

Box 18-3**RISK FACTORS FOR BLADDER CANCER**

- Cigarette smoking
- Occupational exposures
 - Truck driving (diesel exhaust)
 - Painting
 - Leatherworking
 - Metalworking
- Male gender
- Age 55 and older
- Previous treatment with cyclophosphamide or ifosfamide (chemotherapy)
- Previous pelvic radiation (e.g., ovarian cancer treatment)
- European descent
- History of chronic bladder infections (such as with spinal cord injury, stroke), kidney or bladder stones, infection with parasite causing schistosomiasis
- Long-term catheterization (e.g., dementia, Alzheimer's disease, neurologic impairment)
- History of previous bladder cancer
- Family history of bladder cancer or retinoblastoma gene inheritance
- Under investigation:
 - Gene-environment interaction
 - Coffee
 - Fluid intake
 - Bacon consumption
 - Gonorrhea infection

Etiologic and Risk Factors

The specific cause of bladder cancer is unknown, but multiple risk factors are linked with the development of bladder cancer (Box 18-3). The strongest and most significant risk factor is smoking. Sixty-five percent to seventy-five percent of all individuals with bladder cancer have a strong smoking history. Cigarette smokers are twice as likely as nonsmokers to develop bladder cancer.

Occupational exposures are also related to bladder cancer, particularly exposure to (3-naphthylamine, 4-aminobiphenyl (ABP), and benzidine, used in the dye and rubber tire industries. Although these chemicals have been banned, others are currently being investigated for possible association, and those in many occupations appear to be at risk for the development of bladder cancer, such as painters, metalworkers, and truck drivers.^{12,65,184} It is estimated that up to 20% of bladder cancer is caused by an occupational exposure.¹⁰⁶

More than 90% of cases occur in people over 55 years old, making age another risk factor. Caucasians are twice as likely as African Americans to develop the disease, and men develop bladder cancer four times more often than women. A previous history of bladder cancer; previous treatment with high doses of the chemotherapy drugs cyclophosphamide or ifosfamide; and radiation to the pelvis also place people at higher risk.

Chronic inflammation, such as from recurrent UTIs, kidney or bladder stones, or the parasite causing schistosomiasis, increase the risk for the uncommon development of squamous cell carcinoma of the bladder. It is

believed that chronic irritation and inflammation cause transitional cells to undergo metaplasia and transform into malignant cells. This may also occur in areas already epithelialized with squamous cells, such as at the trigone.

Rare risk factors include uncommon birth defects such as exstrophy (where there is a defect in the abdominal wall), inheritance of the retinoblastoma gene, or a family history of bladder cancer.^{39,57} Increased fluid intake may decrease the risk of bladder cancer, leading to speculation that a more frequent urine flow decreases the time of contact between carcinogens and the bladder epithelium.¹²⁹ Long-term catheterization (e.g., in spinal cord injury) is a risk factor for squamous cell bladder cancer due to chronic inflammation.

The relationship between coffee and bladder cancer remains controversial despite decades of research. Studies have published varying results, but the findings to date indicate that there may be a weak association between coffee drinking and bladder cancer.^{166,186,209} Genes most likely play a role in the development of bladder cancer, and specific genes may put some persons at risk once exposed to a carcinogen.¹⁷²

Pathogenesis

Tumors of the urinary collecting system can arise from epithelial, mesenchymal, or hematopoietic tissues, but the majority of bladder cancers arise from the epithelium. Approximately 90% of these cancers are transitional cell carcinomas, with squamous cell carcinomas and adenocarcinomas making up the remainder. Bladder cancer is believed to develop through reversible premalignant stages followed by irreversible steps, ending in invasive cancer that can give rise to distant metastases. Variations in the clinical course suggest that different forms of bladder cancer develop along different molecular pathways, leading to tumor presentations of various malignant potential.²⁰²

The systemic absorption of environmental carcinogens, including cigarette smoke, followed by storage in the bladder exposes the urinary epithelium to concentrated levels of the agents for prolonged periods. This interaction of urine-soluble carcinogens with the epithelium is known as contact chemical carcinogenesis. The precise molecular events leading to the formation of bladder cancer are not known, but several genes appear to be involved. One includes the 9p21 locus (chromosome 9), which contains the CDKN2A/ARF tumor suppressor gene.⁹ Another factor may be the inability to repair deoxyribonucleic acid (DNA) following damage from carcinogens.¹⁶⁴ Further research is needed to determine which genes are involved and how risk factors interact in the development of bladder cancer.

Clinical Manifestations

Painless hematuria is the most common sign of bladder cancer. Gross hematuria is present in up to 85% of people with this condition, and microscopic hematuria is present in a majority of the remainder. The onset of hematuria is often sudden, and the hematuria is frequently intermittent; the degree of hematuria is not related to the volume of tumor or its stage.⁴³ Clots may form and cause urethral

blockage with resultant bladder enlargement and painful spasms. The intermittent pattern of bleeding can result in a delay in diagnosis. Other signs of voiding dysfunction may also be present, including frequency, urgency, and dysuria.

Lymphedema of the lower extremities may occur secondary to locally advanced masses or pelvic lymph node involvement. Obstruction of the ureter can lead to hydro-ureter or hydronephrosis. In the presence of advanced disease, back pain secondary to metastases to the vertebral bones may occur. Metastatic disease may also lead to liver or pulmonary symptoms.

MEDICAL MANAGEMENT

PREVENTION. Although there is no specific way to prevent bladder cancer, modification of risk factors may help. Smoking cessation is the number one prevention strategy for bladder cancer. Reducing exposure to industrial or occupational carcinogens would also lower the incidence of this type of malignancy. Large total fluid intake may reduce the risk of bladder cancer by reducing the time of contact between carcinogens and the bladder epithelium.^{21,129}

Vitamins and increasing consumption of fruits and vegetables initially showed benefit in reducing the risk for bladder cancer, but larger studies have not supported this relationship.^{85,130}

Currently, screening of the general population for bladder cancer is not recommended, principally due to a lack of evidence for its effectiveness (large studies have not been continued for more than 10 years). But there is evidence to suggest that screening people at high risk (i.e., smokers, people with an occupational exposure) may be beneficial.¹²⁷ Early detection of bladder cancer when still superficial can reduce mortality.

The best specific tests to use to screen for bladder cancer have not been determined, but in high-risk individuals, a urine dipstick test, evaluating for the presence of hematuria, and urine cytology are economical and noninvasive. Even with the presence of intermittent symptoms, these screening tests may miss many tumors. Some experts suggest cystoscopy, which visualizes the bladder and has an increased ability to detect tumors that are intermittently symptomatic. Cystoscopy, however, is more invasive and expensive. Further research is needed to determine the most appropriate candidates and tests to screen for bladder cancer.

The majority of bladder cancers are low-grade, superficial carcinomas that do not tend to metastasize. However, 50% to 90% of bladder cancers will recur, depending on the grade and stage. With recurrence, 10% to 50% will progress in stage or grade. Regular follow-up for early detection of cancer recurrence is important for anyone with a previous history of bladder cancer.

DIAGNOSIS. Bladder cancer is seldom recognized in its preclinical stage but rather is detected once symptoms present, usually hematuria. Younger people with hematuria most often have a benign cause, such as a UTI or kidney or bladder stones.

Evaluation usually consists of a history, physical examination, urinalysis, and urine culture. If the cause is not

determined with these measures, further evaluation should be done. For people over the age of 50 with hematuria (gross or microscopic), a history, physical examination, urinalysis, urine cytology, and cystoscopy should be performed. It is important to note risk factors the client may have for bladder cancer.

Cystoscopy allows the urologist to view the bladder for tumor and take a biopsy and cytology washings for evaluation. The cytology samples improve the ability to detect smaller tumors (especially if they are flat), since they are difficult to distinguish from normal bladder tissue.

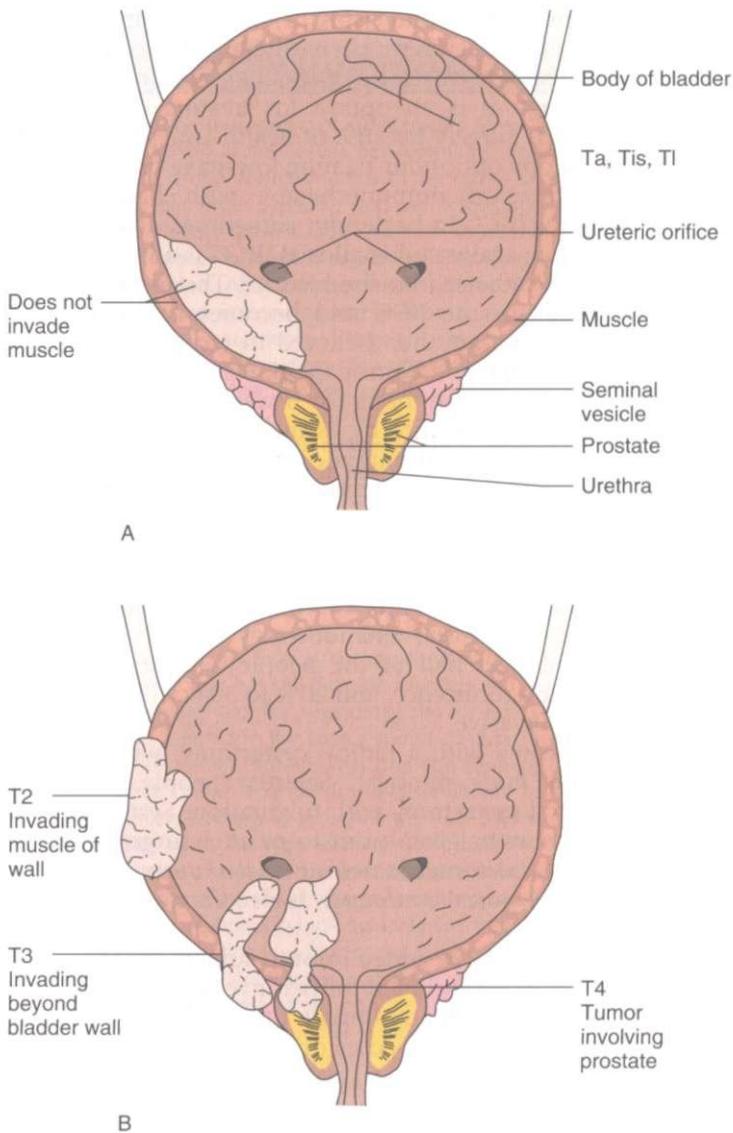
If tumor is noted in the biopsy specimen, depth of involvement can be determined, which aids in determining staging and treatment. Staging of the tumor may involve ultrasound, CT scan, bone scan, or other tests. A number of urine-based markers, including telomerase and nuclear matrix protein 22 (NMP22), are under investigation for their potential usefulness in diagnosing transitional cell cancer and in monitoring for recurrence.^{77,107,169}

STAGING. The TNM staging system is a staging scheme based on the progressive depth of invasion of tumor into the bladder wall that has been used to assign treatment, assess outcomes, and predict prognosis. Cancer cells that are present along the surface of the bladder mucosa but have not yet invaded, also called *in situ* carcinomas, do not yet have the potential for metastasis and are classified as Tis.

Tumors that have penetrated the basement membrane and invaded into the submucosa/lamina propria but not the muscularis propria are categorized as T1. T2 tumors invade the muscularis propria, while T3 tumors invade through the wall into perivesical tissue. T4 tumors invade other organs and structures, such as the prostate, uterus, vagina, pelvic wall, or abdominal wall (Fig. 18-8).

Once tumor is invasive, it has the capacity to metastasize and commonly first reaches lymph nodes near the bladder. The presence of lymph node involvement, number of lymph nodes affected, and distance of involved lymph nodes from the bladder determine the N categorization (NO for no involvement, N1 for nodes near the bladder, and N2 for nodes further away). Distant sites of metastasis include the liver, lung, and bone. The stage is determined by combining the T, N, and M status (e.g., stage 1 is T1, NO, MO). About 74% of bladder cancer is diagnosed as T1 or T2 tumors; 19% is T3; and 3% is T4.

TREATMENT. Treatment of bladder cancer is determined on the basis of the stage of the tumor and the person's general health. Surgery is the principal treatment for bladder cancer. Transurethral resection (TUR), surgery completed through the urethra using a rigid cystoscope called a resectoscope, is performed for early and superficial tumors. After the removal of the lesion, the tumor bed is treated either with a high-beam laser or fulguration (electric current used to destroy tumor tissue). Most clients can return home the same day or the next day. Complications include bleeding and discomfort. Long-term effects of repeated TUR include fibrosis of the bladder and loss of continence.

**Figure 18-8**

Bladder cancer staging using the TNM method. **A**, In Ta, Tis, and T1 tumors, cells do not invade muscle. **B**, If the muscle is involved, the tumor is staged as T2. T3 tumors invade beyond the bladder wall but do not involve other organs. T4 tumors are locally invasive to outside structures such as the prostate as shown or systemically with distant metastases (not shown).

Cystectomy is performed for invasive bladder cancer. If the tumor is small, a partial cystectomy may be performed in order to salvage functioning bladder tissue.¹⁰³ This approach is controversial, with some urologists preferring cystectomy even for selected clients with small tumor mass. A radical cystectomy is the surgery of choice for larger, invasive tumors or multiple tumors. This procedure removes the bladder and adjacent lymph nodes. The prostate is removed in men, and the uterus, ovaries, and a portion of the vagina are removed in women.

Following cystectomy, reconstructive surgery is performed to create a urine drainage system to compensate for the loss of the bladder. A urostomy procedure allows drainage of urine into a bag outside the abdomen. This is the least preferred long-term method of draining urine. The surgery that uses a short piece of small or large intestine to create a pouch or conduit from the ureters to the outside of the body is called an ileal conduit procedure.

Another surgical option is the creation of a continent diversion. In this procedure, the reserve pouch (intestine) has a valve. This valve allows urine to be stored until a

catheter is placed to drain the urine. Newer reconstructive methods create a "neobladder" from intestine, which is then attached to the urethra. This surgery allows clients the ability to urinate normally, using a Valsalva maneuver (increasing intraabdominal pressure). The surgical complications from these types of procedures include infection, urine leakage, and obstruction. Sexual side effects are common, particularly for men. Impotence has been an issue with radical cystectomies in the past, but newer techniques have reduced the risk of nerve damage. If impotence does occur, function can improve with time. Generally, younger men (under the age of 60) are more likely to regain function than older men.

Chemotherapy is administered in two ways: intravesically or systemically. Intravesical chemotherapy is given through a catheter into the bladder, directly affecting the lining of the bladder. Chemotherapy agents are not absorbed into the deep layers of the bladder; therefore, intravesical chemotherapy is effective only for superficial cancers. Systemic chemotherapy is usually given in combination for invasive cancer (such as methotrexate,

vinblastine, doxorubicin, and cisplatin). Radiotherapy in conjunction with concurrent chemotherapy is recommended less frequently because of the long-term consequences, although it is an option for treating clients unable to tolerate surgery because of health issues.

Another therapy option for treating low-stage bladder cancer is intravesical immunotherapy with bacillus Calmette-Guerin (BCG; a bacterium sometimes used to immunize people against tuberculosis). BCG is administered through a catheter into the bladder. The immune system responds to the BCG and becomes activated. These activated cells are then believed to recognize the cancer cells as foreign and destroy them. BCG is typically administered on a weekly basis for 6 weeks. BCG may reduce the risk of recurrence by as much as 50%. Side effects include flulike symptoms and a burning sensation in the bladder. Rarely, the bacterium can spread into the bloodstream, causing sepsis.

Stage 0 and 1 tumors are treated with TUR followed by intravesical BCG. If the tumor does not respond to the BCG, intravesical chemotherapy is administered, although either BCG or intravesical chemotherapy can be used first.⁶⁸ However, over half of the people with stage 1 tumors will have a recurrence, and 20% to 30% will have a cancer that is invasive.

Stage 2 is treated with a radical cystectomy, with or without lymph node removal. Selected people may undergo a partial cystectomy with fulguration. Systemic chemotherapy may be given prior to or after surgery to treat any small micrometastases not seen during the staging process. A radical cystectomy is also the treatment for stage 3.

Chemotherapy may be added prior to surgery (neoadjuvant) to improve survival, but further investigations are needed to determine the appropriate timing for chemotherapy.⁷⁴ Stage 4 therapy focuses on quality of life and slowing tumor growth. A radical cystectomy may be performed with chemotherapy if there are no distant metastases. Various combinations of therapy may be employed when distant metastases are present.

PROGNOSIS. Despite the continued increase in the number of new cases occurring each year, the mortality attributed to bladder cancer has remained fairly stable. Stage and grade of the tumor are prognostic indicators for local failure. The 5-year survival rates with treatment are 84% for white males, 71% for black males, 76% for white females, and 51% for black females (most likely reflecting delay in diagnosis and inadequate care due to socioeconomic issues). Individuals with T1 tumors have a 90% 5-year survival, while for those with muscle-invasive tumors survival at 5 years is 50%; those with deep muscle invasion will go on to have metastatic disease within 2 years.⁵

Bladder cancer is sensitive to chemotherapy and immunotherapy but also has a high incidence of local recurrence, usually within the first 2 years. In approximately 30% of cases metastasis develops during the course of the disease, and 50% of individuals with muscle-invasive disease at the time of diagnosis already have distant metastases. Although rare, long-term survival with recurrent cancer can be achieved in some individuals. Contin-

ued improvements in the management of bladder cancer will improve the prognosis in the future.

SPECIAL IMPLICATIONS FOR THE THERAPIST 18-7

Bladder Cancer

The risk of severe late radiation sequelae is low (less than 5%), and about 75% of long-term survivors maintain a normally functioning bladder. The therapist may likely treat those individuals who have residual bladder control problems. The high rate of cancer recurrence requires therapists to be vigilant in observing for the onset or return of symptoms and signs suggestive of urogenital system disease or metastatic spread. Anyone reporting visible blood in the urine must be evaluated further by a physician.

Neurogenic Bladder Disorders

Overview

Voiding dysfunction associated with neurologic pathology is termed a neurogenic bladder disorder. There are many types of voiding dysfunction that can interfere with normal urine storage and coordinated, voluntary release.

Voiding dysfunction associated with neurologic pathology can be classified using one of many descriptive systems available. Each categorization scheme has advantages and disadvantages. For example, the Bors-Comarr Classification is well suited for clients with voiding dysfunction secondary to spinal cord injury but not as useful for clients with other problems.

Urodynamic classification correlates urodynamic findings and symptoms, while the International Continence Society Classification separates storage and voiding abnormalities and expands many of the urodynamic classification categories. The Lapides Classification is well known and helpful to nonurologists, so will be used as the classification system for this section. It correlates cystometry findings with clinical symptoms.

This classification system separates voiding dysfunction into five categories: (1) sensory neurogenic bladder, (2) motor paralytic bladder or motor neurogenic bladder, (3) uninhibited neurogenic bladder, (4) reflex neurogenic bladder, and (5) autonomous neurogenic bladder. This system provides a framework for understanding neurogenic bladder disorders, particularly for the nonurologist, but applies only to those disorders with a neurologic basis for pathology. Many clients may demonstrate a mixture of sensory and motor abnormalities, and symptoms may overlap between categories.

Incidence

Voiding dysfunction is a common problem associated with many types of neurologic diseases. In the United States, over 91,000 people are released from the hospital each year with a neurologic disease or spinal cord injury.³⁰ Voiding dysfunction is costly and leads to significantly decreased quality of life, particularly in the older adult.

when long-term care is often considered for this problem in an otherwise healthy adult.

Etiologic Factors

The common disorders that can result in neurogenic bladder dysfunction include cerebrovascular accident, dementia, Parkinson's disease, multiple sclerosis, and brain tumors. Neurogenic bladder dysfunction can also occur secondary to spinal cord lesions such as spinal cord injury, herniated intervertebral disc, vascular lesions, spinal cord tumors, and myelitis.

Local pelvic irritation can result in spasm of the external bladder sphincter, impairing urinary function. The local irritation can occur in the presence of vaginitis, perineal inflammation, urethral inflammation, and chronic prostatitis. Hypotonic (flaccid) bladder dysfunction can be secondary to meningocele, spina bifida, and diabetes mellitus.

Pathogenesis

The process of micturition involves a complex interplay of nerves. Proper functioning of these nerves is needed for voiding to occur. The normal structures involved in micturition include the brain, the spinal cord, and nerves to the bladder. The type of voiding dysfunction that occurs is dependent on the underlying cause and which nerves are affected (Box 18-4).

The micturition reflex center is located in the brainstem. The efferent (exiting) neurons travel down the spinal cord in the reticulospinal tract to the detrusor muscle of the bladder. Parasympathetic nerves originate in the spinal cord at the level of S2, S3, and S4 and innervate the bladder wall via the pelvic nerve.

Preganglionic sympathetic nerves have their origin in the spinal cord at the levels of T10 through L2 and travel through the sympathetic chain ganglion to the bladder neck and fundus. The bladder neck contains the internal urethral sphincter (involuntary muscle). The external urethral sphincter (voluntary muscle) is innervated by the pudendal nerves, which originate in the spinal cord at the level of S2 through S4.

Damage to nerves involved in micturition can result in different types of voiding dysfunction. *Cerebral injury* (above the micturition reflex center) leads to loss of voluntary inhibition of voiding and a hyperreflexic bladder, but coordinated sphincter function is retained. This results in the ability to completely void, but because of the hyperreflexic bladder, incontinence occurs. This can be seen in brain tumors, cerebral palsy, cerebrovascular accidents, dementia, Parkinson's disease, pernicious anemia, and Shy-Drager syndrome.

