomen should be palpated for hardened stool. Stool is most easily palpable in the left lower quadrant (sigmoid colon), although it may be palpable throughout the abdomen.

Normal-sized healthy kidneys are difficult to palpate in older children and teenagers because they are overlapped by the diaphragm and ribs and covered by thick musculature of the abdomen and back. In younger children, the kidneys may be palpable on deep inspiration, particularly on the right, where the kidney sits approximately one vertebral level lower (L1-L4 vs. T12-L3 on the left) due to the presence of the liver during development. Palpation of the kidney is best achieved with a bimanual technique, asking the patient to inhale and exhale deeply while progressively applying deeper palpation in the subcostal areas.

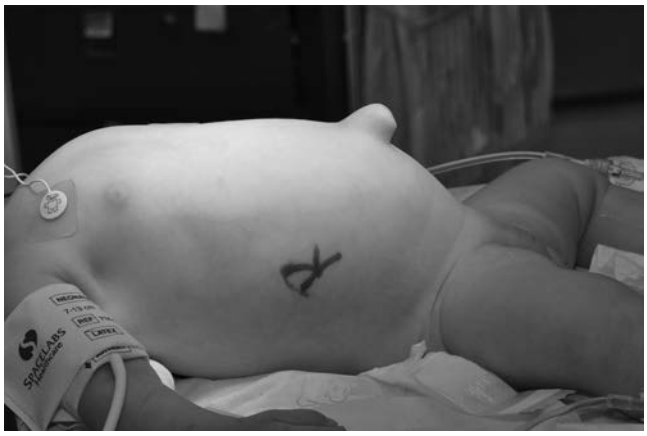

FIGURE 1.3 Abdominal mass.

In neonates and small infants, it is possible to use a single-handed technique by grasping the patient's flank between the thumb (anteriorly) and fingers (posteriorly over the costovertebral angle). At the point of deepest inspiration, bring the thumb in opposition with the fingers, trapping the kidney in between.

In children, over half of the palpable abdominal masses are of renal origin (Figure 1.3). A solid and therefore potentially malignant mass (Wilms' tumor or neuroblastoma) may be occasionally distinguished from a cystic mass (hydronephrosis, polycystic kidney disease, or multicystic kidney disease) by transillumination. This can be accomplished by placing a flashlight against the costovertebral angle on the side of the mass and examining the anterior of the abdomen. Since cystic masses are filled with fluid, they scatter light rays and appear to glow. Solid masses are opaque and will prevent transmission of light. Transillumination is most reliable in younger infants and newborns, as skin thickness, and as a result opacity, increases with age.

With regard to the physical examination of pediatric malignant masses, neuroblastoma typically presents as a firm, irregular mass, which crosses the midline due to its propensity for dissemination and multiple potential sites of origin. Conversely, Wilms' tumor typically presents as a mobile abdominal and flank mass, which does not cross the midline.

In patients with symptoms of urinary tract infection, pyelonephritis should be ruled out. Pyelonephritis, or any condition that distends the renal capsule (stone, perinephrenic abscess, etc.), will cause tenderness at the costovertebral angle.

Examination of the Bladder

The bladder is amenable to examination by both palpation and percussion. Palpation of the bladder should begin at the umbilicus and move caudally toward the symphysis pubis. The bladder is rarely palpable in most patients. A palpable bladder may be soft or tense, depending on its volume and also on the thickness of the detrusor muscle. The finding of bladder distension should prompt further evaluation for bladder outlet obstruction, neuropathic bladder, incomplete bladder emptying, or urinary retention (Figure 1.4).