Lesions in the region of the micturition center to S2 result in loss of voluntary inhibition and coordinated sphincter activity. Since the sphincters are unable to coordinate their activity (the sphincter remains closed although bladder contractions occur), high pressure along with ureteral reflux result, termed dyssynergic sphincter function (*detrusor-sphincter dyssynergia*). This leads to urinary retention and incomplete voiding. Diseases that can result in this type of voiding problem include anterior spinal cord lesions, ischemia, multiple sclerosis, myelodysplasia, and trauma.

Box 18-4

TYPES OF MICTURITION PATHOLOGY

- *Sensory neurogenic bladder* occurs when there is a disruption of the nerves between the bladder and the spinal cord or the afferent nerves to the brain. Diabetes, tabes dorsalis (from syphilis), and pernicious anemia (vitamin B12 deficiency) are the most common causes. Initial changes include an abnormal sensation in response to bladder distention. Affected people will not recognize the need to void, and unless frequent voiding is instigated, the bladder becomes chronically distended. This eventually leads to bladder hypotonicity with urine retention.
- *Motor paralytic bladder* results from the destruction of the parasympathetic motor nerves that innervate the bladder. This may occur with extensive pelvic surgery or trauma. Clinical symptoms can initially vary, ranging from a mild inability to initiate or maintain a urine stream to painful urine retention. Like sensory neurogenic bladder, with chronic bladder overdistension, motor paralytic bladder results in a distended bladder with large-volume urine retention.
- *Uninhibited neurogenic bladder* refers to damage of the corticoregulatory tract. This nomenclature is somewhat outdated; the term is no longer used to classify bladder dysfunction but still may be found in the literature. It was presumed that the regulatory site for reflex bladder control was located in the sacral spinal cord or the micturition reflex center. If there was damage to the corticoregulatory tracts, there was, in turn, a disinhibition of the micturition center, leading to incontinence. Conditions classified as leading to this type of neurogenic bladder included cerebrovascular accidents, brain or spinal cord tumors, Parkinson's disease, demyelinating diseases, and brain tumors. Clinical symptoms included frequency, urgency, and urge incontinence. Bladder sensation is normal but involuntary contractions occur at urine low volumes. Voluntary contractions can be initiated by the affected person but the capacity to store urine is decreased.
- *Reflex neurogenic bladder* describes the condition of the bladder following a spinal cord injury or "postspinal shock." This occurs when there is a complete disruption between the sacral spinal cord and the brainstem, as seen with traumatic spinal cord injury or transverse myelitis. Other disorders or disease processes that cause significant demyelination of the spinal cord can also lead to reflex neurogenic bladder. The bladder lacks sensation and the person is unable to determine when the bladder is distended. Affected people also are unable to initiate micturition (voiding) and develop sphincter dyssynergia incontinence (the external sphincter tightens during micturition as the detrusor muscle is contracting, resulting in increased intravesicular pressure and vesicoureteral reflux).
- *Autonomous neurogenic bladder* refers to the complete separation of sensory and motor nerves of the bladder from the spinal sacral cord. Damage to the sacral roots or cord or the pelvic nerves can lead to this type of voiding dysfunction. Clients with this problem are unable to initiate voiding and there is no bladder sensation, leading to large-volume bladder capacity and distension. This type of voiding dysfunction can be seen in clients with spinal shock. Initial cystometric findings can be similar to those in the late stages of motor or sensory paralytic bladder (large capacity with low bladder pressure), but with continued inflammation and nerve damage, the bladder can lose capacity and compliance.

Complete spinal cord injury above T5 or T6 leads to *autonomic dysreflexia* (loss of sensation of bladder distension results in overdistension) and detrusor-sphincter dyssynergia. This type of injury also involves the sympathetic nerves and loss of sympathetic inhibition, leading to systemic sympathetic symptoms such as hypertension, facial flushing, perspiration, and headache. Since the vagal nerve is intact, bradycardia accompanies this syndrome.

Spinal cord lesions at the level of S2 and below lead to bladder areflexia and dysfunction of the external sphincter. Since parasympathetic nerves are not affected (ganglia are in or near the bladder wall), bladder tone is preserved, but bladder compliance decreases with time (secondary to repeated infection, fibrosis, and changes in innervation).

The external sphincter maintains some tone but the bladder neck does not relax, leading to obstructive problems when voiding (overflow incontinence). Acute transverse myelitis, diabetes, Guillain-Barre syndrome, herniated intervertebral disc, myelodysplasia, pelvic surgery, tabes dorsalis (syphilis), and trauma can cause this type of neurogenic bladder.

Diabetic bladder neuropathy occurs in 43% to 87% of people with type 1 diabetes mellitus and 60% to 75% of people with type 2 diabetes.^{53,104} The actual neurologic damage and symptoms vary among clients with diabetes and include diabetic cystopathy (impaired bladder sensation, increased postvoid residuals, increased bladder capacity, and decreased bladder contractility), detrusor overactivity, bladder outlet obstruction (seen in men), and urge and stress incontinence. Diabetic bladder neuropathy occurs when other diabetic complications are apparent (e.g., diabetic retinopathy, microalbuminuria).

Clinical Manifestations

Neurogenic bladder dysfunction is manifested by partial or complete urinary retention, incontinence, urgency, suprapubic pain, or frequent urination. Common complications include UTIs, kidney stones, and deterioration in renal function.

MEDICAL MANAGEMENT

DIAGNOSIS. Numerous tests can be used to assess the anatomic and physiologic status of the bladder, associated structures, and nervous system. Urodynamic testing includes many types of urologic studies and is frequently performed to categorize abnormalities and determine cause and most appropriate treatment.

Urodynamic studies include uroflowmetry, cystometry, urethral pressure studies, pressure-flow micturition studies, electrophysiologic studies, and video urodynamic studies. All or a portion of these tests can be performed as appropriate, if spinal cord or brain abnormalities are suspected, an MRI is beneficial.

Many diseases lead to voiding dysfunction, and a complete history and physical can often reveal the cause. Other tests can be performed as needed to diagnose these disease processes.

TREATMENT. The primary goals of treatment include preventing incontinence, bladder overdistention, UTIs, and renal damage. Treatment modalities include catheteriza-

tion, pharmacologic agents, bladder training, and surgery.

Clean intermittent catheterization is a commonly employed intervention to avoid bladder overdistention. It is usually performed at 4-hour intervals and aids in reducing the risk for vesicourethral reflux and kidney damage. Permanent indwelling catheters are used only in specific medical situations, and alternatives should be used as possible.

Indications for short-term indwelling urinary catheter include the following: (1) for accurate monitoring of urine output, (2) for relief of urinary obstruction, (3) for prevention of obstruction from large clots when hematuria is present, (4) for surgical procedures involving general or spinal anesthesia, and (5) for incontinence when pressure ulcers are present.

Although a medical necessity in certain situations, permanent indwelling catheters carry a risk. UTIs, urethral irritation, epididymo-orchitis, pyelonephritis, renal calculi, and cancer have all been associated with the use of permanent indwelling catheters in people with spinal cord injury.^{41,201} Although associated with fewer adverse effects, intermittent catheterization can lead to reduced quality of life.¹³⁹

Catheterization is frequently used in conjunction with medications. Anticholinergic agents are used to treat voiding dysfunctions that include detrusor hyperactivity. These agents relax the bladder, reduce high pressures, and increase bladder capacity. Side effects include dry mouth, gastrointestinal disturbances, drowsiness, cognitive impairment, hallucinations, and delirium.

While a relatively new treatment, botulinum toxin A injections into the detrusor muscle appear to reduce involuntary bladder contractions in people with neurogenic detrusor overactivity.^{4,101} Long-term studies are needed to determine appropriate duration and efficacy of treatment.

Bladder training methods are designed to enhance bladder function and prevent complications. Adequate fluid intake is important for the prevention of infection and overconcentrated urine. With a hyperreflexive bladder or detrusor-sphincter dyssynergia the abnormally concentrated urine can stimulate afferent nerve endings, exacerbating the bladder disorder. This could increase vesicular pressures, vesicoureteral reflux, and overflow incontinence.

Fluid intake must be controlled and monitored to prevent bladder distention. Biofeedback techniques using electromyography or cystometry help the person control external sphincter function or increase intravesicular pressure sufficiently to overcome outflow resistance.

A variety of surgical interventions for neurogenic bladder exist, although due to the invasive nature of the surgery, it is often utilized after more conservative methods have failed. Procedures include bladder augmentation cystoplasty (colon, ileus, stomach, or ureter can be used); cystectomy with or without continent diversion; ureteral and bladder neck suspension; artificial urinary sphincter implantation¹¹⁵; ileovesicostomy, ileal conduit, or placement of suprapubic catheters; denervation procedures and electrostimulation (for complete lesions); and sacral nerve neuromodulation (for incomplete lesions).

SPECIAL IMPLICATIONS FOR THE THERAPIST **18-8**

Neurogenic Bladder Disorders

PREFERRED PRACTICE PATTERNS

See also *Special Implications for the Therapist: Urinary Incontinence* later in the chapter.

5C: Impaired Motor Function and Sensory Integrity Associated with Nonprogressive Disorders of the Central Nervous System—Congenital Origin or Acquired in Infancy or Childhood

5D: Impaired Motor Function and Sensory Integrity Associated with Nonprogressive Disorders of the Central Nervous System—Acquired in Adolescence or Adulthood

5F: Impaired Peripheral Nerve Integrity and Muscle Performance Associated with Peripheral Nerve Injury (flaccid bladder)

5H: Impaired Motor Function, Peripheral Nerve Integrity, and Sensory Integrity Associated with Nonprogressive Disorders of the Spinal Cord

Therapists provide care for many people who have sustained spinal cord injuries and cerebrovascular accidents or who have myelomeningoceles, multiple sclerosis, or brain tumors. Neurogenic bladder disorders are usually only one of the complications associated with these conditions, but familiarity with this complication is important. The potential for UTIs, renal calculi, and renal damage is high in those with neurogenic bladder disorders.

The development of any of these comorbidities can interfere with the rehabilitation process. Several medical conditions such as UTI, diabetes, congestive heart failure, bladder cancer, and enlarged prostate can be mistaken for a bladder control problem. Familiarity with the signs and symptoms associated with these potential diseases is a necessity. Detection of any of these symptoms warrants communication with a physician.

Incontinence associated with any of the bladder conditions discussed here can be greatly improved and even eliminated in many people through a program of exercise and behavioral intervention. Specific guidelines are available.^{91,92,185,197}

Urinary Incontinence

See the section on Pelvic Floor Disorders in Chapter 20.

Definition and Overview

UI may be defined as an involuntary loss of urine that is sufficient to be a problem and occurs most often when bladder pressure exceeds sphincter resistance.⁵⁰ The following four categories can be used to classify UI:

1. *Functional incontinence* occurs in people who have normal urine control but who have difficulty reaching a toilet in time because of muscle or joint dysfunction.
2. *Stress incontinence* is the loss of urine during activities that increase intraabdominal pressure such as coughing, lifting, or laughing.

3. *Urge incontinence* is the sudden unexpected urge to urinate and the uncontrolled loss of urine. Urge incontinence is often related to reduced bladder capacity or detrusor instability (the latter is also referred to as *overactive bladder*, *hyperreflexive bladder*, *detrusor-sphincter dyssynergia*, or *detrusor hyperreflexia*).

4. *Overflow incontinence* is the constant leaking of urine from a bladder that is full but unable to empty.

Some people can have more than one type of incontinence (most often stress and urge incontinence together), known as *mixed incontinence*. *Postsurgical incontinence* refers to the incontinence a person can develop following urologic surgery.

UI is common, particularly in older adults. Approximately 10% to 35% of community-dwelling and 50% to 60% of nursing home adults have incontinence. Yet the condition is poorly understood, underdiagnosed, and often inadequately treated. Many people are embarrassed to acknowledge that they are incontinent. Only 20% to 50% of incontinent adults seek medical care.¹⁹⁹ Others regard incontinence as part of the normal aging process. The economic price tag associated with UI is estimated to be greater than \$26 billion per year in the United States.⁹⁰ Incontinence can be a significant contributory factor related to falls in older adults,¹⁹ pressure sores, UTIs, institutionalization, depression, and isolation.

Prevalence

UI is more prevalent in women than men and in the aging over the young. The prevalence of UI was first reported in 1988 at the National Institutes of Health Consensus Conference on Adult Urinary Incontinence. At that time, an estimated 10 million adults in the United States experienced incontinence, including 15% to 30% of community-dwelling older adults and more than 50% of nursing home residents.³³

Others cite a range of 13 to 25 million individuals in the United States.⁵⁰ In fact, it is estimated that 50% of all admissions to skilled nursing facilities today are a direct result of UI, and another large portion of affected individuals are homebound.

Since the first consensus conference, an increased awareness of and focus on the problem of UI has come about. Until recently, the impact of UI on working women employed full time, a population generally characterized as healthy, has not been the focus of research. One survey at a large university center reported that 21% of the women surveyed (age 18 and older) reported UI at least monthly.⁵⁵

Risk Factors

A wide range of factors can contribute to the increased risk of developing UI (Box 18-5). Some risk factors are more likely to lead to one type or another or several types of incontinence. Since women are more likely than men to develop UI, there are several factors associated with childbirth and gynecologic surgery. Women who have had multiple pregnancies and deliveries (whether cesarean section or vaginal birth) have a higher incidence of UI. Hysterectomy, the presence of a cystocele, and uterine prolapse may also increase a woman's risk.

Box 18-5**RISK FACTORS FOR URINARY INCONTINENCE**

- Altered local anatomy and physiology
 - Pelvic floor muscle weakness (e.g., pregnancy/multiple pregnancies; childbirth/delivery [vaginal or cesarean section]; episiotomy; high fetal gestational weight; any pelvic surgery, including hysterectomy for women, prostatectomy for men])
 - Cystocele or uterine prolapse
 - Congenital sphincter muscle weakness or damaged sphincter muscle
 - Pudendal nerve damage (e.g., childbirth trauma, pelvic surgery, radiation)
- Neurologic disorder (e.g., myelomeningocele, multiple sclerosis, brain injury, Parkinson's disease, cerebral palsy, spinal cord injury, stroke)
- Psychogenic (e.g., childhood and/or adult sexual trauma for both males and females, negative sexual experiences, emotional stress)
- History of benign prostatic hyperplasia (BPH)
- Constipation, fecal impaction
- Tobacco use
- History of recurrent urinary tract infections
- Medications
 - α -Adrenergic blockers (antihistamines, decongestants)
 - Antibiotics
 - Antiparkinson agents
 - Diuretics
 - Hormone replacement therapy (estrogen plus progestin in postmenopausal women)
 - Hypertensives
 - Tranquillizers, sedatives
 - Tricyclic antidepressants
- Decreased estrogen (deficiency)
- Bladder irritation
 - Caffeine
 - Alcohol (?)
- Restrictive clothing, restraints
- Loss of activities of daily living skills for toileting
- Decreased or impaired mobility
- Impaired cognitive function
- Radiation therapy
- Obesity
- Race (Caucasian)
- Higher socioeconomic status

Consistent evidence shows that frequency of UI (particularly urge incontinence) increases with age. One large study showed that the prevalence of urge and mixed incontinence increased with age, while stress incontinence was not related to advancing age. This may be because the prevalence of stress incontinence remained unchanged.¹⁶

Medications commonly prescribed for other illnesses can also increase the risk of incontinence. These pharmacologic agents can interfere with conscious inhibition of voiding, induce a quick diuresis (diuretics),¹³¹ produce urinary retention, or reduce urethral resistance to the point of stress incontinence. Tranquillizers and sedatives may impair awareness of the usual cues related to urinary urgency and may also depress the cerebral corticoregula-

tory tract, affecting detrusor muscle activity.¹¹⁷ Drugs producing anticholinergicside effects (e.g., major tranquilizers and antiparkinsonian agents) may cause urinary retention because of failure of bladder contraction. Laxatives, estrogen, and antibiotics are also associated with an increased risk for ui.^{54,86,168}

Although estrogen deficiency is a risk factor for UI, hormone replacement, including estrogen plus progestin, in healthy postmenopausal has been linked with incontinence.^{75,162} Topical estrogen can be used if incontinence is due to atrophic vaginitis or severe vaginal atrophy.

High caffeine intake (more than 400 mg/day) can also contribute to the development of urge incontinence, while studies involving alcohol consumption have reported mixed results.^{54,171} Constipation and other bowel problems increase the risk of UI, which may be related to pelvic organ prolapse.²⁶ Recurrent UTI is also an independent risk factor for developing UI, as is increased body mass index (BMI). Obesity is a common condition among women in developed countries and is believed to have a major impact on stress incontinence. The proposed mechanisms for this association include the increased intraabdominal pressures that adversely stress the pelvic floor and the effect of obesity on the neuromuscular function of the genitourinary tract.³⁵

Race and socioeconomic class may also play roles in the development of UI. It appears that Caucasian women are more likely to have UI than African American women, while women from a higher socioeconomic class have an increased risk of UI. The risk associated with smoking is unclear, but smoking may be an independent risk factor for UI.

Overflow incontinence can occur as a result of conditions that cause urethral or bladder neck obstruction, such as benign prostatic hyperplasia (see Chapter 19), fecal impaction, or organ prolapse (see Figs. 20-9 and 20-10).

Lastly, as older adults lose their mobility and manual dexterity secondary to a multitude of ailments, getting to the bathroom or commode in a timely fashion and manipulating clothing become increasingly difficult. The presence of two or more diseases significantly increases the likelihood of developing UI. Common illnesses associated with UI include diabetes, stroke, hypertension, cognitive impairment, parkinsonism, arthritis, and hearing and visual impairments.

Pathogenesis and Clinical Manifestations

Incontinence, as discussed earlier, is categorized depending on the cause and pathophysiology. Each type of UI has associated clinical manifestations. Mixed incontinence, particularly urge and stress incontinence, is common, with overlapping symptoms from both types of incontinence.

Functional incontinence lacks a pathologic origin and is the consequence of chronic impairments of physical or cognitive function that make toileting in a timely fashion difficult.

Urge incontinence is often caused by involuntary bladder (detrusor) spasms and is associated with both increased frequency and urgency. Normal bladder control is a minimum of 2 hours and usually gauged as 3 to 5 hours

without toileting. Urinating more than eight times a day and/or two or more times a night is a symptom of urge incontinence.

Normal urination involves signals from the cortex of the brain, through the pons, spinal cord, peripheral autonomic system, sensory afferent innervation of the lower urinary tract, and finally to the bladder itself. Normally, the bladder is designed to hold a pint of urine for several hours. As it fills, the detrusor muscle relaxes to allow the bladder to stretch and accommodate more urine; the sphincter contracts to prevent urine from escaping through the urethra.

Pelvic floor muscles also support the base of the bladder and close off the bladder end of the urethra, further blocking the flow of urine. When the bladder is full, a message to get to the bathroom is received, at which time the sphincter and pelvic muscles relax, allowing urine to flow into the urethra, while the detrusor muscle contracts to squeeze the urine out of the bladder.

Because much of this system involves the nervous system, overactive bladder is often associated with neurologic conditions such as stroke, multiple sclerosis, advanced diabetes, spinal cord injury, and dementia. Urge incontinence is characterized by leakage (sometimes large-volume accidents) after a sudden precipitant urge to urinate or by events such as trying to insert a key in the door, running hands under water (or hearing running water), or passing by a bathroom.

Stress incontinence results from weakness or loss of tone in the pelvic floor muscles, urethral sphincter failure, hypermobility of the ureterovesical junction, or damage to the pudendal nerve (e.g., tumor, childbirth) (see Figs. 20-7 and 20-8). It is accompanied by leakage that is coincident with increases in intraabdominal pressure (e.g., coughing, sneezing, laughing, bending, high-impact physical activity or exercise). Someone with mixed urge and stress incontinence may exhibit signs of both types.

Other clinical manifestations, depending on the underlying pathology, may include constant dribbling, leakage without warning, frequency, urgency, nocturia, hesitancy, weak stream, or straining to void. Prolapsed bladder, uterus, and/or bowel may accompany or contribute to leakage, especially when caused by multiple pregnancies and deliveries.

Overflow incontinence is usually the result of a neurologic problem such as hypotonic or underactive detrusor secondary to drugs, fecal impaction, diabetes, lower spinal cord injury, or multiple sclerosis. It can also occur as the result of obstruction (e.g., prostatic hyperplasia, genital prolapse, or surgical overcorrection of urethral detachment in women). In this situation, as the bladder fills and becomes overdistended, the pressure inside the bladder finally exceeds the maximal urethral pressure and urine "overflows."

Overflow incontinence often manifests with symptoms of stress and urge incontinence and is characterized by frequent or constant dribbling, inability to completely empty the bladder, hesitancy, weak stream, need to strain to void, bladder distension, and urinary urgency and frequent urination. Anticholinergics, narcotics and α-adrenergic agonists can worsen these symptoms.

MEDICAL MANAGEMENT

PREVENTION. Preventive education is the key to eliminating a large majority of incontinence. Many health care professionals advocate early education for adolescent girls and young women before they become pregnant. Prepartum and postpartum pelvic floor muscle training has been shown to have immediate and long-term effects in preventing incontinence, improving quality of life, and improving sexual dysfunction.^{11,133,134}

Proper instruction in pelvic floor exercise emphasizing both fast-twitch and slow-twitch muscle fibers is an important part of prevention. Brief verbal or written instruction in performing a Kegel pelvic muscle contraction is not adequate preparation as measured in more than 50% of cases investigated.⁷ A properly performed Kegel exercise should result in a significant increase in the force of the urethral closure without an appreciable Valsalva effort. Improperly done, the Kegel technique can potentially promote incontinence.

The best time to explain a Kegel exercise is during a pelvic examination. The medical practitioner can describe the exercise and verify that it is done correctly during the examination. A trained practitioner, such as a physical therapist, can also provide follow-up assessment and training with necessary biofeedback to ensure the success of a properly performed exercise program. This may be particularly helpful in older adults, who often have a difficult time localizing pelvic muscles.

Avoiding constipation through proper nutrition, adequate hydration, and responding to the need to toilet should be part of the health curriculum for children. The therapist can be very instrumental in establishing screening programs for all ages to assess for risk factors for UI or for the presence of incontinence and teaching proper lifting techniques, lifestyle management, behavioral techniques, and pelvic floor protection during increased abdominal pressure (e.g., lifting, laughing, coughing, sneezing, vomiting). Anyone experiencing leaking during exercise needs a prescriptive exercise program both for the leaking and modifying the exercise that precipitates the leaking.

DIAGNOSIS. Since UI is related to a wide variety of disorders and factors, a detailed investigation may be necessary to determine the cause(s). An important part of this investigation is a voiding diary to determine the frequency, timing, and amount of voiding and to assess the numerous other risk factors potentially associated with incontinence.⁵⁰

A careful history will investigate medication usage, prescribed and OTC; past and current illnesses; and surgical and birth histories. Physical examination should include a pelvic, genitourinary, and rectal examination to evaluate for the presence of prolapse, fecal impaction, atrophic vaginitis, cystocele, masses, prostate hypertrophy, and prostate nodule.

Urinalysis may reveal hematuria or infection. In order to differentiate between urge and overflow incontinence, a postvoid residual should be obtained. If obstruction is not present, the bladder should contain less than 100 ml of urine after voiding. Many of the cases of incontinence

can be diagnosed without significant invasive techniques and treated by modifying reversible risk factors. The mnemonic DIAPPERS summarizes the reversible causes of incontinence: *D* for delirium, *I* for infection, *A* for atrophic urethritis/vaginitis, *P* for pharmaceutical, *P* also for psychologic disorders, *E* for excessive urine output (associated with congestive heart failure or hyperglycemia), *R* for restricted mobility, and *S* for stool impaction.¹⁹⁴

Clients who have abnormal physical or laboratory findings may require further workup, particularly if surgery is planned or the diagnosis is in doubt. Cystoscopy is beneficial in the presence of hematuria to assess for bladder cancer. Urodynamic evaluation is used in select clients who may have nonspecific symptoms or for whom a more precise diagnosis of obstruction is needed. Cystometry is used to assess bladder capacity, sensation, voluntary control, and contractility. Cystometry consists of filling the bladder with water or carbon dioxide and recording changes in intravesicular pressure. When stress incontinence is suspected, provocative stress testing is carried out. The client is asked to cough vigorously while the examiner observes for urine loss. The test is initially done in the lithotomy position but if the result is negative, is repeated in a standing position.⁵⁰ Dynamic MRI is being investigated to study specific aspects of voiding associated with stress incontinence.^{10,83}

TREATMENT. Management of UI depends on the type of incontinence and the person's age and general health but usually falls into one of three categories: behavioral, pharmacologic, and surgical. Behavioral intervention is considered the first line of treatment for pelvic muscle rehabilitation and includes a combination of lifestyle and dietary changes, prescriptive exercises including Kegel exercises and Beyond Kegel exercises,⁹² pelvic floor electrical stimulation, biofeedback therapy, support devices such as pessaries, and vaginal weight training.

Pessaries are devices inserted into the vagina that are designed to support the bladder and bladder neck. These devices come in a variety of shapes and sizes and are made of flexible or rigid silicone, latex, or acrylic. Some pessaries can stay in the vagina for up to 3 months before being removed, cleaned, and replaced; others are used just during exercise or sexual intercourse. A properly fitted pessary should not interfere with bowel or bladder function and should not be uncomfortable.

A new technology using noninvasive pulsed magnetic fields (extracorporeal magnetic innervation) has recently been used in the treatment of stress and urge incontinence, with mixed results.^{66,195,208}

Functional Incontinence. Functional incontinence occurs from mobility and access deficits, such as being confined to a wheelchair or needing a walker to ambulate. Deficits in dexterity, such as weakness from a stroke or neuropathy and loss of motion from arthritis, may keep the individual from getting pants unfastened or underpants pulled down in time to avoid an accident. Altered mentation from dementia or Alzheimer's disease can also contribute to untimely urination without a urologic structural problem.

Because this type of incontinence has no urologic pathology but is due to other factors, treatment is aimed

at correcting or improving the underlying problems. For example, if physical impairments make mobility difficult, thus affecting the client's ability to reach a bathroom, appropriate devices (i.e., bedside commode) and therapy can be provided. Clothing should be easy to remove.

Physical and occupational therapists can often help improve mobility skills. Behavioral strategies for scheduled voiding and assistance may help avoid accidents. If cognitive impairment is a factor, prompted voiding can decrease the number of incontinence episodes. In extended care facilities, a toileting assistance program can be established.

Stress Incontinence. Stress incontinence can be treated by behavioral and surgical methods. Behavior modifications include pelvic floor muscle training (Kegels, Beyond Kegel exercises),⁹² with or without biofeedback and electrical stimulation. A recent Cochrane review reported pelvic floor muscle training to be effective for the treatment of stress or mixed incontinence.⁸¹

Studies evaluating electrical stimulation show only slight improvement over placebo, while the use of vaginal cones was found to be inferior to pelvic floor training.⁸⁰ Self-positioning pessaries are available as an alternative to pads and surgery.⁵¹

Surgeries that may be used to correct pelvic floor laxity include an open retropubic colposuspension, anterior vaginal repair, bladder neck needle suspension, and suburethral sling procedure. Surgical correction of a cystocele or uterine prolapse may improve symptoms. Periurethral injections with a bulking agent (such as collagen) may be administered to increase sphincter resistance in women and in men who have stress incontinence due to post-prostatectomy changes. Artificial urinary sphincters can be considered but have a cure rate of about 50% with high morbidity.⁶⁹

Urge Incontinence. Various interventions are used to treat urge incontinence, with the primary focus being behavioral modification. Biofeedback and pelvic floor training along with bladder retraining can significantly improve urge incontinence.²⁰⁶ Bladder training consists of scheduled voiding (trying to increase time between each void) and urge-suppression techniques. For clients with cognitive impairment, prompted voiding can be beneficial and decrease incontinent episodes (remind every 2 hours to toilet). Electrical stimulation has also been used with some success. Clients should also be encouraged to manage constipation and avoid caffeine.

Pharmacologic therapy is frequently used in conjunction with behavioral modifications. First-line drug therapy for urge incontinence is the use of anticholinergics or muscarinic antagonists, which inhibit involuntary detrusor contractions.⁸² The most common side effect is dry mouth. Other adverse effects include drowsiness, cognitive impairment, delirium, and hallucinations. These side effects are more likely to occur in older adults than younger clients. Tolterodine is associated with fewer adverse effects than oxybutynin.¹⁷⁴

Other medications have shown some benefit but are not as effective as the anticholinergics/muscarinic antagonists or have off-label usage. Estrogens have been used to treat UI, although there are few data to support their use, and oral hormone therapy has been associated with

increased incidence of incontinence. In men with symptoms of urge incontinence and prostatic hypertrophy, alfuzosin and tamsulosin (a-adrenergic antagonists) can be used initially. If these agents do not alleviate symptoms, obstruction should be ruled out before starting an anticholinergic agent.¹⁴⁰

Overflow Incontinence. Once the diagnosis of overflow incontinence is made, treatment then depends on the presence of obstruction or weak detrusor muscles. Surgery can be performed to alleviate obstruction (e.g., stricture dilation or transurethral prostatectomy). If a weak detrusor muscle is the cause, a few measures can be utilized to improve symptoms. One behavior modification is to have the client double-void. Medications such as cholinergic agonists or a-adrenergic antagonists are not typically efficacious in long-term use. If these measures are not appropriate or not effective, clean intermittent catheterization may be required.

SPECIAL IMPLICATIONS FOR THE THERAPIST 18-9

Urinary Incontinence

See the section on Pelvic Floor Disorders in Chapter 20.

PREFERRED PRACTICE PATTERNS

Selection of the most appropriate practice patterns depends in part on the underlying etiologic factors and pathogenesis of the UI.

4C: Impaired Muscle Performance

4D: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Connective Tissue Dysfunction

4I: Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Bony or Soft Tissue Surgery

5B: Impaired Neuromotor Development (spina bifida, myelomeningocele)

5C: Impaired Motor Function and Sensory Integrity Associated with Nonprogressive Disorders of the Central Nervous System—Congenital Origin or Acquired in Infancy or Childhood

5F: Impaired Peripheral Nerve Integrity and Muscle Performance Associated with Peripheral Nerve Injury (pudendal nerve injury)

5H: Impaired Motor Function, Peripheral Nerve Integrity, and Sensory Integrity Associated with Nonprogressive Disorders of the Spinal Cord

7A: Primary Prevention/Risk Reduction for Integumentary Disorders

Therapists have an important direct role in the assessment and treatment intervention of UI. Physical therapy guides the rehabilitation of muscle imbalance and pelvic alignment and promotes pelvic muscle awareness and function through biofeedback, electrostimulation, therapeutic exercise, and a behavioral management approach.^{23,111}

The pelvic rehabilitation program is designed to prevent recurrence of the impairment and to restore bowel, bladder, sexual, and supportive muscle func-

tioning.¹⁵⁵ Quality-of-life issues can be assessed using the Urge Impact Scale (URIS) for older people with urge incontinence.⁴⁴

For some clients seen by therapists who do not specialize in pelvic floor rehabilitation, UI will be a comorbidity or a condition that has yet to be evaluated. Many adults think that incontinence is an inevitable part of aging and do not report the problem. Any perimenopausal or postmenopausal woman, any woman who has been pregnant, anyone (male or female) over the age of 60 (earlier if prostate or bladder infection or cancer is evident), and any person with multiple risk factors should be screened for UI.

Anyone with onset of incontinence with concomitant cervical spine pain (even without a history of trauma or known cause) may be experiencing cervical disc protrusion, requiring additional screening and evaluation. Additionally, the possibility of genitourinary disorders as a result of sexual abuse or assault exists and requires careful assessment.

The generally positive rapport that develops between client and therapist may facilitate the acknowledgment that UI exists and uncover the potential underlying risk factors. Specific questions should be included in the history to help bring this information to light, such as the following:

- Do you leak urine when you lift, cough, sneeze, or stand up?
- Do you get up at night to urinate (how often)?
- Do you go to the bathroom more often than every 2 to 3 hours?
- How much water do you drink in a waking day?
- Are you constipated?

The therapist may be in a position to direct the person to the appropriate physician for evaluation. Successful intervention in UI may enhance rehabilitation efforts geared to improve the client's physical and social activity level. A variety of examinational, evaluative, and diagnostic tools and management options are available. The National Association for Continence (<http://www.nafc.org>) also offers a wide variety of information, and the Women's Health Section of the American Physical Therapy Association (APTA) offers a broad range of information and courses on incontinence specific to the physical therapist.

For an internal pelvic floor assessment, including a manual muscle test and assessment of trigger points, a consent-to-treat form is recommended. This form should include an explanation of the internal examination and specifically addresses the client's right to refuse or stop the evaluation at any time.

Some clinicians offer to have a third person in the room during the assessment, either a friend or relative of the client's or another woman from the health care facility. Any unspoken behaviors or indication of discomfort on the part of the client should prompt the physical therapist to stop and communicate with the client before continuing or discontinuing. Issues of

Continued.

^aReferences 50, 91, 92, 150, 185, 197, 199.

childhood incest or sexual assault or adult sexual issues may be a significant contributing factor, requiring combined pelvic muscle rehabilitation and psychotherapy or sexual abuse counseling.

Understanding the use of medications and potential side effects for these conditions is essential; many of the same medications used to treat incontinence can also cause incontinence if used inappropriately. Medications to treat other conditions can have side effects that cause incontinence. A concise listing of this information is available.⁹²

Exercise and Incontinence

Studies to verify the effectiveness of exercise programs to strengthen pelvic muscles administered by nurses have provided evidence-based protocols.¹⁶⁷ Several references for physical therapy-based intervention approaches are also available,^{11,133,134} but further research documentation of outcomes is needed.

Comparison of biofeedback and exercise programs administered by physical therapists showed equal effectiveness in reducing nocturnal urinary frequency and improved subjective outcome; only the group receiving physical therapy experienced reduced daytime urinary frequency.¹⁴¹

Although pelvic floor muscle exercises have proven effective in the short term, long-term noncompliance may hamper continued success. Predictors of compliance may include amount of urinary loss per wet episode and individual perception of the ability to do the exercises as recommended under various circumstances. This information should be taken into consideration during the education portion of any home program. Further studies to determine components of adherence behavior are needed.¹

STRESS INCONTINENCE

Exercises can be performed to retrain and strengthen the pelvic floor musculature. This type of exercise has been advocated for decades.¹⁰⁵ Exercise management, including adductor and obturator assist and "quick flick" exercises, can help develop adequate sphincteric function and improve bladder and bladder outlet position in the pelvis.

A quick flick exercise is a quick contraction followed by release with full relaxation of the pelvic muscles while the gluteals, abdominals, adductors, and obturator internus muscles remain relaxed. Quick flicks are designed to improve the strength and function of the fast-acting fibers, primarily of the urogenital diaphragm and external sphincter muscles. These fibers are important for prevention of leaking during coughing, sneezing, lifting, and pulling, because these fibers act with speed and intensity to maintain urinary control.⁹²

Restoring normal pelvic floor strength and bladder control is essential before resuming vigorous physical activity or exercise. The therapist is very instrumental in teaching contraction of the appropriate muscles (e.g., the pelvic diaphragm, urogenital diaphragm, and external sphincter muscles) without muscle contraction in the anal area or of the gluteal muscles and with

complete relaxation of the pelvic muscles between contractions.

Physiologic quieting including hand warming, diaphragmatic breathing, and body/mind quieting can be used to normalize bladder function and autonomic nervous system innervation of bladder and bowel.⁹² With verbal and manual cues, biofeedback (auditory, visual, or electronic), physiologic quieting, and electromyography (surface or intravaginal), the client can be taught to disassociate pelvic floor muscle activity from other hip and pelvic muscle activity and to maintain pelvic floor muscle tone while avoiding a Valsalva maneuver. Weighted vaginal cones and electrical stimulation can also be used to rehabilitate the pelvic floor.

URGE INCONTINENCE

Continence requires the ability to inhibit automatic detrusor contractions, and pelvic floor exercises facilitate the use of urge inhibition techniques. Pelvic floor rehabilitation specifically using pelvic floor muscle exercises for an overactive bladder may be able to suppress the desire to void by reducing detrusor and increasing urethral pressure, resulting in suppression of the micturition reflex.

Pelvic floor muscle contraction appears to prevent internal sphincter relaxation produced by the micturition reflex. Failure of the internal sphincter to relax seems to cause reflex detrusor relaxation, an action mediated through the voluntary urinary inhibition reflex.¹⁷⁸

The bladder needs to be trained to respond to a specific voiding schedule. Clients void at scheduled intervals to suppress the micturition reflex, increase bladder capacity, and decrease urinary frequency. The initial retraining interval is usually 60 minutes. The voiding intervals are increased by 15- to 60-minute extensions using urge inhibition if it occurs too soon.

Success is marked by voiding at 3- to 4-hour intervals, continence (perhaps measured by number of pads used), minimal sensory symptoms, and functional capacity (minimum of 300 ml of urine or 8 or more seconds of a steady urine stream). Biofeedback (visual, auditory, or electronic) and physiologic quieting (e.g., diaphragmatic breathing) can also be used to train the client to inhibit abdominal muscle activity and bladder contractions, thereby reducing detrusor pressure.¹⁹⁹

An episode of urge incontinence at least once a week increases the risk of fractures by 34% because of falls at night. Early diagnosis and appropriate treatment of urge incontinence may decrease the risk of fracture.¹⁸ The therapist can be very instrumental in performing a home assessment for the older adult with urge incontinence. Placing strategically located night lights near the bed, hallway to the bathroom, and bathroom and removing objects along the path (e.g., throw rugs) are essential preventive steps to take.

For the individual with incontinence and postural orthostatic hypotension, low blood pressure (or even

use of hypertensives with the potential for hypotension as a side effect) and rising from bed quickly at night can also result in falls. Assessing for this complication and teaching prevention measures are recommended (see the section on Orthostatic [Postural] Hypotension in Chapter 12).

References

To enhance this text and add value for the reader, all references are included on the companion Evolve site that accompanies this textbook. The reader can view the reference source and access it on-line whenever possible. There are a total of 210 cited references and other general references for this chapter.

CHAPTER 19

The Male Genital/Reproductive System

CATHERINE C. GOODMAN

The male genital or reproductive system is made up of the testes, epididymis, vas deferens, seminal vesicles, prostate gland, and penis (Fig. 19-1). These structures are susceptible to inflammatory disorders, neoplasms, and structural defects. Unless treating individuals with urinary incontinence, therapists do not typically treat people for primary reproductive system disease, but because of the incidence and nature of these disorders, an understanding of their clinical presentation is essential.

Prostate cancer is the most common cancer in males in the United States, and testicular cancer, although relatively rare, is on the rise and the most common cancer in males age 15 to 35 years. Benign prostatic hyperplasia (BPH) is one of the most common disorders of the aging male population. Because of the high incidence of these diseases, therapists will see clients with such a history, and the disorder or prescribed medical treatment could have a profound effect on the client's clinical presentation and response to treatment.

The initial presenting symptom for some of these disorders could be back pain, a condition for which physical therapy care is often sought. An awareness of other symptoms besides pain and signs associated with urogenital system diseases may alert the therapist to other origins of the back pain. The presence of such symptoms warrants communication with a physician regarding the client's status. Therapists have long been taught to ask clients with back pain questions regarding sexual function, the concern being the possible presence of cauda equina syndrome. An awareness of the more probable causes of sexual dysfunction helps the therapist determine the relevance and potentially urgent nature of a client's complaints. The disorders discussed in this chapter are those of the highest incidence or of greatest implications for therapists.

AGING AND THE MALE REPRODUCTIVE SYSTEM

The reproductive system undergoes degenerative changes associated with aging that can affect sexual function. The testes become smaller, with thickening of the seminiferous tubules impeding sperm production; the prostate gland enlarges, potentially affecting urine outflow; and sclerotic changes occur in the local blood vessels, possibly

resulting in sexual dysfunction (erectile dysfunction [ED]/impotence).

The age-related decrease in male sex hormone levels (androgen deficiency) also has significant local and systemic effects. Protein synthesis, salt and water balance, bone growth, and homeostasis and cardiovascular function are all under the influence of these hormones. A decline in bioavailable testosterone has been clearly correlated with age-related memory changes; decreasing sexual interest; and physical changes, including decreased strength, body mass, and bone density.^{5,8,108,165}

Arteriosclerosis of the blood vessels resulting in peripheral vascular disease can also affect vessels supplying the penis. Sexual (erectile) dysfunction can be an indicator of ischemic heart disease and should not be ignored as a symptom requiring medical evaluation.

DISORDERS OF THE PROSTATE

Prostatitis

Overview

Clinically, the diagnosis of "prostatitis" refers to multiple disorders that cause pelvic pain and discomfort ranging from acute bacterial infection to complex conditions that may not necessarily be caused by prostatic inflammation. Because the traditional etiologic-based classification system did not always correlate symptoms with what worked in treatment, the National Institutes of Health (NIH) proposed a new classification of prostatitis.⁸¹ Inflammation of the prostate gland can be acute bacterial, chronic bacterial, chronic prostatitis/chronic pelvic pain syndrome, or asymptomatic inflammatory prostatitis.