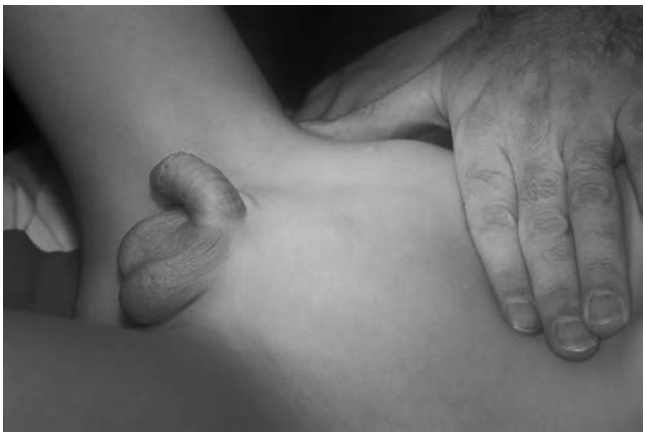

FIGURE 1.4 Palpation of distended bladder.

Significant bladder distension may be visible even on inspection as convex protuberance in the hypogastric region. If bladder distension is suspected based on physical exam, additional evaluation with ultrasound is warranted.

Genital Examination

Importance of the Genital Exam

The genital exam is not only the specific domain of the pediatric urologist, whose expertise in examining this area surpasses that of any other specialist, but also a part of the physical exam that is conducted less frequently by the generalist due to its intimate nature. Therefore, missed diagnoses in this area can go unnoticed for longer periods of time than other more readily accessible physical areas. In addition, many genital issues are congenital in origin and best repaired when the child is young. Finally, some genital conditions (undescended testes and disorders of sexual differentiation), whether repaired early or not, may have a significant medical and psychosocial effect on the patient later in life if they go undiagnosed.

Examination of the Scrotum and Its Contents

Examination of the scrotum begins, like other areas of the body, with inspection. Inspection may not only identify rare congenital malformations, such as disorders of sexual differentiation, but also provide insight into more common conditions. The inguinal and scrotal areas can be assessed simultaneously, looking for asymmetry, hernias, hydroceles, and undescended testes. Hydroceles should be closely examined to ensure that the testes can be palpated. Transillumination is frequently performed to demonstrate a fluid-filled hydrocele sac (Figure 1.5). Failure to identify a testis by palpation in a patient with a tense hydrocele should always prompt further evaluation with a scrotal ultrasound regardless of the results of transillumination, but particularly when transillumination suggests a solid mass[38] (Figure 1.6). The position of the testes in the scrotum should be observed prior to touching the patient, and invariably descended and retractile testes will be visible prior to palpation. Placing a hand over the inguinal area at the pubic tubercle before touching the scrotum will prevent

FIGURE 1.5 Transillumination of a scrotal hydrocele.

a retractile testis from ascending into the inguinal area in response to the cremasteric reflex, and allow the examiner to distinguish a retractile from an undescended testis (UDT) (Figure 1.7a and b). The examination of the scrotal contents

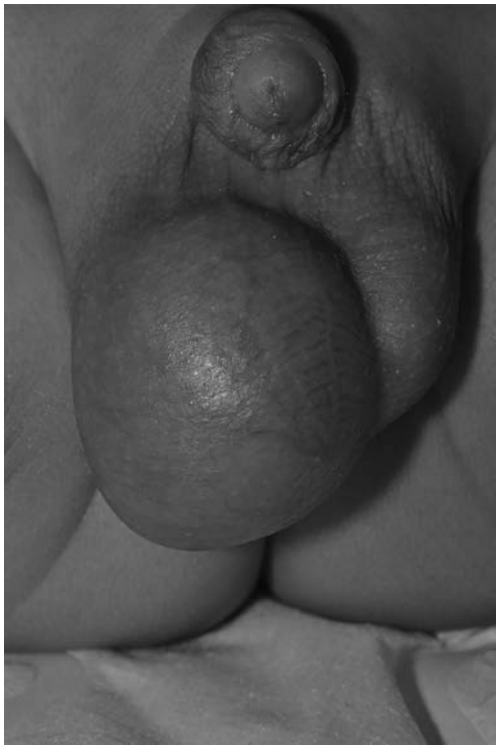

FIGURE 1.6 Testicular mass.