Acute bacterial prostatitis (category I) is the least common of the four types but also the easiest to diagnose and treat effectively. Men with this disease often have chills, fever, pain in the lower back and genital area, urinary frequency and urgency often at night, burning or painful urination, body aches, and a demonstrable infection of the urinary tract as evidenced by white blood cells and bacteria in the urine. The treatment is an appropriate antibiotic.¹⁰⁹

Chronic bacterial prostatitis (category II), also relatively uncommon, is acute prostatitis associated with an underlying defect in the prostate, which becomes a focal point for bacterial persistence in the urinary tract. Effective

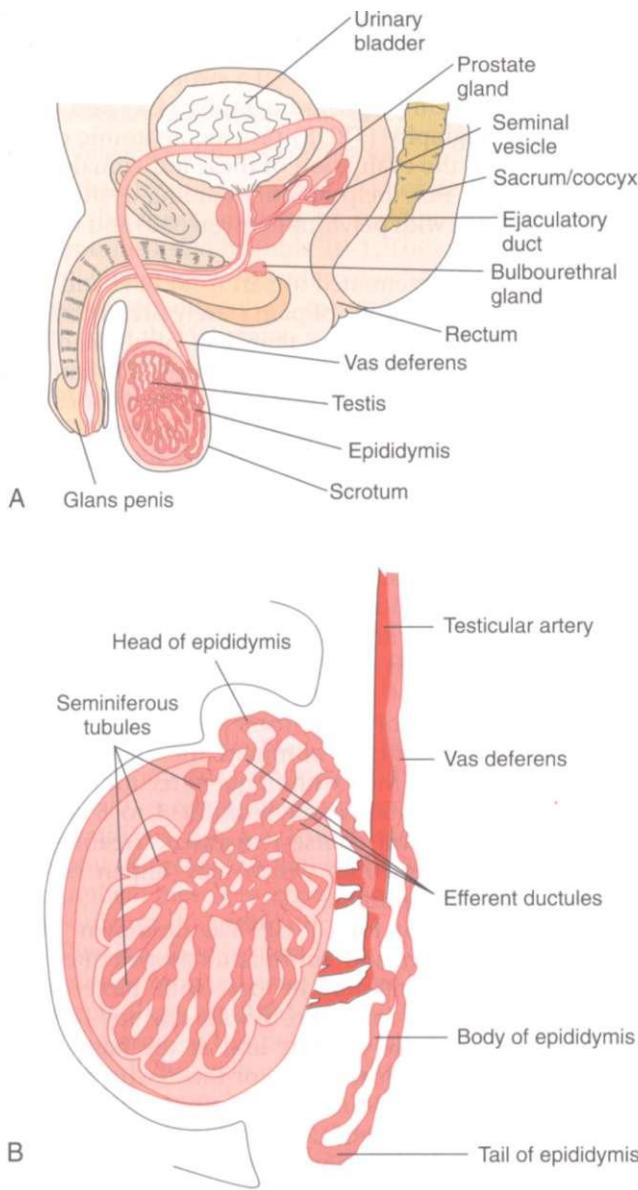


Figure 19-1

A, The male reproductive system. **B**, Internal structure of the testis and relationship of the testis to the epididymis. (**A**, modified from Bloom V, Fawcett DW: *Textbook of histology*, ed 10, Philadelphia, 1975, WB Saunders; **B**, redrawn from Guyton AC: *Anatomy and physiology*, Philadelphia, 1985, Saunders College Publishing.)

treatment usually requires identifying and removing the defect and then treating the infection with antibiotics. However, antibiotics often do not cure this condition.¹⁰⁹

Chronic prostatitis/chronic pelvic pain syndrome (CP/ CPPS), previously known as *nonbacterial prostatitis*, is classified as category III and the most common (more than 90% of cases) but least understood form of prostatitis. It is found in men of any age, its symptoms go away and then return without warning, and it may be inflammatory or noninflammatory. In the inflammatory form (category IIIA), urine, semen, and other fluids from the prostate show no evidence of a known infecting organism but do

contain the kinds of cells the body usually produces to fight infection.

In the noninflammatory form (category IIIB), no evidence of inflammation, including white blood cells, is present in the semen.¹⁰⁹ Because there appears to be no correlation between the presence of leukocytes and symptoms, classification into categories IIIA and IIIB is controversial. An α -blocker may be used to relax the muscle tissue in the prostate. No single solution works for everyone with this condition.¹⁰⁹

Asymptomatic inflammatory prostatitis (category IV) is the diagnosis when the man does not complain of pain or discomfort but has white blood cells in his semen. Doctors usually find this form of prostatitis when looking for causes of infertility or when testing for prostate cancer.¹⁰⁹

These conditions are typically preceded by lower urinary tract infections (UTIs) (see Chapter 18). Therapists are least likely to encounter problems associated with acute prostatitis because the symptoms are usually severe enough that physician contact is initiated by the client (or family), and rehabilitation is typically placed on hold until the antibiotic therapy is successful.

On the other hand, therapists are likely to encounter chronic bacterial prostatitis, which is a much more subtle disorder, and complete resolution with treatment is often difficult to obtain. CPPS is common and may benefit by pelvic floor reeducation with a physical therapist.¹²

Incidence and Risk Factors

Prostatitis affects millions of men, and about half of all men have at least one episode during their lifetime. The prevalence is highest among men in their forties; older men especially prone to UTI develop prostatitis, but this condition can affect men of all ages. UTIs are among the more common infections, afflicting the male population secondary to bladder outlet obstruction associated with BPH. As the infection ascends through the urogenital system, the prostate can become involved. UTIs generally occur with much higher frequency in women than men, but men can still be affected and should not view UTI as a "woman's disease."

Besides a history of UTI and BPH, recent urethral catheterization or instrumentation and multiple sexual partners increase the risk of developing prostatitis. Some men find that stress, emotional factors, alcohol, spicy foods, or caffeine triggers episodes. Poorly controlled diabetes mellitus increases the risk of UTI and prostatitis developing because the increased urine glucose provides the substrate for bacterial growth.

Etiologic Factors and Pathogenesis

The etiology of prostatitis appears to be multifactorial. The etiology of the most common form of prostatitis, CP/ CPPS, is poorly understood. Despite the assumption that there is an infectious or inflammatory process, this theory has not been proven. Autoimmunity may play a role in chronic prostatitis, since up to one-third of men with prostatitis have elevated levels of specific molecules that regulate the inflammatory response. Another hypothesis is that many of the men affected have a pelvic floor spasm associated with undiagnosed pelvic floor disorders

Table 19-1 Clinical Manifestations of Prostatitis

Category I/II: Acute Bacterial	Category III: CP/CPPS	Category IV: Asymptomatic Inflammatory Prostatitis
Urinary Frequency	Urinary Frequency	Asymptomatic infertility
Urgency	Urgency	
Nocturia	Dysuria	
Dysuria	Erectile dysfunction	
Urethral discharge	Ejaculatory pain	
High fever	Decreased libido	
Chills	Pain	
Malaise	Low back	
Myalgia	Scrotal	
Arthralgia	Groin/pelvis	
Pain	UTI	
Lower abdominal		
Rectal		
Low back		
Sacral		
Groin/pelvis		
UTI		

CP/CPPS, Chronic prostatitis/chronic pelvic pain syndrome; UTI, urinary tract infection.

mimicking prostatitis. The NIH is funding several prostatitis studies to examine this further.

The most commonly found pathogens associated with chronic bacterial infections are the gram-negative enterobacteria such as *Escherichia coli*, *Proteus mirabilis*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*. The pathogens associated with acute prostatitis include *E. coli*, *pseudomonads*, *staphylococci*, and *streptococci*. Although controversial, other infectious agents, such as gonococci, *Ureaplasma* species, chlamydiae, and mycoplasma, are possible etiologic factors.

Clinical Manifestations

Table 19-1 contains a summary of symptoms associated with the four categories of prostatitis. Acute prostatitis occurs suddenly with severe symptoms. Fever, chills, and UTI are typical, along with pelvic discomfort. Blood in the urine, urinary retention, and urinary blockage are frequent, and there may be a steep rise in prostate-specific antigen (PSA), a marker for prostate cancer.

If not treated, acute prostatitis may become chronic. Men who experience chronic prostatitis are plagued by persistent low-grade symptoms with flare-ups of pelvic pain, voiding problems, and sexual dysfunction (e.g., erectile dysfunction, ejaculatory pain, and a decline in emotional well-being).¹³⁰ The pelvic pain is usually located behind the scrotum or in the perineum, the area between the rectum and testicles. This pain is usually made worse by sitting down and may be relieved by ejaculation. Pain in the tip of the penis may be experienced.

MEDICAL MANAGEMENT

DIAGNOSIS. Urinalysis, analysis of an expressed prostatic specimen, and a digital rectal examination (DRE), in

which the physician palpates manually for prostate changes or enlargement, are used to establish a diagnosis of prostatitis. The DRE may reveal a swollen, tender, and warm prostate. Computed tomography (CT) and transrectal ultrasonography (TRUS) provide anatomic details often needed in the evaluation of these individuals. Urodynamic testing may help identify voiding dysfunction, especially in men with pelvic or perineal pain and voiding symptoms.⁵⁹

Prostatitis is differentiated in part from BPH and prostate cancer by the presence of pain (rarely present in BPH or cancer) and by age (more than half of all men with prostatitis are younger than 45 years of age). Current NIH guidelines, which stratify prostatitis into the four categories of prostatitis, advise using the NIH Chronic Prostatitis Symptom Index (NIH-CPSI) to assess symptoms and plan treatment. The CPSI provides scores for pain, urinary symptoms, and quality of life.^{12,88,110}

TREATMENT. Treatment depends on the type of prostatitis present. Acute prostatitis (category I) is treated with antibiotics. For men who are unable to empty their bladders, suprapubic drainage is preferred over an indwelling urethral catheter.

Treatment of category II (chronic bacterial) prostatitis also involves antibiotics to eliminate the organism producing the infection. Men with frequent recurrences may be placed on antibiotic prophylaxis for 3 to 6 months and have their clinical course reassessed. Treatment of bladder outlet obstruction, which may impair bladder emptying, is also important.

Optimal treatment for CP/CPPS is unknown. Treatment with antibiotics and antiinflammatories often fail. Multimodal treatment may be best with biofeedback, pelvic floor reeducation, and α -blocker therapy (to relax smooth muscle of the prostate and at the base of the bladder). Newly diagnosed cases or those who have not been treated before are more likely to respond to α -blocker therapy compared to chronic refractory cases. Longer courses of treatment (4 to 6 months) seem to work better than shorter courses.⁸²

Because the cause of nonbacterial prostatitis is unknown, treatment is often given to simply provide symptom control and relief. Antiinflammatory medications are administered. Antibiotics, fluoroquinolone, and antifungal agents may also be given. For unknown reasons, about half of men with nonbacterial prostatitis respond to antibiotics; antibiotics are used to treat bacterial prostatitis.

Treatment of chronic bacterial prostatitis can be equally as difficult, as the antibiotic agents have difficulty penetrating the chronically inflamed prostate. Drug therapy of 4 to 6 months' duration may be used in an attempt to treat this infection. Transurethral prostatectomy (TURP) may be indicated if the disease is not cured with medications.

Other treatments for CP/CPPS range from medications to treat neuropathic pain, anticholinergic medications, phytotherapies (e.g., herbal treatment with quercetin or bee pollen), physical therapy, and in rare cases, surgery to treat bladder neck obstruction. For category IV prostatitis, no treatment is recommended.

SPECIAL IMPLICATIONS FOR THE THERAPIST

19-1

Prostatitis**PREFERRED PRACTICE PATTERNS****4C: Impaired Muscle Performance**

When treating people at risk for developing prostatitis, therapists need to be vigilant for the onset of symptoms listed in Table 19-1. The symptoms may be subtle initially or difficult to ascertain because of communication difficulties common in the aging adult. The fact that therapy may extend over a number of weeks may allow the therapist to detect the subtle changes and initiate contact with the primary physician.

In young people with back pain, visceral disease is rarely the first thought as a cause of back pain. Prostatitis can be the cause of back pain of unknown origin in young males. The presence of any of the symptoms listed in Table 19-1, along with the onset of back pain, should raise concern.

When rehabilitating someone with a history of chronic prostatitis, therapists need to be aware of symptoms associated with UTIs. Many of these men experience recurrent UTIs as the prostatic bacteria continue to invade the bladder. The waxing and waning of symptoms may interfere with the client's compliance with a rehabilitation program. Reassurance that prostatitis is not a warning sign of cancer may be helpful. Bicycle seats can aggravate prostatitis, thus a recumbent bicycle is recommended because it puts less pressure on the groin.

Physical therapy for pelvic floor reeducation can help improve symptoms in some men with CPPS from category III prostatitis. Men with CPPS often have high muscle tone of the pelvic floor (i.e., the muscles do not relax). Biofeedback and educational instruction to relax these muscles can be effective in treating this problem.²⁸ Postisometric relaxation, massage of the prostate, and transrectal mobilization of the pelvic ligaments have been suggested.¹²⁹

Benign Prostatic Hyperplasia**Overview**

Benign prostatic hyperplasia (BPH) is an age-related non-malignant enlargement of the prostate gland.

Incidence and Risk Factors

Of men age 50 years and older, 75% experience symptoms of prostate enlargement.¹³⁰ The disease is rarely noted in men under age 40 and tends to become symptomatic after age 50 years. Besides age, geography and ethnicity are important factors in the incidence of this disease. BPH is found most often in the United States and western Europe and least often in the Far East. The incidence of BPH is also higher in blacks than in whites. Drinking moderate amounts (one or two alcoholic drinks per day) is associated with a reduced risk of BPH. Cigarette smoking increases the risk for BPH-like symptoms,

possibly because bladder irritation caused by cigarette smoke may heighten the urgency and frequency of urination.

Dietary risk factors are under investigation. Milk and dairy products have been related to an increase in BPH but not all studies confirm this association; fruit has been reported to have a protective effect against this condition. Other food groups, including meat and vegetables, have been analyzed in relation to BPH, but the results have been inconsistent. More frequent consumption of prepared cereals, bread, eggs, and poultry may be a risk factor.¹⁸

Pathogenesis

The prostate gland, a muscular part of the male reproductive system, is normally about the size and shape of a walnut, normally weighing about 20 g. It is located in front of the rectum and just below the bladder (see Fig. 19-1). It consists of five lobes that surround the urethra and produces seminal fluid to nourish and transport semen. Throughout life, the body constantly replaces old, dying prostate cells with new ones. For reasons still not completely clear, as men age, the ratio of new prostate cells to old prostate cells shifts in favor of lower cell death. By age 70 years, the hypertrophic prostate can weigh up to 200 g, resulting in significant urethral obstruction, decreased urine storage capability, and difficulty emptying the bladder.

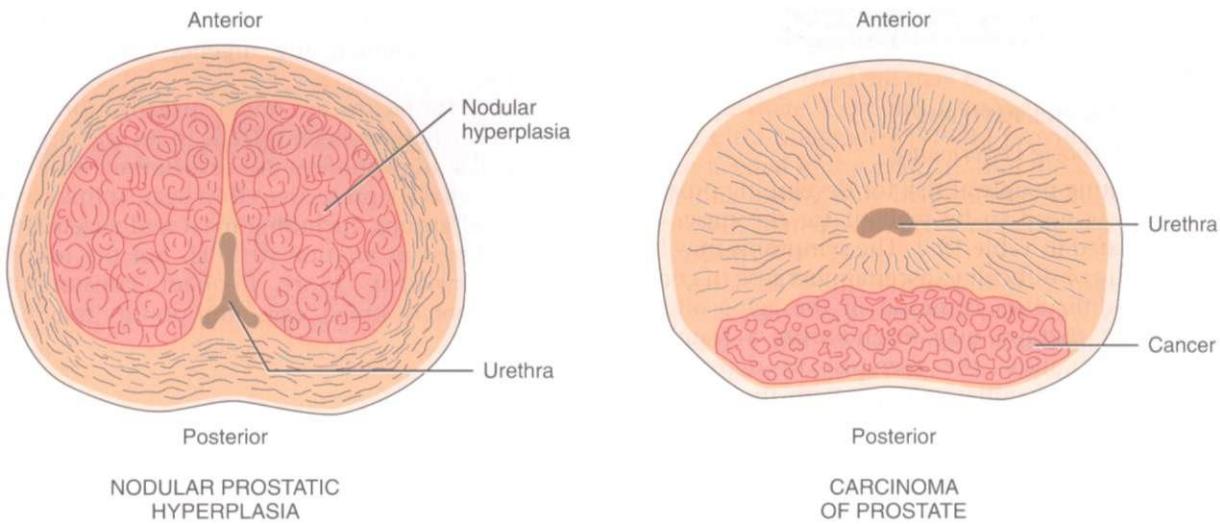
Although the cause is unknown, changes in hormone balance associated with aging may be responsible for the development of BPH. The condition is commonly referred to as *benign prostatic hypertrophy*, but the pathologic changes are marked by *hyperplasia*, not hypertrophy. Multiple prostatic nodules develop, resulting from the proliferation of epithelial cells, smooth muscle cells, and stromal fibroblasts of the gland. These nodules initially develop in the periurethral region of the prostate as opposed to the periphery of the gland (Fig. 19-2). The lumen of the urethra becomes progressively narrowed.

Both androgens and estrogens contribute to the hyperplasia of this condition. Dihydrotestosterone (DHT), the biologically active metabolite of testosterone, is thought to be the primary mediator of hyperplasia, whereas estrogens sensitize the prostatic tissue to the growth-producing effects of DHT. The increased levels of estrogen that occur with aging may enhance the action of androgens at this point in the life cycle.

Clinical Manifestations

The clinical presentation of BPH is related to secondary involvement of the urethra. As men age, the prostate slowly grows larger. If it becomes too large, urine flow can become restricted. The nodular hyperplasia results in a narrowing of the urethra, producing urinary outflow obstruction. The client may note a decreased caliber and force of the urine stream and difficulty initiating or continuing the urine stream so that only small amounts of urine are released.

In addition, residual urine in the bladder results in urinary frequency, which is particularly troublesome at night (nocturia). Quality of life and emotional function can be adversely affected by fatigue, micturition

**Figure 19-2**

In benign prostatic hyperplasia (BPH), the nodules initially develop in the periurethral region, compressing the urethra. Cancer of the prostate typically develops initially in the periphery of the gland.

problems, and sleeping disturbances.⁷⁰ As the urethral obstruction progresses, the risk of developing UTIs, marked bladder distention with destructive bladder wall changes, hydroureter, and hydronephrosis increases (Fig. 19-3).

Hydroureter refers to the ureteral wall as it becomes severely stretched secondary to the bladder outflow obstruction, which increases the pressure in a retrograde direction. The ureteral wall can become stretched to the point where it loses the ability to undergo peristaltic contractions. With hydronephrosis, urine-filled dilation of the renal pelvis and calices occurs; destruction of renal tissue may occur.

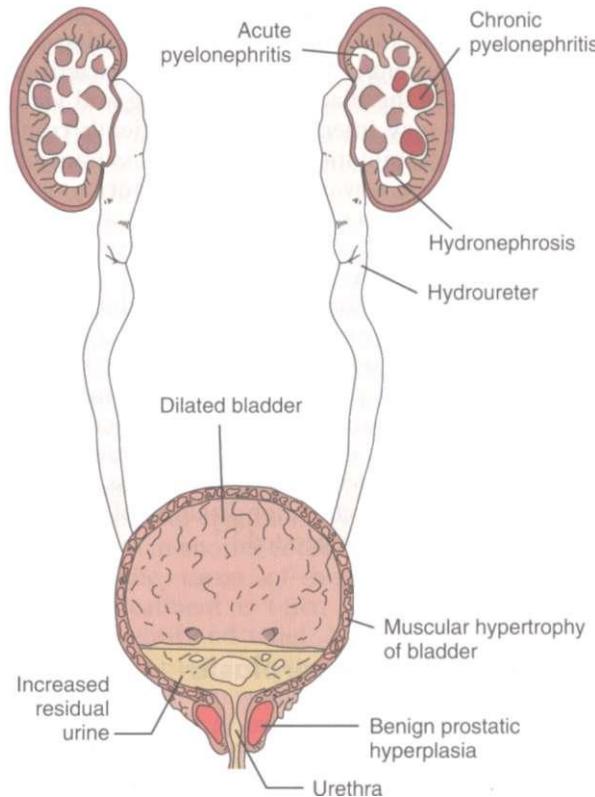
Ultimately, renal failure and death may occur if treatment is not initiated. Other urinary symptoms associated with the later stages of the disease include urge incontinence, terminal urinary dribbling, urgency, hematuria, and dysuria.

MEDICAL MANAGEMENT

PREVENTION. There has been some controversy over the use of saw palmetto, lycopene, and tomato products as possible antioxidant prevention of BPH. The general consensus is that these natural products will not do any harm but they may not help either.

DIAGNOSIS. Correlation of the history, palpation findings (DRE), and urodynamic test results (flow rate and force of stream) typically give rise to the diagnosis of BPH and indicate the choice of treatment. Regarding palpation, the bladder may be palpable as urinary retention progresses. In addition, a smooth, rubbery enlargement of the prostate may be noted during DRE, although the perceived size of the prostate does not always correlate with the degree of urethral compression.

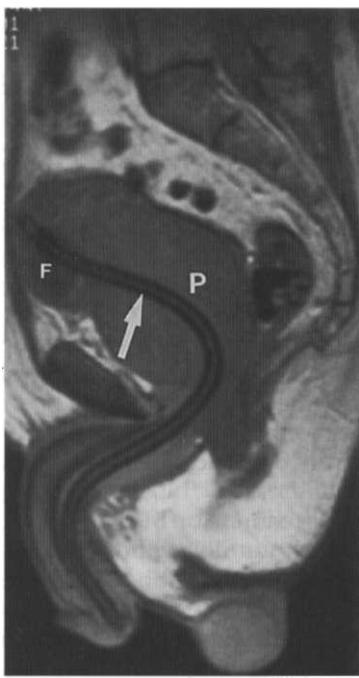
PSA is an additional test that helps predict the natural course of BPH. Higher levels of PSA are linked with a greater risk of future prostate growth and subsequent complications. Urinalysis is usually done to check for hematuria and UTI. The most commonly employed uro-

**Figure 19-3**

A cascade of destructive events potentially associated with advanced benign prostatic hyperplasia (BPH). Viewing Fig. 19-1, A, the relationship of the prostate located at the base of the bladder, surrounding a part of the urethra can be visualized. As the prostate enlarges, the urethra becomes obstructed, interfering with the normal flow of urine.

dynamic test for the assessment of BPH is uroflowmetry. The urine flow rate and the force of the urine stream are measured. It is generally agreed that a peak urine flow rate of less than 10 ml/sec is suggestive of obstruction.

Uroflowmetry by itself is a screening modality, not diagnostic, because the urinary obstruction could be

**Figure 19-4**

Magnetic resonance image (MRI) demonstrating benign nodular hyperplasia with enlargement of the prostate gland (P). The arrow is pointing to a Foley catheter in place. The inflated Foley balloon (F) indicates the level of the bladder neck. (From Grainger RG: *Grainger & Allison's diagnostic radiology: a textbook of medical imaging*, ed 4, Philadelphia, 2001, Churchill Livingstone.)

occurring at sites other than at the prostate gland. In addition, diagnostic ultrasound, magnetic resonance imaging (MRI), and abdominal radiographs may be used to evaluate the size and length of the urethra, the size and configuration of the prostate, and the bladder capacity (Fig. 19-4). The American Urological Association has also developed a self-administered screening tool used to determine the frequency and severity of urinary symptoms.

TREATMENT. If symptoms related to BPH are mild, the condition is often just monitored because the clinical status of the disorder may stabilize or even improve. Aggressive treatment is indicated, however, if the more severe symptoms of obstruction develop.

Symptoms suggesting advanced disease include urine retention, incontinence, hematuria, and chronic UTIs. The goals of treatment include providing client comfort and avoiding serious renal damage. For those with moderate-to-severe symptoms, the two medical treatment approaches for BPH are pharmacologic and surgical.

Medication. In most cases, symptoms associated with BPH can be controlled with medications. One trial, known as *Medical Therapy Of Prostatic Symptoms* (MTOPS), found that combining medications produces better results than administering only one drug (monotherapy).⁷⁵

Pharmacologic agents are used to treat BPH by shrinking glandular tissue ($5\text{-}\alpha$ -reductase inhibitors) and relaxing smooth muscle tissue of the prostate, bladder neck, and urethra (α -adrenergic blockers). The $5\text{-}\alpha$ -reductase

inhibitors address the hormonal causes of BPH by preventing the enzyme $5\text{-}\alpha$ -reductase from converting testosterone into DHT (DHT prompts glandular tissue to develop). As a result, the prostate shrinks by as much as 20%. This is a gradual process that can take up to a year to obtain maximum benefit.

The α -adrenergic receptors are located in the muscle fibers of the adenoma and prostate capsule. The resultant smooth muscle relaxation decreases pressure on the urethra, enhancing urinary flow. Phytopharmaceuticals (e.g., substrates from the saw palmetto plant) used for the management of BPH represent up to 80% of all prescriptions in many European countries.⁷⁷ Earlier studies in the United States showed significant effects of saw palmetto on epithelial contraction, urinary flow rates, and improved symptoms compared with placebos,^{51,94} but more recent studies have not shown similar benefits.^{7,15,58}

Androgen suppression drug therapy can also be used to block the synthesis and action of testosterone, including DHT. A 20% to 30% reduction in prostate volume can be noted. This can result in a lessening of the severity of symptoms and improvement in the objective criteria related to urinary obstruction although this can take 3 to 6 months.

Surgery. Not everyone with BPH responds adequately to medications. In such cases, BPH can progress to the point where surgery is required. The goal of surgical intervention is to alleviate the obstruction to urine flow. TURP is considered the gold standard in surgical treatments for BPH. A long tube with a miniature camera on the tip is threaded up the urethra into the bladder, allowing visual inspection of both of these structures. When the excess prostate tissue is identified, a surgical instrument is threaded through this tube, and resection of excess prostate tissue is performed to enlarge the urinary channel.

TURP is very successful in relieving symptoms and improving quality of life, but some drawbacks are evident (e.g., requires a general anesthetic and hospital stay and may be accompanied by side effects such as bleeding, incontinence, ED/impotence, or retrograde ejaculation in which an ejaculation goes back into the bladder). An alternative technique is transurethral incision of the prostate (TUIP). In the case of TUIP, incisions in the muscle wall of the prostate and bladder neck allow for an outward expansion of the gland, relieving some of the pressure on the urethra. TURP is preferable when there is a large gland, severe and recurrent gross hematuria, and prostatitis; the goal is to remove infected tissue and calculi.

Thermotherapy by either transurethral microwave therapy (TUMT), such as Prostatron, or laser surgery through laser-induced thermotherapy, such as Green Light laser or indigo laser, has been developed over the past 10 years to provide effective alternatives to surgical management. Lasers are used for rapid incision and vaporization of the prostate with minimal bleeding. This treatment procedure is indicated in the case of small-size BPH and in the presence of risk factors, such as heart disease or anticoagulation therapy, or for men who do not tolerate medications well. This modality restores spontaneous urine flow by destroying diseased prostate tissue.

Results of long-term studies are not available at this time, but short-term results demonstrate that laser therapy is at least as safe and effective in relieving BPH symptoms as TURP and may provide reduced morbidity.⁴⁹ The potential advantages of these procedures over TURP and TUIP are shorter operative time, usually without hospitalization; minimal bleeding; and decreased incidence of postoperative retrograde ejaculation and bladder neck contracture.

Potential disadvantages of laser treatment include postoperative urinary retention, no tissue being available for histologic study, and less than optimal prospects for treating large lesions. This technique may be associated with a high recurrence rate requiring additional treatment.¹⁶⁰ In the case of laser, the larger the lesion, the more passes are required, increasing the associated risks.¹⁶⁴ The introduction of an integrated system of computer, robotics, and laser technology for prostate resection may be the intervention of the future.⁶⁵

Other. Other procedures include water-induced thermotherapy. Heated water is injected into a balloon inserted into the urethra. The heat destroys excess prostate tissue. The procedure is done on an outpatient basis, but a catheter must be worn for 1 to 3 weeks afterward. Water-induced thermotherapy is not advised for men who have had previous prostate, pelvic, or rectal surgery. A past history of pelvic radiation for prostate cancer is another exclusion factor.

Transurethral ethanol ablation of the prostate (TEAP) involves injecting ethanol (a type of alcohol) through the urethra into the prostate to destroy excess prostate tissue. Both of these procedures are designed to improve peak flow rate, but long-term data are not yet available.

Botulinum toxin (BTX), or Botox, has been used successfully in the treatment of BPH. Botox injected directly into the prostate has been shown to reduce lower urinary tract symptoms and improve erectile function. The mechanism by which BTX can reduce prostate volume and intravesicular resistance remains unclear.⁶ Promising preliminary results have been reported in studies combining medications with BTX.^{24,152} The use of botulinum neurotoxin in the prostate is currently considered Food and Drug Administration (FDA) off-label use.

PROGNOSIS. BPH can contribute to chronic problems with lower urinary tract symptoms, ED, and decreased quality of life. Treatment is reserved for symptomatic presentation, but there is considerable risk of progression with possible development of prostate cancer.

SPECIAL IMPLICATIONS FOR THE THERAPIST 19-2

Benign Prostatic Hyperplasia

PREFERRED PRACTICE PATTERN

5A: Primary Prevention/Risk Reduction for Loss of Balance and Falling (side effect of medication)

See the Preferred Practice Patterns associated with urinary incontinence in this chapter.

Therapists conducting a past medical history with men over the age of 50 years can easily include a series

of four questions to help identify the presence of urologic involvement:

- Do you urinate often, especially during the night?
- Do you have trouble starting or continuing your urine?
- Do you have weak flow of urine or interrupted urine stream?
- Does it feel like your bladder is not emptying completely?

A yes answer to any of these questions warrants further medical evaluation. Painful urination; blood in the urine; or unexplained lower back, pelvis, hip, or upper thigh pain in the presence of any of these symptoms requires medical referral. Men over the age of 40 years should be encouraged to get regular check-ups in order to prevent complications from delayed diagnosis of BPH.

Surgical procedures for BPH carry the risk of complications, such as ED/impotence and retrograde ejaculation; venous thromboembolism is a potential complication of open prostatectomy. Unexplained reports of sexual dysfunction warrant communication with a physician. If the person notes sexual dysfunction and has a history of the previously mentioned procedures, then ask him periodically about changes in sexual function. If there appears to be a worsening, communication with a physician would again be warranted.

Pharmacologic agents used to treat BPH are associated with numerous side effects. These include general muscle weakness, ED (inability to achieve an erection), loss of libido, gynecomastia, drowsiness, dizziness, tachycardia, and postural orthostatic hypotension. The therapist can advise clients about the possibility of falls from dizziness and loss of balance associated with these medications and take steps to institute a falls prevention program when appropriate (see the Special Implications for the Therapist: Orthostatic [Postural] Hypotension in Chapter 12). Any change or new onset of symptoms should be reported to the physician.

Prostate Cancer

Overview

Adenocarcinoma of the prostate arises from the glandular cells and accounts for 98% of primary prostatic tumors. Ductal and transitional cell carcinomas make up the remainder of the tumors. Prostate cancer usually starts in the outer portion of the prostate and spreads inwardly and then beyond the gland with metastases in more advanced stages.

Incidence

Prostate cancer, the most frequently diagnosed visceral malignancy in American men, is the second most common cause of male death from cancer. One in five American men will develop prostate cancer. Approximately 218,890 men were newly diagnosed in 2007 (up from 189,000 in 2002).⁷¹

Box 19-1**RISK FACTORS FOR PROSTATE CANCER**

- Age >50 years
- African American
- Geography (United States and Scandinavian countries)
- Family history; inherited gene mutation
- Environmental exposure to cadmium
- High-fat diet
- Alcohol consumption

The number of new cases of prostate cancer in the last decade represents an increase of 200%.⁷² However, the evidence suggests the use of PSA screening as a means of early detection may be the reason for the increased incidence. Widespread implementation of prostate cancer screening in the United States has led to more cancers being detected but at an earlier stage with fewer cases of metastases at diagnosis and a decrease in mortality rate.¹⁵¹

Autopsy studies indicate that occult prostate cancer is present in 25% of men age 60 to 69 years, in 40% of men age 70 to 79 years, and in more than 50% of men age 80 years and older.¹³¹ Men less than 50 years of age make up less than 1% of those with prostate cancer. Prostate cancer incidence and mortality vary strikingly among ethnic and national groups with a particular propensity for African Americans.⁴²

In the United States the incidence of prostate cancer is approximately 60% higher in African American men than in European American men; the mortality rate from the disease is more than twice as high among African Americans.¹²⁴ Screening rates for African American men with a positive family history of prostate cancer are significantly lower than in Caucasians, especially in older men ages 60 to 70 years.¹⁶⁹

Risk Factors

Box 19-1 lists risk factors related to prostate cancer. Prostate cancer is a disease of the aging male, but evidence exists that genetic, environmental, and social factors jointly and in combination contribute to observed differences in various populations. Geographically, the highest frequencies of prostate cancer are found in the United States and northwestern Europe (Scandinavian countries), whereas the lowest are found in Mexico, Greece, and Japan. As mentioned, African Americans have twice the risk of non-Hispanic whites, which is attributed to traditional socioeconomic, clinical, and pathologic factors.⁶⁶

Although no genetic marker has been found, a familial history of prostate cancer is a risk factor. A significant increase in risk has been estimated for men who have both a first- and second-degree relative with the disease.¹⁴¹ If a close relative has prostate cancer, a man's risk of the disease doubles; with two relatives, his risk increases five-fold; and with three close relatives, the risk is about 97%.¹¹¹ In addition, mortality from prostate cancer is believed to be three times greater in relatives of men with

prostate cancer compared with those without such a family history.

Exposure to cadmium through welding, electroplating, alkaline battery production, farming, typesetting, and ship fitting places men at higher risk of prostate cancer. High dietary fat intake has been correlated with prostate cancer,^{54,114} with a protective effect from higher intake of tomato sauce and physical activity.^{55,56} Other risk factors still under investigation include having a vasectomy, eating red meat, vitamin deficiency (vitamins D and E), and frequency of ejaculations. The role of frequency of ejaculations (either through sexual intercourse or masturbation) in developing prostate cancer has been questioned but results of a study involving 30,000 men suggest that ejaculation frequency is not related to increased risk of prostate cancer.⁸³

Etiologic Factors

Although the precise cause of prostate cancer is unknown, a strong endocrine system link is theorized. Androgens in particular have been implicated based on the androgenic control of normal growth and development of the prostate and the fact that males castrated before puberty do not develop prostate cancer or BPH. In addition, the responsiveness of prostate cancer to surgical castration and estrogen therapy supports this theory.¹²⁵ The higher incidence of cancer in African Americans is correlated with a 15% higher serum testosterone level in this same population.³⁹

The development of prostate cancer reflects a complex sequence of biologic and molecular events. Even though it is difficult to identify genes that predispose to prostate cancer because of late age at diagnosis, several inheritable and somatic genetic changes have been identified, including a prostate cancer susceptibility locus with linkage to a locus on chromosome 17p.¹⁶³ However, this gene is only responsible for between 2% and 5% of all prostate cancers, suggesting that additional genes contribute to this disease.^{113,148} The EphB2 gene was recently implicated as a prostate cancer tumor suppressor gene, with somatic inactivating mutations occurring in approximately 10% of sporadic tumors. This may be an important factor in African American men with a positive family history of prostate cancer.⁷⁶

A complementary deoxyribonucleic acid (cDNA) fragment (C13) has been identified that is down-regulated in malignant prostate tissues, suggesting that this gene encodes a protein that may have a tumor- or metastasis-suppressing function in prostate tissue.^{79,132}

A newly identified virus, tentatively called XMRV, may be associated with the development of prostate cancer in genetically susceptible men. XMRV is closely related to a virus that causes leukemia in mice and is a newly identified infectious agent in humans. Researchers theorize that XMRV could be sexually transmitted, leading to chronic inflammation and cancer similar to how human papillomavirus triggers cervical cancer.³²

Pathogenesis

Most prostatic adenocarcinomas are characterized by small- to moderate-size disorganized glands that infiltrate the stroma of the prostate. The tumors are more likely to

develop initially in the periphery of the prostate, unlike BPH, in which the pathologic changes typically originate close to the urethra (see Fig. 19-2). The cancer invades adjacent local structures, such as the seminal vesicles and urinary bladder, and spreads to the musculoskeletal system, particularly the axial skeleton, and lungs. Lymphatic metastasis may involve the obturator, iliac, and periaortic lymph nodes, extending up through the thoracic duct (see Fig. 13-8).

The mechanism underlying the *organ-specific* metastasis of prostate cancer cells to the bone is still poorly understood. Whether the cells only invade the bone and proliferate there or whether they invade many tissues but survive mainly in the bone is unclear; this concept is referred to as *seed and soil*.

Research suggests that osteonectin, a small protein found in bone marrow, attracts prostate cancer cells to bone and once attracted, stimulates the cells to invade bone. These findings suggest that antibodies to osteonectin could reduce the invasiveness of prostate cancer (and breast cancer) and offer a potential way of preventing the spread of prostate cancer to the bone.⁶⁸

Clinical Manifestations

The clinical presentation of prostate cancer is extremely variable and may be completely asymptomatic until the disease is advanced. In many men the disease is noted incidentally on DRE or discovered in fragments of prostatic tissue removed through TURP for BPH. Depending on the size and location of the lesion, the initial presenting symptom could be related to urinary obstruction, onset of pain, or constitutional symptoms such as fatigue and weight loss.

The urinary obstruction symptoms associated with cancer are similar to those associated with BPH but typically present in later stages of the disease compared with BPH. Cancer originating in the subcapsular region of the prostate as opposed to the periurethral area would account for this difference. The obstructive symptoms include urinary urgency, frequency, hesitancy, dysuria, hematuria, difficulty initiating or continuing the urine stream, and decreased urine stream. Blood in the ejaculate may also be noted.

Bony metastasis occurs via lymphatics to adjacent structures and pelvic nodes in the majority of people with metastatic disease. Of the primary tumors that metastasize to the spine, prostate lesions rank fourth behind breast, lung, and myeloma. The axial skeleton is affected more than the appendicular skeleton, especially the spine, ribs, sternum, femur, and pelvis. Prostate cancer is unique in that bone is often the only clinically detectable site of metastasis, and the resulting tumors tend to be osteoblastic (bone forming) rather than being osteolytic (bone lysing).⁶⁹

Prostate cancer can also metastasize to the lungs and liver. The Gleason score is used to grade prostate cancer cells on how they appear under a microscope (Fig. 19-5) and predict the likelihood of metastases (Box 19-2).

Pain complaints associated with prostate cancer can vary tremendously. A dull, vague ache may be noted in the rectal, sacral, or lumbar spine region, and the individual may have difficulty walking. The sacral and lumbar

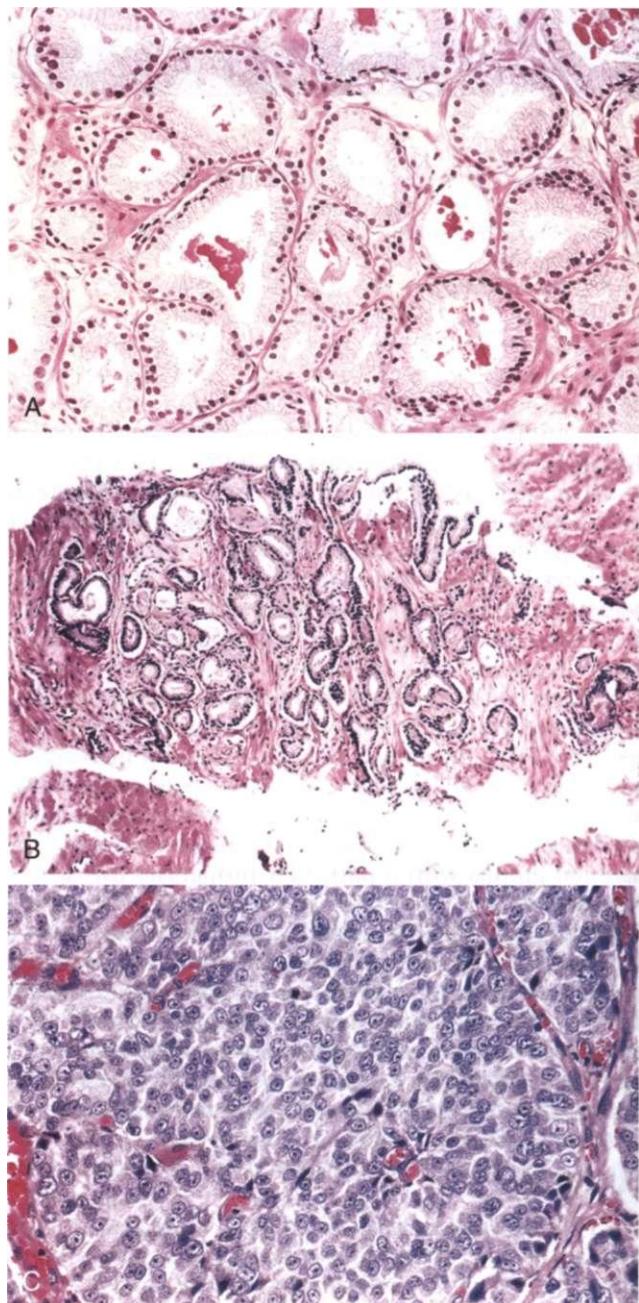


Figure 19-5

A, Low-grade (Gleason score 2) prostate cancer consisting of back-to-back, uniformly sized, well-differentiated (resembling normal cells) malignant glands. **B**, Variably sized, more widely dispersed glands of moderately differentiated adenocarcinoma (Gleason score 6). The higher the Gleason score, the more abnormal and poorly differentiated the cells, the more aggressive the tumor is likely to be. **C**, Poorly differentiated adenocarcinoma composed of sheets of malignant cells (Gleason score 10). (From Kumar V: Robbins and Cotran: pathologic basis of disease, ed 7, Philadelphia, 2005, WB Saunders.)

pain is typically associated with bony metastasis. Pain may be noted in the thoracic and shoulder girdle areas secondary to lymphatic spread of the disease or again secondary to local bony metastasis. Symptoms, such as fatigue, weight loss, anemia, and dyspnea, have all been attributed to metastatic spread of the disease.

Box 19-2**GLEASON SCORE**

Scores are assigned based on cytologic examination and range from 2 to 10, indicating the likelihood that the tumor will spread.

Score	Interpretation
2-4	Unlikely to spread, good prognosis
5-6	Mildly aggressive
7	Moderately aggressive
8-10	Highly aggressive, poor prognosis

Data from Gleason DF: The Veteran's Administration Cooperative Urologic Research Group: histologic grading and clinical staging of prostatic carcinoma. In Tannenbaum M: *Urologic pathology: the prostate*, Philadelphia, 1977, Lea and Febiger.

MEDICAL MANAGEMENT

PREVENTION. Prostate cancer has a long latency period between appearance of premalignant lesions and clinically evident cancer, making it a type of cancer susceptible to chemoprevention (the use of agents to slow progression of, reverse, or inhibit carcinogenesis). There is some evidence that this cancer may be preventable with a non-toxic oral agent such as vitamin E, selenium, soy,^{112,167} or other dietary or nutritional supplement.^{44,155}

In 2003, the Prostate Cancer Prevention Trial (PCPT) became the first phase III clinical trial of prostate cancer prevention. Started in 1993, this landmark study ended early because of the 24.8% reduction of prostate cancer prevalence over a 7-year period in men taking finasteride (Proscar), a 5-a-reductase inhibitor. Other ongoing phase III clinical trials of prostate cancer chemoprevention include the REDUCE study using dutasteride (Avodart) and the SELECT study using vitamin E and selenium.¹⁵⁵

An inverse relationship has been observed between dietary intake of lycopene and the risk of prostate cancer. Vitamin and lycopene supplementation (and other anti-oxidants) may be another form of effective chemoprevention currently under investigation.^{78,90}

Prostate cancer growth is known to depend on androgen, making this another area of study in chemoprevention of this particular type of cancer. Data support the use of antiandrogens to block androgens at the cellular level in the prevention of prostate cancer, although the toxicity of these agents (gynecomastia and gastrointestinal disturbance) poses concerns for the current application in all men.¹⁷ Studies of predictive factors, biomarkers for chemoprevention, or agents, such as calcitriol, that can interrupt the development of prostate cancer are under investigation.^{73,158}

A review of the literature suggests a strong link between physical activity and exercise and decreased prostate cancer risk.^{55,56} Average risk reduction from physical activity and exercise is between 10% and 30%. Exercise may modulate hormone levels and can prevent obesity while enhancing immune function and reducing oxidative stress as possible mechanisms for risk reduction.¹⁵⁷

SCREENING. The American Urological Society recommends annual PSA screening and DRE for men ages 50

years and older if they have more than a 10-year life expectancy, usually defined as having a greater than 50% probability of surviving 10 years. The PSA is a blood test that measures an enzymatic protein manufactured only in the prostate gland. An elevated value (usually 4.0 ng/ml or higher) may be caused by BPH, prostatitis, or cancer. Some medications (e.g., finasteride [Proscar] for BPH and Propecia for hair loss) can depress PSA levels.

PSA may be age-specific, but the exact values for each age remain under investigation. PSA normally rises with age but remains in the 0 to 4 ng/ml range. The level should not rise more than 0.75 ng/dl per year. A level 4 to 10 increases the risk of prostate cancer by 25%; a level greater than 10 ng/ml has a 50% higher risk of prostate cancer.

The optimal upper limit of the normal range for PSA is unknown; approximately 15% of men with PSA levels of 4 ng/ml or less have prostate cancer (some even aggressive tumors).¹⁵⁴ However, lowering the PSA threshold below 4.0 ng/ml would dramatically increase the number of men subjected to prostate biopsy without any evidence that the mortality rate would be lowered.

Men who have a high risk of prostate cancer should start testing at age 45 years; this includes African American men and men with a first-degree relative who had prostate cancer before age 65 years. Testing may be advised even earlier (age 40 years) for men with several first-degree relatives who have had prostate cancer at an early age. There is no conclusive evidence that PSA screening reduces prostate mortality at any age or life expectancy, and benefit is unlikely for men older than 75 years.¹⁶⁶

Some questions have been raised about how long to continue PSA screening in older men with limited life expectancy. There is some evidence that the potential immediate harms (e.g., false positive tests leading to additional procedures, psychologic distress, and morbidity associated with treating clinically insignificant prostate cancer) outweigh the potential benefits.¹⁶⁶

DIAGNOSIS. The diagnosis of prostate cancer is made by a variety of tests, including DRE, transrectal ultrasound, serum PSA assay, and radiographic imaging modalities. Tissue biopsy is performed to confirm the diagnosis, usually when PSA is elevated for unexplained reasons. The DRE may reveal a hardened, fixed structure or a diffusely undulated gland. A limitation to this procedure is that typically only the posterior and lateral aspects of the prostate can be palpated. An ultrasound probe (TRUS) can be performed by inserting a small ultrasound probe into the rectum. The sound waves emitted by the probe produce a video or photographic image of the prostate. These images help guide a thin needle through the rectum to the gland for a biopsy and staging (TRUS-guided biopsy). The use of positron emission tomography (PET) as a noninvasive means of detecting prostate cancer is under investigation.²⁰

The PSA assay is an important part of the screening process and offers some diagnostic information, but prostate cancer cannot be diagnosed by PSA alone. The average prostatic cancer produces approximately 10 times the PSA a normal prostate gland does. However, PSA

values bounce around on a daily basis and an elevated PSA assay (between 4 and 10 ng/ml) may also be related to prostatitis, BPH, prostatic infarcts, and prostatic biopsy and surgery. Therefore an elevated PSA is organ-specific and has some predictive value but is not diagnostic by itself. The PSA may be false negative in up to 30 % of cases with localized prostate cancer.

Radiographic imaging modalities are also utilized for staging of the disease. MRI allows for evaluation of the prostate gland and regional lymph nodes. Lymph node involvement must typically be advanced (nodes larger than 1 cm) to be demonstrable. Radiographs may detect metastatic lesions, but the radionuclide bone scan, although not diagnostic, is a more sensitive modality for detection of a metabolically active lesion.

A relatively new testing method, known as *reverse transcription-polymerase chain reaction* (RT-PCR), is now available and is capable of testing tiny markers that cancer cells carry when they spread to lymph nodes. This test is able to detect cancer previously undetected with standard tests and may also be able to assist in the detection of cancer cells in the surgical margins after radical prostatectomy.^{74,144}

STAGING. The Whitmore-Jewett staging system is a commonly used method of staging for prostate cancer. With this system, the spread of prostate cancer has been divided into four stages: A through D (Fig. 19-6). The stage of the disease at the time of the diagnosis helps dictate the course of treatment. Alternately, the Gleason score, which rates the tumor from 1 (slow growing) to 6 (very fast growing), may be used to determine the aggressiveness of the cancer tumor and the suitability of treatment (see Box 19-2).

TREATMENT. The medical treatment of prostate cancer depends on the man's age and health, the stage of the disease, speed at which the PSA is doubling, and personal preferences. Many uncertainties surround the issue of treating prostate cancer because of the inability to differentiate tumors that will progress from those that will remain unchanged. More men appear to die with prostate cancer than from it.⁶³

No randomized controlled trials have demonstrated the superiority of one treatment over another in terms of survival, although differences in complications vary. The American Urologic Association advocates a presentation of all options for the individual to consider. Once the cancer treatment has begun, most clients are reevaluated every 3 to 6 months. At follow-up visits, symptoms of urinary obstruction and pain are investigated. DRE and a PSA assay are carried out, and prostatic acid phosphatase levels are measured. Other tests may be routinely ordered depending on the individual's status.

The most commonly used effective treatments include observation; radical prostatectomy; radiation (external-beam or brachytherapy); and hormonal therapy. Unless relatively young, men with early stage A disease may be simply monitored because prostate cancer can be an indolent disease. These cancers rarely progress during the initial 5 years after diagnosis but do progress in 10% to 25% of clients 10 years after diagnosis.^{13,41} Generally,

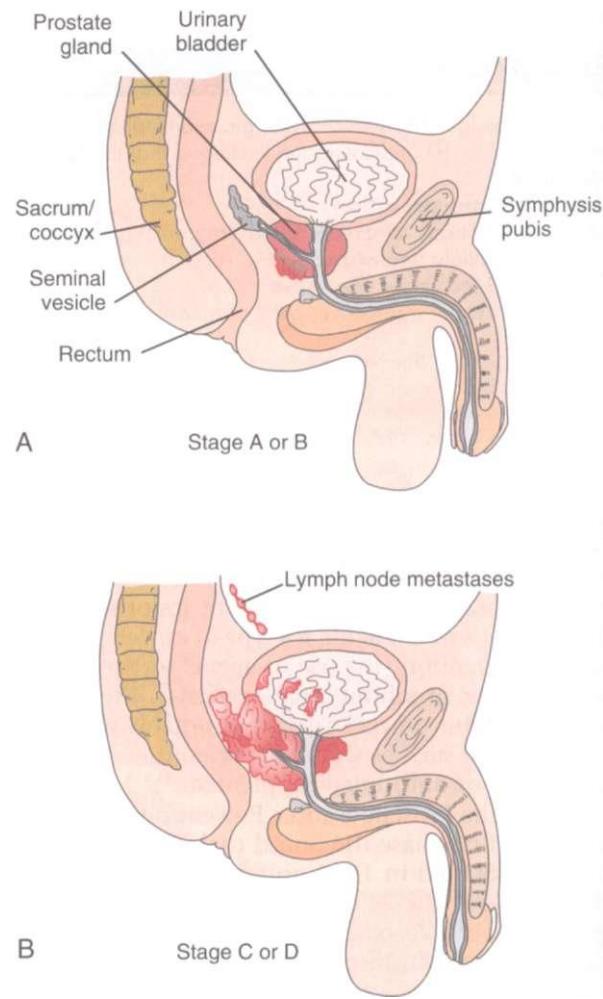


Figure 19-6

Prostate cancer: clinical staging. **A**, The tumor has not spread beyond the gland's capsule in stages A and B. **B**, In stage C the tumor has spread into adjacent tissues; in stage D the disease has spread into the lymphatic system and beyond.

however, men with a life expectancy of 10 years or more and with disease diagnosed in later stage A or B undergo radical prostatectomy and possibly radiation therapy.

Surgery. Radical prostatectomy involves removal of the entire prostate, seminal vesicles, a portion of the bladder neck, and regional lymph nodes and ensures that the original source of the cancer is removed. The conventional surgical approach can be retropubic or perineal, but using a laparoscopic approach provides a significantly magnified televised view of the surgical area and minimizes the potential nerve damage more likely with traditional prostatectomy.^{52,61}

The retropubic approach involves an incision from the pubic symphysis to the umbilicus and allows for staging pelvic lymphadenectomy. The primary postoperative complications with conventional surgery are infection; urinary incontinence (e.g., detrusor instability with small bladder capacity or pudendal nerve denervation); ED/impotence, excessive bleeding; and rectal injury with fecal incontinence. Potency may return gradually over the course of a year; however, after these procedures, as many

as one-third of men have incontinence or urinary frequency beyond 1 year and an even greater number continue to experience ED.

Radiation. Radiation therapy may be used to treat localized prostatic lesions as an adjunctive treatment after radical prostatectomy or for palliative effects in the presence of widespread disease. Relief of pain and improvement in symptoms associated with urethral obstruction are possible benefits of this treatment modality. Potential side effects of radiation therapy include urinary frequency, burning with urination, rectal pain or burning, and diarrhea. Some men never experience these problems, but if they do, they are usually transient and clear up within days to weeks after therapy.

Sexual dysfunction (erectile dysfunction or impotence) is a possible long-term complication and occurs in up to 50% of men treated with radiation. Age and comorbidities, such as diabetes or heart disease, can also increase this risk. Pharmacologic treatment for ED in this population is usually successful.

Palliative radiation therapy may be used for sites of pain secondary to bone lesions from bone metastases in men who have failed hormonal therapy. Metastases to the spine with or without spinal cord compression can be treated with external-beam radiation. Benefit has been demonstrated even for men with neurologic changes. Surgery may be combined with radiation for spinal cord compression.¹²³

Radiation therapy is most often used with stage C disease because many men have occult pelvic lymph node metastases. The radiation therapy can be administered daily by external-beam radiation over a number of weeks (usually up to 2 months). External-beam radiation makes it easier to focus and shape the radiation beam (intensity modulation) so that it is less likely to hit other organs, thereby reducing rectal and bladder toxicity.

Examples of external-beam radiation include three-dimensional conformal radiation therapy (3DCRT), which conforms to the shape of the tumor, or intensity-modulated external-beam radiation therapy [IMRT] that directs thousands of pencil-thin radiation beams of varying intensities at the tumor from many different angles. IMRT beam intensity is highest in the thicker, middle portion of the prostate and much lower in thinner, outer parts of the gland, which minimizes the risk of postradiation bladder and bowel problems.

For men with small, nonaggressive tumors, brachytherapy may be the preferred treatment. Brachytherapy is also indicated for men with medical problems that put them at increased risk for any type of surgery or for men who do not feel comfortable with the idea of losing their prostate if there is another option. Small tumors in men with a Gleason score of 6 or less and a pretreatment PSA level of less than 10 may be the best candidates for this type of treatment. Difficulty with urination may preclude brachytherapy since the procedure increases the risk of developing a sudden inability to urinate after undergoing the procedure. Brachytherapy is the delivery of tiny, rice-sized radioactive seeds by a single injection directly into the prostate. This treatment provides a constant, highly concentrated, yet confined dose of radiation to the tissue in and immediately around the tumor. Once in place, the

seeds deliver radiation 24 hours a day for several months; they remain in place after they lose their radioactivity.

The prostate absorbs almost all of the radiation so that nerves and other tissues of the surrounding structures of the rectum, bladder, and urethra are spared with fewer complications with ED or incontinence.¹²⁰ With technologic advances, brachytherapy now has similar cure rates for localized cancer as radiation and radical prostatectomy.

Hormone Therapy. Hormone therapy is the treatment of choice in the presence of stage D disease; the goal of treatment is androgen deprivation. Testosterone stimulates prostate cancer growth, so by blocking its production, hormone therapy shrinks or slows the progression of prostate tumors. Since the testes produce 95% of the circulating testosterone, orchectomy is the primary method of manipulating hormone levels.

In recent years, there has been an increase in the use of hormone therapy at all stages of prostate cancer. The extensive use of androgen-deprivation therapy (ADT) has raised concerns about potential adverse effects such as hot flashes, osteoporosis, sexual dysfunction (e.g., loss of libido or ED/impotence), and psychologic effects (e.g., depression, mood swings, or memory loss).⁵⁷

A second option, estrogen therapy, is used less often because of adverse effects, including gynecomastia, loss of libido and ED/impotence, bloating, and pedal edema. Hormone therapy is not usually advocated for newly diagnosed, locally contained prostate cancer because of its adverse effects (e.g., bone deterioration, decreased libido, mood changes, and anemia). Additionally, serious cardiovascular disease, including stroke, heart attack, and deep venous thrombosis, can be associated with estrogen therapy in anyone at high risk.

Chemotherapy. Chemotherapy may be advised for men with androgen-independent prostate cancer (AIPC), also known as *hormone refractory prostate cancer*, whose PSA doubling time (PSADT) is less than 6 months, especially if there is a positive bone scan. These men have advanced, metastatic prostate cancer and have relapsed after initial treatment with hormone therapy. In the majority of men with prostate cancer, AIPC occurs after a median time of 18 months of hormone deprivation.¹³³ They are resistant to further hormone manipulation.¹⁰⁴

Docetaxel chemotherapy is now the standard of care for men with metastatic hormone-resistant prostate cancer (HRPC); however, the benefit of this treatment is limited. Optimal treatment timing, dose, and duration have not yet been established.^{93,106,123}

Some men are treated indefinitely until unacceptable toxicity or disease progression occurs. Others are treated using an intermittent approach with chemotherapy interrupted after the initial response.⁸⁷ Research is focused on improving the efficacy of docetaxel by combining it with novel biologic agents; studies combining docetaxel with angiogenesis inhibitors are underway. Other studies are investigating second-line treatments of HRPC with new cytotoxic agents (e.g., satraplatin and ixabepilone).³¹

Immunotherapy. Targeted immunotherapy for control of metastatic prostate cancer is focused on designing an antibody that discriminates between normal and adenocarcinoma cells and targets specific components within

tumor cells (e.g., mucins such as MUC1) with toxins or radionuclides. Overexpression of MUC1 plays an important role in prostate cancer progression. Targeting this particular glycosylated protein may help prevent and/or control micrometastases and hormone refractory disease. It may even be possible to develop a vaccine targeting tumor-associated MUC1 antigen.⁸⁵

Vaccine. Clinical trials are under way to investigate the development of a vaccine that fights prostate cancer by a variety of immunomodulation techniques.⁹⁷⁻¹⁵⁶ For example, a dendritic cell-based cancer vaccine for prostate cancer has moved from the laboratory to human clinical trials. Dendritic cells are antigen-presenting (immune system) cells. They initiate and shape an adaptive immune response by capturing, processing, and presenting antigen material to T and B cells. Early results of dendritic cell vaccinations are being reported.^{103,153} Research continues to focus on improving patient selection, vaccine delivery methods, immune monitoring, and vaccine manufacturing.

In other areas of research, scientists are able to trick the human immune system into recognizing cancerous prostate cells as foreign invaders by genetically engineering the individual's own cells and injecting them back into the body. This is done by harvesting prostate cancer cells, irradiating them, treating them with autologous granulocyte-macrophage colony-stimulating factor (GM-CSF), and reintroducing them into the body.¹⁰ Results so far indicate that both T-cell and B-cell immune responses to human prostate cancer can be generated.^{46,137}

Researchers are also combining vaccines with cytokines or immune modulators, which can foster dramatic antitumor responses. A variety of immunotherapeutic approaches have been followed through to phase III trials for other types of cancer. There is hope that this type of immune therapy can be developed for prostate cancer treatment as well.¹³⁸

PROGNOSIS. Multiple sources of data show that prostate cancer incidence rates rose after the introduction of PSA testing. The average age at diagnosis has fallen, the proportion of advanced stage tumors has declined, the proportion of moderately differentiated tumors has increased, and a decline in mortality began in the United States in 1991.¹⁰² Data show that 93% of men diagnosed with prostate cancer survive at least 10 years and 77% survive at least 15 years, but it is still the second most common cause of cancer deaths among American men. Earlier detection has given men more choices and better treatment resulting in improved morbidity and mortality rates.⁵

Men with small or nonaggressive tumors are more likely to be cancer free than men with large or aggressive tumors. Seed implants are more successful for men whose pretreatment level of PSA is below 10 ng/ml. Without any treatment at all, men with the least aggressive prostate cancers face only a 4% to 7% risk of dying from prostate cancer within 15 years of diagnosis.⁴

The rate of relapse in men with pathologic evidence of pelvic lymph node involvement is high (more than 50%, although some studies report as high as 90%) within 5

years of local treatment. Lymph node involvement occurs in 15% to 20% of men with localized prostate cancer that exhibits high-risk features (as defined by tumor size, serum PSA level, and Gleason score).⁴³

Prostate cancer is sometimes referred to as a "two-decade disease" because it often returns 10 to 20 years after successful local therapy, which is one reason why some physicians advocate radical prostatectomy. Even with radical prostatectomy, recurrence is reported in up to 40% of patients. One-third of those men progress to incurable metastatic disease.¹⁵³ Metastatic prostate cancer remains a lethal disease, although new treatment strategies discussed earlier are being developed and incorporated into clinical trials that may improve survival rates.

Men with advanced, metastatic prostate cancer who have relapsed after hormone therapy often have disease extending to the skeleton, which is associated with severe pain and disability. The prognosis for this group of individuals is poor at this time (median survival is between 10 and 20 months)¹³³ but improved overall survival demonstrated in studies with chemotherapy for these individuals shows promising results.¹⁰⁴

Postoperatively, after radical prostatectomy, incontinence is 100% when the catheter is removed, but urinary control is regained for many men within the first 6 to 8 weeks. Men can speed recovery of urinary function and reduce the likelihood of remaining incontinent with pelvic floor exercises.^{161,162} Any incontinence 12 months or more after surgery and rehabilitation may require additional medical intervention such as collagen injection (a sclerosing agent to "tighten up" the sphincter) or placement of an artificial urinary sphincter (AUS).

Besides the complications of radiation therapy already discussed, rectal cancer is another potential serious complication, especially for men treated with older forms of radiation therapy 10 years ago before the development of more modern tissue-sparing techniques. Men who have had radiation therapy for prostate cancer should be followed and screened regularly for rectal cancer.

SPECIAL IMPLICATIONS FOR THE THERAPIST 19-3

Prostate Cancer

PREFERRED PRACTICE PATTERNS

- 4A:** Primary Prevention/Risk Reduction for Skeletal Demineralization (hormonal therapy)
- 4B:** Impaired Posture
- 4C:** Impaired Muscle Performance
- 4F:** Impaired Joint Mobility, Motor Function, Muscle Performance, Range of Motion, and Reflex Integrity Associated with Spinal Disorders (metastases)
- 5A:** Primary Prevention/Risk Reduction for Loss of Balance and Falling
- 5F:** Impaired Peripheral Nerve Integrity and Muscle Performance Associated with Peripheral Nerve Injury

Screening for Referral

Considering the number of aging adult men seen in a rehabilitative setting and the incidence of prostate

disease, therapists are seeing a number of clients with preexisting prostate conditions. Investigating the symptoms or signs associated with any prostate condition provides the therapist with the baseline information needed to monitor the client's status. For example, if the client experiences difficulty with initiating the urine stream, continuing the stream of flow, urinary frequency, or dribbling or continuous leaking, the therapist should periodically ask if there has been a change regarding the urinary dysfunction.

Pain is often the primary or only symptom associated with prostate disease. If the pain is located in the thoracic, lumbar, or sacral area, the client may seek care from a therapist, thinking the pain has a mechanical origin. Metastatic spread of the disease to the axial skeleton or the periaortic lymph nodes may account for these complaints. If the back pain does not present in a mechanical fashion (based on history and physical examination findings) or if the person notes urologic dysfunction, referral to a physician is warranted.

A previous history of prostate cancer in any man with current reports of shoulder, back, groin, or hip pain of unknown cause must be screened for medical disease. Age over 50 years, past history of cancer, and unknown cause of musculoskeletal pain or symptoms are three red flags that warrant further medical investigation.

Preoperative Physical Therapy

Preoperative pelvic floor training is advocated, but results of a preoperative program of pelvic floor exercises and/or biofeedback have not been documented in a randomized study and remain a matter of debate.¹²² Although postoperative biofeedback has been reported to improve urinary incontinence after radical prostatectomy,¹⁰⁵ the use of preoperative biofeedback or electrical stimulation before surgery has not been proved effective.^{8,86} One random controlled trial of preoperative biofeedback-assisted behavioral training did speed up the recovery of urine control and decrease the severity of incontinence after radical prostatectomy.²¹

One study of ball-assisted pelvic floor exercises did report that men regained bladder control significantly sooner compared with men who did not do the exercises. However, the treatment had little benefit for men who were still incontinent 4 months or more after surgery; it is likely that their bladder problems resulted from surgical damage.¹¹⁸

Postoperative Considerations

In a radical prostatectomy, the urogenital anatomy is significantly altered. The bladder neck or the internal sphincter may be surgically excised. The prostate and a portion of the urethra are removed, compromising the pressure resistance normally provided by the urethra. The bladder is reattached to the remaining urethra.

Pelvic floor rehabilitation must be aimed at both the slow-twitch fibers of the rhabdosphincter (external urethral sphincter) that maintain resistance and the fast-twitch fibers of the pelvic floor muscles that can

tighten quickly to prevent leakage during increased intraabdominal pressure (e.g., laughing, coughing, and lifting) (see Box 16-1).

Men with early incontinence caused by bladder instability are good candidates for physical therapy. Knowing the type of incontinence and the amount of leaking assists in prioritizing a treatment protocol. For example, dribbling after the completion of urinating indicates dysfunction of the external urethral sphincter or detrusor instability (excessive bladder contractions). Exercise and physiologic quieting (see Chapter 18) are often effective if innervation is intact.

Pelvic floor reeducation has been shown effective in returning men to being functionally dry or completely continent after radical prostatectomy and should be recommended as a first-line option.^{161,162} Current literature suggests that the time period toward continence after a radical prostatectomy can be shortened if pelvic floor reeducation is initiated directly after catheter removal.^{27,118} Bladder diaries and behavioral management techniques are also effective in the early management of urinary incontinence after radical prostatectomy.^{21,45}

Early postoperative biofeedback-enhanced pelvic floor exercises initiated 6 weeks after radical prostatectomy to prevent urinary incontinence has been studied with mixed results.⁴⁸ Studies with similar biofeedback methods that began exercises immediately after catheter removal seem to be more effective; more study is needed to confirm these results.¹⁵

Although pelvic floor exercises help men regain continence faster, the rates of continence at the end of 1 year have been reported equal between the exercise group and control group. There is still a potential cost savings with earlier return to continence.^{118,171}

If continuous urine flow occurs months after the surgery, "stove pipe urethra" (intrinsic sphincter deficiency) may be diagnosed, and medical intervention is required. If urine flow is difficult to initiate or flow is weak, an overactive puborectalis muscle, a stricture, or decreased bladder contractions may be evident. Exercise, biofeedback, and medication are treatment options to relax the pelvic musculature and improve detrusor contraction strength and coordination.

If no improvement has taken place with an appropriate rehabilitation program or if the symptoms are getting worse, the client should be referred to the physician who is managing the prostate condition. Options for medical treatment include injection, anticholinergic medication (if it has not already been tried), and implantation of an AUS. Knowledge of other potential symptoms associated with prostate conditions provide the basis for a screening checklist the therapist could use periodically while treating the individual. Once again, if the onset of new symptoms is noted, referral to the physician is warranted.

Metastases to the pelvic lymph nodes can cause lumbar plexopathy and swelling caused by compression of veins and/or lymphatics. The development of lymphedema may be related to smoking, stage of cancer, and radiation therapy. The therapist has an

Continued.

important role in screening men for risk of lymphedema and early recognition/intervention of this condition.³⁰

Complications of Medical Treatment

Important implications exist related to the commonly employed treatment approaches to the various prostate conditions. Complications associated with radical prostatectomy procedures include infection, incontinence, and sexual dysfunction. If the therapist is seeing someone who has undergone such a procedure, being vigilant for symptoms associated with infection is necessary for months after the surgery. If the client reports malaise, fever, chills, sweats, or sudden worsening of symptoms, communication with the physician is warranted.

The surgery may account for the individual's complaints of incontinence and ED/impotence. The average time to achieve continence is 3 weeks with virtually all individuals being continent within 6 months. Postoperative ED occurs in 70% of men who undergo retroperitoneal prostatectomy. Potency can be spared in 70% to 80% with nerve sparing in young men.

Although reduced in recent years, delayed complications of radiation therapy can occur with increasing problems from 6 to 24 months postradiation.⁴⁴ Diarrhea, gastrointestinal or urinary bleeding, irritative voiding symptoms, ED, and tenesmus (painful spasm of the anal sphincter with straining) are all possible complications. The presence of these problems could interfere with a rehabilitation program, slowing progress. A recent onset or worsening of any of these complications should be brought to the physician's attention.

Multiple potential side effects are associated with endocrine or hormonal manipulation (Box 19-3). Decrease in bone mass and increase in bone turnover with a concomitant increased risk of fracture has been documented in men receiving ADT (antiandrogen therapy).^{67,142} Significant loss of bone mineral density occurs within 12 months of starting therapy and continues indefinitely while treatment continues; there is no recovery after treatment is stopped.⁶⁷

Exercise and fracture prevention is an important feature of treatment for anyone on androgen deprivation therapy. Up to 20% of men surviving at least 5 years after diagnosis of prostate cancer have a fracture if treated with ADT compared with 12.6% of men not receiving ADT. Vitamin D deficiency exacerbates the development of osteoporosis. Treatment with bisphosphonates in men on ADT has been shown to prevent bone loss and increase bone mineral density, but it does not prevent fractures in this population group.⁶⁷

Many men on ADT for prostate cancer are not being screened or treated for osteoporosis.¹⁴⁷ The therapist can assess for additional risk factors and institute an osteoporosis education and prevention plan for anyone receiving this treatment. As with the complications associated with surgical procedures and radiation therapy, these problems may interfere with rehabilitation, altering the prognosis. Knowing the individual is being treated with endocrine manipulative therapy

Box 19-3

SIDE EFFECTS OF HORMONAL MANIPULATION

- Muscle atrophy
- Decreased bone density, osteoporosis
- Loss of libido
- Erectile dysfunction/impotence
- Hot flashes
- Gynecomastia
- Bloating and pedal edema
- Nausea and vomiting
- Diarrhea
- Weight gain/redistribution
- Myocardial infarction, cerebrovascular accident, deep venous thrombosis

and being familiar with the side effects can lessen alarm on the therapist's part if the client reports any of these symptoms.

Exercise and Prostate Cancer

The role of physical activity and exercise in reducing the risk of prostate cancer were discussed earlier in this chapter (see section on Risk Factors under Prostate Cancer). Resistance exercise may be able to counter some of these side effects of ADT (e.g., fatigue, functional decline, increased body fat, loss of lean body tissue, and decreased quality of life associated with these physical changes) by reducing fatigue, elevating mood, building muscle mass, and reducing body fat. This form of exercise may be an important component of supportive care for these men.¹³⁴

Moderate intensity exercise has also proven effective in reducing radiation-induced fatigue and other treatment-induced complications in men with prostate cancer.¹⁷² The overall role of exercise with individuals who have cancer is discussed in Chapter 9. If symptoms or signs of myocardial infarct, cerebral vascular accident, or deep venous thrombosis develop, immediate referral to a physician is warranted (see Chapter 12).

DISORDERS OF THE TESTES

Orchitis

Overview and Etiologic Factors

Orchitis is inflammation of the testis, can be acute or chronic, and is often associated with epididymitis. Gram-negative bacteria and *Chlamydia trachomatis* are the usual infectious agents.

Incidence and Risk Factors

Anyone with primary infections of the genitourinary tract or infections in other body regions (e.g., pneumonia or scarlet fever) is at risk of developing orchitis. Sexually active males with multiple partners are at higher risk of developing genitourinary infections. Males 10 years of

age and older who have parotitis (mumps) are also at risk of developing orchitis. The incidence of orchitis in this group can be as high as 25% to 33%.⁵³ Men with indwelling catheters are also at higher risk of developing orchitis secondary to genitourinary tract infection.

Pathogenesis and Clinical Manifestations

Orchitis is often secondary to UTIs. The bloodstream and lymphatics are then the route of spread from other body areas to the testes. Systemic infections, such as pneumonia, scarlet fever, and parotitis, use the same routes to spread to the testes. Orchitis is marked by testicular pain and swelling. Pain may also be noted in the lower abdominal area. Fever and malaise can be present, but symptoms of urinary dysfunction are usually absent.

MEDICAL MANAGEMENT

DIAGNOSIS. Physical examination reveals a tender and swollen testicle. Laboratory tests revealing an elevated white blood cell (WBC) count and urinalysis are an important component of the diagnostic process.

TREATMENT. See the section on Epididymitis and Special Implications for the Therapist: Epididymitis and Testicular Torsion in this chapter.

Epididymitis

Overview and Risk Factors

Epididymitis is an inflammation of the epididymis. The two primary types of epididymitis are sexually and nonsexually transmitted infections. Males typically under the age of 40 years who are sexually active with multiple partners are at higher risk of developing genitourinary disease that can lead to epididymitis. Iatrogenic sources of infection include cystoscopy and indwelling catheters. In the older male population, this condition can be precipitated by prostatitis and UTIs.

Pathogenesis and Etiologic Factors

Epididymitis is typically caused by bacterial pathogens. The sexually transmitted infections leading to epididymitis are associated with urethritis. In the nonsexually transmitted infections, urine containing pathogens may be forced up the ejaculatory ducts, through the vas deferens, and into the epididymis. Pressure associated with voiding and physical strain can force the urine from the urethra. Infection originating elsewhere in the body can spread to the epididymis via the lymphatics of the spermatic cord. Congenital urinary tract abnormalities can lead to epididymitis in children.

Clinical Manifestations

Epididymitis may be associated with pain, urinary dysfunction, fever, and urethral discharge. Unilateral scrotal pain is common, but pain may also be noted in the lower abdominal, groin, or hip adductor muscle areas. When bacteriuria is present, urinary frequency and urgency and dysuria can occur. When the epididymitis is related to sexually transmitted disease, urethritis and urethral discharge are present concurrently. Local scrotal erythema and swelling are associated with epididymitis.

MEDICAL MANAGEMENT

DIAGNOSIS. In addition to the findings noted under the section on Clinical Manifestations, urinalysis, urethral smear, and urine culture are important for the diagnosis of epididymitis. An elevated WBC count is also usually present.

TREATMENT. During the acute phase, treatment includes bed rest; scrotal elevation and support; nonsteroidal anti-inflammatory drugs (NSAIDs); or antibiotics. Hospitalization may be necessary if signs of sepsis or abscess formation are present or if the pain is severe. Once treatment has been initiated, a significant decrease in pain should be noted within a week, but the scrotal edema may be present for 2 to 3 months. (See the sections on Epididymitis and Testicular Torsion.)

Testicular Torsion

Overview

Testicular torsion is an abnormal twisting of the spermatic cord as the testis rotates within the tunica vaginalis. The torsion can occur intravaginally or extravaginally, but intravaginal torsion is the more common. This condition is a surgical emergency. Early diagnosis and treatment is imperative to save the testis.

Etiologic Factors

Torsion of the spermatic cord is often associated with congenital abnormalities. These include absence of the scrotal ligaments, incomplete descent of the testis, and a high attachment of the tunica vaginalis. Increased mobility of the testis and epididymis within the tunica vaginalis facilitate twisting of the spermatic cord. Testicular torsion can also occur after heavy physical activity.

Incidence and Risk Factors

Intravaginal torsion most often occurs in males 8 to 18 years of age. The condition is rarely seen after age 30 years. The extravaginal torsions occur primarily in neonates. A firm, painless scrotal mass is discovered shortly after birth.

Pathogenesis

The spermatic cord contains the vas deferens and the nerve and blood supply for the scrotal contents. If the torsion is severe enough to occlude the arterial supply, infarction of testicular germ cells can quickly occur. Intravaginal torsions are often precipitated by congenital abnormalities. These anomalies allow for rotation of the testis around the spermatic cord, or the torsion may occur between the testis and epididymis. Extravaginal torsion occurs most often during the fetal descent of the testes, before the tunica adheres to the scrotal wall. This allows the testis and fascial tunica to rotate around the spermatic cord above the level of the tunica vaginalis.

Clinical Manifestations

An abrupt onset of scrotal pain and then swelling suggests testicular torsion. The pain may extend up into the

inguinal area. Nausea, vomiting, and tachycardia may be present.

MEDICAL MANAGEMENT

DIAGNOSIS. Diagnosis can be difficult and misdiagnosis of epididymitis can delay treatment, resulting in testicular loss.⁹⁶ Physical examination reveals a firm, tender testis that is often positioned high in the scrotum. Erythema and scrotal edema may be present. The cremasteric reflex is often absent. Color and power Doppler sonography make it possible to identify the absence of perfusion in the affected testis. Scintigraphy (radionuclide scanning) remains an acceptable diagnostic alternative in evaluation testicular torsion when color Doppler is unavailable or inadequate.¹¹⁹ A urinalysis is performed to help rule out infection.

TREATMENT. Testicular torsion is considered a urologic emergency. Once the diagnosis of testicular torsion is made, emergency surgery is performed. The procedure includes detorsion, and if the testis is deemed nonviable, then an orchectomy is performed. The duration of the torsion is critical regarding salvage of the testis. If the surgery is performed within 3 hours of onset, a greater than 80% salvage rate occurs. The salvage rate drops to 20% if more than 12 hours passes before the surgery.

SPECIAL IMPLICATIONS FOR THE THERAPIST 19-4

Testicular Torsion

Pain extending into the groin and scrotum can occasionally be referred from muscle or joint structures, but if a client notes the onset of scrotal pain, immediate communication with a physician is warranted. Ask the client if he has noted scrotal swelling or tenderness; feels feverish or nauseated; has any difficulties with urination, including urgency, frequency, or dysuria; or has noted any urethral discharge. If the scrotal or groin pain is associated with musculoskeletal dysfunction, it can be expected that the therapist could alter the symptoms by mechanically stressing a component of the musculoskeletal system.

Testicular Cancer

Overview

Testicular cancer occurs when cells in one or both testicles become malignant. Primary testicular tumors are divided into two histogenetic categories: seminoma and nonseminoma. Germ cell tumors (origin in the primordial germ cells) make up more than 95% of testicular tumors, whereas the remaining neoplasms are mostly tumors of stromal or sex cord origin. Metastatic tumors to the testis from primary neoplasm elsewhere in the body are uncommon, although involvement by lymphoma may occur in older men.

Incidence

Although relatively rare, testicular cancer is the most common solid organ tumor in young men. There are

considerable geographic and ethnic variations in the global incidence of testicular cancer. The disease mainly affects Western populations, with an increasing incidence since the middle of the twentieth century.⁵⁰ Average rates in developed areas of the world are six times higher than those in developing areas.¹⁹

Testicular cancer is the most common cancer in the 15- to 35-year-old male age group and second most common malignancy from age 35 to 39 years, with a white-to-black incidence ratio of 5 to 1. Approximately 79,200 new cases of testicular cancer were estimated to occur in the United States in 2007.⁷¹

Etiologic and Risk Factors

The etiology of testicular cancer is not well understood. Although the cause is unknown, hormonal balance at various life stages appear to be related. Congenital and acquired factors have been associated with the development of testicular cancer; familial clustering has been observed particularly among siblings.^{33,47}

The first susceptibility gene for testicular cancer has been located and named TGCT1 on the long arm of chromosome X, inherited from the mother; its presence increases a man's risk of testicular cancer by up to 50 times.¹²⁶ There is some evidence that cancer stem cells are derived from normal stem cells that have gradually accumulated various genetic defects; a group of tumor-specific antigens known as cancer/testis antigens (CTAs) may be expressed at early stages during embryogenesis in germ cell precursors eventually leading to testicular cancer.²⁹

The most significant factor in testicular cancer is the association of cryptorchidism (the testes not descending into the scrotum). The incidence of testicular cancer is 35 times higher in males with a cryptoid testis. There is now strong evidence that prenatal or postnatal environmental estrogen exposures (e.g., endocrine-mimicking environmental pollutants, pesticides, industrial chemicals, or chemical contaminants in drinking water) contribute to testicular cancer; this remains under further investigation.^{62,143}

Other risk factors still under investigation may include mothers who took exogenous estrogen during pregnancy (diethylstilbestrol)^{145,146}; scrotal trauma¹⁰¹; exposure to high levels of radiofrequency/microwave radiation in radar technicians¹²⁷; first-born sons¹⁷⁰; and nonidentical twins.

Men with Klinefelter's syndrome (a sex chromosome disorder characterized by low levels of male hormones, sterility, breast enlargement, and small testes) are also at greater risk of developing testicular cancer. Lifestyle and occupational exposures occurring later in life may play a role in promoting the disease, but they are not likely involved in the initiation of the cancer development.⁵⁰

A previous history of testicular cancer and history of infertility and poor semen quality or infection have been associated with an increased risk of developing testicular cancer. A causal relationship has not been established between infertility and infection and testicular cancer.⁹²

Pathogenesis

Since germ cell tumors make up the vast majority of testicular cancers, the following discussion focuses solely on

such tumors. Carcinoma *in situ* usually becomes an invasive germ cell tumor in a median period of approximately 5 years.¹⁶ The neoplastic transformation of a germ cell results in either a seminoma, an undifferentiated tumor, or a nonseminomatous tumor composed of embryonal carcinoma teratoma, choriocarcinoma, or yolk-sac carcinoma (endodermal-sinus tumor). Seminomas are the most common testicular cancers, accounting for approximately 40% to 50% of germ cell tumors and most often appearing in the fourth decade of life. Seminomas appear as a solid, grey-white growth and are rarely necrotic or cystic. The entire testis can be replaced by the tumor.

The incidence of nonseminomas peaks in the third decade of life, and hemorrhage, necrosis, or cystic changes are more common. Yolk-sac tumors are the most common germ cell tumors of infants. These tumors result in enlarged testes, which appear grossly as poorly defined lobulated masses. Focal areas of hemorrhage are common.

Clinical Manifestations

The most common initial sign of testicular cancer is enlargement of the testis with diffuse testicular pain, swelling, hardness, or some combination of these findings. The condition may go undetected if no pain is experienced and the male is not periodically performing testicular self-examination. The enlargement may be accompanied by an ache in the abdomen or scrotum or a sensation of heaviness in the scrotum. Metastasis, although with little or no local change, is noted in the scrotum.

Retroperitoneal primary tumors may present with back pain and/or groin or pelvic pain (psoas muscle invasion). Metastatic testicular cancer can present as back pain (may be the primary presenting complaint), abdominal mass, hemoptysis, or neck or supraclavicular adenopathy. Up to 21% of men with testicular germ cell cancer have back pain as the primary presenting symptoms.¹⁷ A significant delay occurs in diagnosis of testicular cancer in these men compared with men who also had symptomatic unilateral testicular enlargement.

Pain may be the sole presenting symptom in metastasis to the retroperitoneal, cervical, and supraclavicular lymphatic chains. Since the testis embryologically originates in the genital ridge and descends during fetal life through the abdomen and inguinal canal into the scrotum, the primary lymphatic and vascular drainage of the testis is to the retroperitoneal lymph nodes and the renal or great vessels, respectively. Approximately 20% of all cases have involved lymph nodes.¹⁸ Bone metastasis is a late event, often combined with metastasis to the retroperitoneal lymph nodes, lung, and liver. Symptomatic, solitary bone lesions are responsive to chemotherapy and local radiation therapy.

Occurring during the prime of life for most men and potentially affecting sexual and reproductive capabilities, testicular cancer has a major emotional impact and can affect overall quality of life.

MEDICAL MANAGEMENT

PREVENTION. No known preventive strategies exist but teaching and promoting testicular self-examination as a

technique for early detection of this disease is recommended.²⁶ Since survival is dependent on early detection, men should be encouraged to practice testicular self-examination at least every 6 months. For optimal effect, health education programs need to take into account complexities such as cultural diversity, if men are to heed vital and in some cases, life-sustaining advice.

DIAGNOSIS. A thorough urologic history and physical examination are the basis for making a diagnosis of testicular cancer. A painless testicular mass is highly suggestive of testicular cancer. Transillumination of the scrotum may also reveal a testicular mass. Serum tumor markers (e.g., alpha-fetoprotein [AFP], human chorionic gonadotropin [hCG], and lactate dehydrogenase [LDH]) are increased in 40% to 60% of all cases and may be used to guide treatment and follow-up.

Testicular ultrasound is used to differentiate a variety of scrotal disorders besides cancer (e.g., epididymitis, orchitis, hydrocele, or hematocoele). The modalities used to assess metastatic spread include CT scans and MRI. MR lymphography may replace the currently used tomography scanning or MRI used to noninvasively stage retroperitoneal lymph nodes.¹¹ Biopsy with microscopic examination of testicular tissue by a pathologist is the best way to make a definitive diagnosis.

STAGING. Clinical staging is based on the TNM classification system: stage I, or tumor confined to the testis, epididymis, or spermatic cord; stage II, which has spread to the retroperitoneal lymph nodes and divided into A, B, and C according to the size of the nodes; and stage III, which is distant metastasis or high serum tumor-marker values.

TREATMENT. Management of testicular cancer has changed substantially in the last 20 years, primarily because of the ability of cisplatin-containing combination chemotherapy to cure advanced disease. Even over the last 5 years, the management of stage I testis cancer has changed tremendously.

Organ-sparing surgery has become an accepted approach to treat malignant and nonmalignant tumors of a single testis. Combined with adjuvant radiotherapy to the retroperitoneal and ipsilateral pelvic lymph nodes, this approach has proven as effective as orchidectomy. Nerve-sparing retroperitoneal lymph node dissection is an integral part of testis cancer management strategies for both early and advanced-stage disease.⁶⁸ Nerve-sparing techniques help preserve sexual function and prevent incontinence. As many as 50% of men with clinical stage I testis cancer can be treated with close surveillance instead of immediate adjuvant treatment.³

Testicular-sparing management of testicular masses is an alternative to radical orchiectomy and allows for preservation of sperm and hormonal function without endangering survival rates.¹¹⁷ Sperm collection and cryopreservation before the initiation of therapy is an available reproductive technology. Only a few sperm are needed for successful in vitro fertilization.¹⁷³

Chemotherapy is used in cases of relapse after radiation therapy or when there is a high risk for occult

metastatic disease. The recommendation of which therapies to include is based on pathologic findings from the orchiectomy and results of the CT and MRI procedures. Second-line conventional-dose or high-dose chemotherapy with stem cell rescue may cure 25% to 50% of men with recurrent testicular tumors. New chemotherapeutic agents, including the taxanes gemcitabine and oxaliplatin, may also be used.¹⁴⁰

PROGNOSIS. With early detection, more than 95% of men with newly diagnosed germ-cell tumors are cured. It is estimated that with adequate diagnostics and treatment, 100% of men with stage I testis cancer will survive in the future.³ Delay in diagnosis correlates with a higher stage at presentation for treatment.¹⁶ One confounding factor related to the diagnosis being delayed is the potential lack of perceptible testicular changes while the disease spreads. Men who have had testicular cancer have an increased likelihood of developing cancer in the remaining testicle.

Long-term sequelae of cisplatin use may include leukemia, cardiovascular events, and reports that circulating cisplatin can be detected in the plasma as long as 20 years after treatment.^{99,116} The most serious long-term complications of chemotherapy or radiotherapy are cardiovascular toxicity and second malignancies; each has a 25-year risk of approximately 16%.⁴⁰

Chemotherapy-related cardiovascular toxicity may be the result of both direct endothelial damage induced by cisplatin and indirect hormonal and metabolic changes. There is an increased incidence of metabolic syndrome in long-term survivors that is most likely caused by the lower testosterone levels.⁴⁰

Current therapeutic regimens have significantly improved survival but often adversely affect fertility¹¹⁷; cisplatin-based chemotherapy results in 30% to 50% infertility rates in men with testicular cancer who are treated with chemotherapy.⁸⁰ Options to maintain fertility after testicular cancer and its treatment are discussed in detail elsewhere.^{13,6}

Other chemotherapy-induced complications include chronic neurotoxicity (50%), permanent ototoxicity and renal function impairment (30%), pulmonary fibrosis (5% to 10% when treated with bleomycin); and late relapse.⁴⁰

SPECIAL IMPLICATIONS FOR THE THERAPIST 19-5

Testicular Cancer

PREFERRED PRACTICE PATTERNS

4B: Impaired Posture (postoperative)

6E: Impaired Ventilation and Respiration/Gas Exchange Associated with Ventilatory Pump Dysfunction or Failure (pulmonary fibrosis)

6H: Impaired Circulation and Anthropometric Dimensions Associated with Lymphatic System Disorders (lymphatic dissection)

Other practice patterns may be appropriate depending on complications from treatment.

Therapists need to be aware of the potential signs and symptoms related to this disease because clients may be seen by the therapist for other conditions before the cancer is diagnosed. The most likely scenario is someone with thoracic or lumbar pain secondary to undiagnosed lymph node adenopathy or someone with low lumbar pain that radiates around the iliac crest to the groin.

Low lumbar and iliac crest pain may be secondary to biomechanical dysfunction, whereas the groin pain could be secondary to the cancer. Correlation of findings from the history and physical examination and the client's response to treatment may raise suspicion, warranting communication with a physician.

An awareness of the location of superficial lymph nodes is also important for the therapist (see Fig. 13-7). Observation of a mass or even a filling-in of the concavity normally found in the left supraclavicular region should alert the therapist to palpate this area. Palpation of a nodule or a positive iliopsoas sign (see Figs. 16-14 and 16-15) requires medical referral.

Surgical treatment of testicular cancer also holds implications for the therapist. Postoperatively, lymph node dissection can result in compromised lymphatic flow and resultant lymphedema (see Chapter 13). The surgical scars related to orchiectomy and retroperitoneal lymph node dissection may affect the person's posture or movement mechanics of the trunk, pelvis, and hip regions.

Other potential adverse effects of the surgery include infertility associated with sexual dysfunction, such as occurs with retrograde ejaculation or failure to ejaculate. Serious adverse effects of combination chemotherapy include neuromuscular toxic effects, death from myelosuppression, pulmonary fibrosis, and Raynaud's syndrome. See the section on Treatment and Special Implications for the Therapist: Prostate Cancer for a description of the side effects of radiation and chemotherapy.

Erectile Dysfunction

Overview

Erectile dysfunction (ED), also referred to as *impotence*, is a general term that refers to the inability to achieve, keep, or sustain an erection sufficient for satisfactory sexual performance for both partners and may include a problem with libido, penile erection, ejaculation, or orgasm. The degree of erectile dysfunction may be graded according to the number of satisfactory attempts out of 10 (mild: 7 to 8, moderate 4 to 6, and severe 0 to 3).

Incidence and Risk Factors

The prevalence of ED in various community studies has varied from as low of 7% to as high as 52% and has a definite correlation with increasing age. There are an estimated 30 million men in the United States and 152 million men worldwide with ED.² Epidemiologic studies of ethnic groups in the United States are not available at this time.

Box 19-4**RISK FACTORS FOR ERECTILE DYSFUNCTION****Age****Smoking****Medical history**

- Diabetes mellitus
- Coronary heart disease
- Peripheral vascular disease
- Hypothyroidism
- Hypopituitarism
- Hypertension
- Hyperlipidemia
- Chronic uremia
- Neuromuscular disease
- Psychiatric disorders
- Multiple sclerosis
- Chronic alcoholism
- Kidney or liver disease
- Obesity

Surgical history

- Transurethral procedures
- Aortoiliac procedures
- Proctocolectomy
- Abdominoperineal resection

Adverse reaction to medications

- Antihypertensives (β -blockers)
- Tranquillizers (sedatives)
- Amphetamines
- Opiates
- Antidepressants
- Antihistamines
- Antiulcer (e.g., cimetidine)

Risk factors for ED include age-related testosterone deficiency; certain medications; chronic diseases, particularly coronary artery disease, neurologic conditions, and diabetes mellitus; alcohol use; mental or emotional problems; and smoking.^{84,136,150} Being overweight or underweight is a risk factor; physical activity can reduce the risk of ED, but only in men who are obese.²³ Treatment for prostate cancer such as prostatectomy, external radiation therapy, and brachytherapy can contribute to the development of ED.

Etiologic Factors

The underlying causes of erectile dysfunction are commonly classified as *neurogenic*, *arteriogenic*, *venogenic*, or *psychogenic*. Approximately 50% to 80% of men seeking treatment for sexual dysfunction have an organic lesion. The ratio of organic to psychogenic lesions is directly proportional to age. In 70% of men less than 35 years old, the cause is psychogenic. The psychogenic factors include anxiety, fear, depression, stress, fatigue, and so on.

In 85% of men over the age of 50 years, the cause is organic. Conditions that can impede blood flow (e.g., atherosclerosis or medications) or impair nerve transmission (e.g., diabetes or surgery) are the most common organic causes.^{95,100} Neurogenic or neurovascular ED can result from surgical or traumatic injury to the autonomic

or somatic penile innervation or neurovascular mechanisms that initiate erections.

Autonomic denervation of the pudendal nerve and pelvic or perineal trauma from radical pelvic surgeries (e.g., for colon or prostate cancer) result in poor smooth muscle relaxation, arterial insufficiency, and venous inad-equacy, thus preventing adequate erection.⁹¹

Both surgery and radiation therapy can cause this type of autonomic dysfunction. Radiation may also produce ED by accelerating microvascular angiopathy, causing cavernosal fibrosis or stenosis of the pelvic arteries, and by accelerating existing arteriosclerosis, leading to vascular impotence.¹⁴⁹

Another possible neurologic mechanism is microscopic neuropathy with breakdown of cholinergic, adrenergic, noncholinergic, or nonadrenergic neurotransmission. Individuals with diabetes mellitus experience change in the ultrastructure of the cavernous nerves arising from the S2 to S4 spinal nerves. These changes include diffuse thickening of the Schwann cells and perineurial basement membranes.

ED can be a hemodynamic event and can warn of ischemic heart disease in some men. Conditions resulting in arterial insufficiency can also result in local penile changes. Researchers refer to ED as *penis angina* and a *penile stress test* that can be as predictive as a treadmill exercise stress test for atherosclerosis and subsequent peripheral vascular disease.¹¹⁵

Pathogenesis

Despite great strides in research into ED, knowledge and understanding of the pathophysiologic mechanisms responsible for ED are still not entirely clear. Numerous factors and structures can influence the process of sexual function and dysfunction. Coordinated interaction between regulatory centers in the diencephalon, brain-stem, and spinal cord are required for sexual function. Penile erection is a neurovascular event modulated by neurotransmitters and hormonal status.

The penis is innervated by autonomic and somatic nerves. In the pelvis, the sympathetic and parasympathetic nerves merge to form the cavernous nerves, which enter the corpora cavernosa to regulate blood flow during erection and ejaculation. The corpus cavernosum is one of two chambers in the penis that run lengthwise and are surrounded by a membrane called tunica albuginea. A spongy tissue filling the chambers contains smooth muscles, fibrous tissues, spaces, veins, and arteries. The urethra along the underside of the corpus cavernosum is surrounded by the corpus spongiosum.¹⁴⁹

The parasympathetic visceral efferent fibers arise from sacral roots 2 to 4 to supply the pelvic plexus located on the lateral wall of the rectum. The cavernous nerves leave the pelvic plexus and travel in the lateral pelvic fascia on the posterolateral surface of the prostate gland to supply the corpora cavernosa of the penis. The somatic component, the pudendal nerve, is responsible for penile sensation.¹⁴⁹

During sexual stimulation, impulses from the brain and local nerves trigger the arteries in the penis to widen and the smooth muscle to relax. Blood moves into the spongy smooth muscle while the penile veins constrict to

keep the penis engorged and rigid. The tunica albuginea helps trap the blood in the corpus cavernosum, sustaining the erection.¹⁶⁸

Clinical Manifestations

Manifestations of sexual dysfunction include inability to have or maintain penile erection, inability to achieve orgasm, infertility, and dyspareunia. Most men (and their partners) experience significant feelings of emotional distress and/or depression associated with sexual dysfunction and subsequent infertility. Quality-of-life issues are an important aspect of this disorder.

MEDICAL MANAGEMENT

PREVENTION. Without a better understanding of the pathophysiology behind ED, treatment rather than prevention is the main focus. Preventing coronary artery disease and diabetes mellitus may aid in preventing this condition. Anyone with ED should be counseled to avoid recreational drugs and excessive alcohol. Hypertension should be treated, and for anyone with diabetes, glucose levels must be monitored carefully and kept under control.

Regular exercise, keeping cholesterol levels below recommended levels, maintaining an ideal body weight, and quitting smoking are all healthy lifestyle choices that may help prevent ED.

DIAGNOSIS. Because of the sheer number of possible etiologic factors, a definitive diagnosis related to ED can be difficult. Differentiating between an organic versus psychogenic cause is the initial challenge. The nocturnal penile tumescence test, which monitors the incidence of nocturnal erections, helps with this distinction. Men with psychogenic ED/impotence will have nocturnal erections, whereas those with an organic lesion will not.

Physical examination includes an abdominal and genital inspection and palpation, assessment of peripheral pulses and blood pressure, and DRE to evaluate prostate size. Laboratory values, including serum chemistries, complete blood cell count, fasting lipid levels, thyroid function tests, and hormone levels may help rule out systemic diseases.

As a potential marker of cardiovascular risk, ED is no longer considered a benign result of aging. Its documented association with many chronic diseases and high-risk situations extends the significance of ED beyond the purely sexual domain, providing insight into general and cardiovascular health.¹⁴ Arteriography is the standard test for vascular diagnostic testing, but ultrasonography is also used to assess the vascular integrity of the genital area.

TREATMENT. The goals of treatment for ED are to improve self-esteem, confidence, and overall sexual and relationship satisfaction. Management of ED can help restore men to their full erectile potential. Optimal treatment improves erection hardness and is designed to improve outcomes in overall sexual experience.¹⁰⁷

Medical treatment for ED varies, depending on the cause. Pharmacologic treatment with phosphodiesterase type 5 (PDE-5) inhibitors, such as sildenafil (Viagra),

vardenafil (Levitra), and tadalafil (Cialis), to increase blood flow to the penis by inhibiting a particular enzyme has become the new first-line treatment for anyone without heart disease. PDE-5 inhibitors can be used cautiously with α -blockers but are contraindicated in men who take any form of nitrate or nitrite because these drug combinations can cause serious hypotension.¹⁶⁸

Other products are available for select individuals. For example, alprostadil (applied as a topical gel to the head of the penis or used as a suppository inserted into the urethra), previously only available as an injection into the penile tissue, can be used by anyone who is not hypersensitive to the drug, who does not have a history of venous thrombosis, or who does not have sickle cell anemia or sickle cell trait, thrombocytopenia, polycythemia, or multiple myeloma. An erection occurs within 10 minutes and will last for 30 to 60 minutes.

Testosterone injections are an option for men with documented androgen deficiency. Injection of vasoactive substances directly into the penis may also be used. These drugs relax the arterioles and smooth muscle of the corpus cavernosum and increase cavernous arterial blood flow, causing an erection. Penile prosthetic devices can be implanted surgically, and men with arterial and venous deficiencies are candidates for vascular reconstruction procedures. Erections can be achieved mechanically with a vacuum pump device.

Anyone with arteriogenic ED should be counseled regarding risk-factor modification, including lifestyle interventions such as exercise and weight loss and pharmacologic management of hypertension and hyperlipidemia.¹²⁸ Psychologic counseling and/or behavioral therapy is indicated for those with a psychogenic basis for the sexual dysfunction.

PROGNOSIS. ED occurs immediately after radical prostatectomy with variable return of function. Preservation of sexual function can be difficult even among men who have been treated with nerve-sparing surgery. Preservation of the nerves responsible for erection may depend on experience of the surgeon and preoperative potency. Younger, healthier men also may have better outcomes after surgery. In the case of radiation-induced ED, years may elapse before clinically significant ED develops.¹⁴⁹

SPECIAL IMPLICATIONS FOR THE THERAPIST 19-6

Erectile Dysfunction

PREFERRED PRACTICE PATTERNS

4C: Impaired Muscle Performance

It may be necessary to assess for ED in men with pelvic floor problems or dyspareunia (painful intercourse). Many men are reluctant or uncomfortable discussing sexual function or dysfunction. Questions about sexual health must be culturally, ethnically, and spiritually sensitive; suggested questions for the physical therapist to ask are available.⁶⁰ To decrease the man's discomfort, the therapist may want to explain that these questions are routinely asked of all clients.

The male pelvic floor muscles support the abdominal contents, are active during breathing, maintain

urinary and fecal continence, increase local blood supply, and are active during sexual intercourse. The perineal muscles, specifically the ischiocavernosus and bulbospongiosus, play a major role in gaining and maintaining penile erection and preventing postmicturition urinary dribble.

Weakness or imbalance in the pelvic floor muscles may contribute to sexual dysfunction. There is a limited amount of studies in this area, but results consistently show that pelvic floor reeducation and rehabilitation have an important role in restoring normal sexual, urologic, and erectile function.^{9,37,38}

Pelvic floor exercises have been shown effective as a way of restoring erectile function in some men with ED.³⁸ Spasm of the pelvic floor muscles causes pain and often responds to relaxation techniques. Prescriptive exercise is often recommended for the individual with intact nerve innervation and vascular supply. Kegel and Beyond Kegel exercises and "quick flicks" (see Chapter 18) may be helpful.

Pelvic floor muscle exercises, biofeedback, electrical stimulation, and suggestions for lifestyle changes are effective in the treatment of sexual dysfunction (e.g., regaining a normal erection) and postmicturition

dribble in men with erectile dysfunction.^{36,37,161,162} A pelvic floor training program is an acceptable and effective noninvasive alternative to surgery for the treatment of sexual dysfunction and should be offered all men as the first line of treatment.^{25,161,162}

Therapists usually ask clients with back pain about the presence of sexual dysfunction as part of the screening for cauda equina syndrome. Many people who answer "yes" to these questions may have a preexisting condition that accounts for the ED/impotence. Sexual dysfunction may be a postoperative complication related to some of the procedures described earlier in this chapter. If the person notes a sudden change in sexual function, communication with a physician is warranted.

References

To enhance this text and add value for the reader, all references are included on the companion Evolve site that accompanies this textbook. The reader can view the reference source and access it on-line whenever possible. There are a total of 173 cited references and other general references for this chapter.

CHAPTER 20

The Female Genital/Reproductive System

CATHERINE C. GOODMAN

The female genital or reproductive system is made up of the ovaries, fallopian tubes, uterus, vagina, and external genitalia (Figs. 20-1 and 20-2). The primary functions of this system are related to preparing the woman for conception and gestation (pregnancy) and for gestation itself. The female hormonal system, including the ovarian hormones, estrogen and progesterone, plays a key role in these functions. Malfunctioning of this system can result in a multitude of local disorders, some benign and others life-threatening, as well as widespread systemic changes via the hormonal influences.

The diseases discussed in this chapter have several implications for therapists. Some conditions, for example, pelvic floor disorders or postsurgical rehabilitation after mastectomy, may be the primary reason the woman is seeing the therapist. Other conditions, such as endometriosis, may be manifested solely by pain, and the woman presents to the therapist with back or pelvic pain of unknown cause.

The incidence of some of the disorders discussed in this chapter is quite high. For example, endometriosis is present in approximately 50% of women receiving treatment for infertility and in 10% to 15% of all premenopausal women. Breast cancer accounts for approximately one-third of all female cancers. Therapists frequently encounter disorders of this system.

The presence of some of these conditions places the woman at higher risk for developing other diseases. For example, a history of endometriosis increases the risk of ectopic pregnancy, a potentially life-threatening disorder. Menopause is known to contribute to disorders of aging such as osteoporosis, cardiovascular diseases, and cancer.

Therapists are now involved in the field of urogynecology with specific evaluation and assessment tools, treatment modalities, and therapeutic interventions. Increasingly, therapists are involved in the management of conditions such as vaginismus, dyspareunia, vulvodynia, sexual dysfunction, pelvic pain, levator ani syndrome, endometriosis, organ prolapse, and incontinence.

Therapists' participation in women's health issues reflects the medical profession's changing view of women. The traditional allopathic emphasis on women's breasts and reproductive system (the "bikini view") is shifting focus to a more holistic view of women as unique indi-

viduals during their reproductive years and beyond, both in health and in disease.

AGING AND THE FEMALE REPRODUCTIVE SYSTEM

The most significant age-related change associated with the female reproductive system is menopause, which is the permanent cessation of menses. The average age at which this event occurs is between 45 to 50 years, but changes begin as early as mid-30s for many women. The period of time leading up to complete menopause is referred to as *perimenopause*.

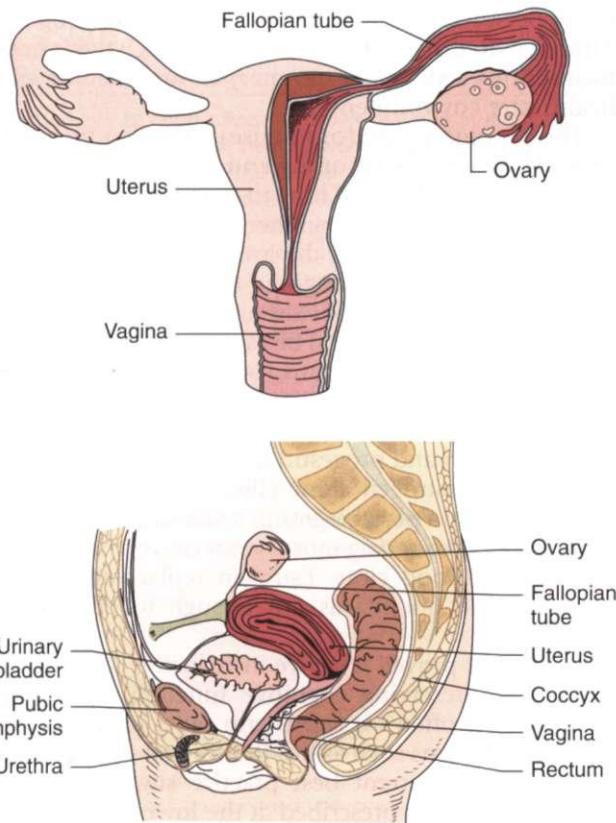
Perimenopause

Perimenopause may be referred to as "the change before the change." Changes in the menstrual cycle; sleep disturbances; increased body temperature; anxiety, depression, or other mood changes; fatigue; and difficulty concentrating are just a few of the sporadic symptoms women may notice. Perimenopause varies greatly from one woman to the next. Some experience symptoms as early as 10 years before the cessation of the menstrual cycle, marking the period known as menopause. For others, it can occur just a few months before menopause. Most women report a 3- or 4-year period of time when symptoms gradually escalate.

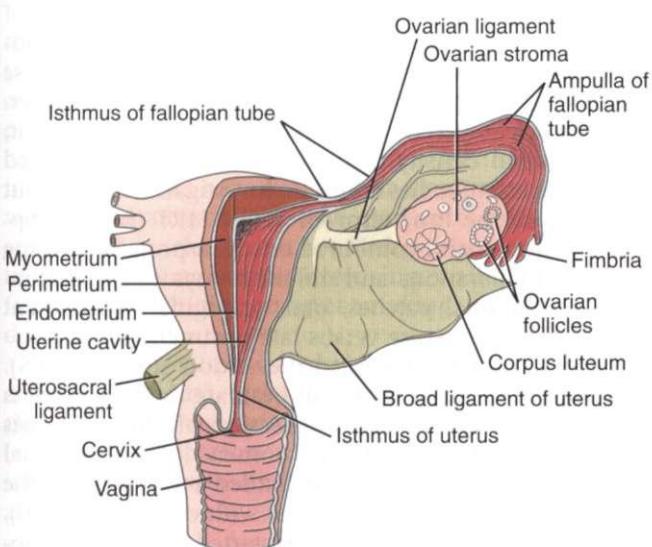
Perimenopause is the physiologic reverse of puberty. Levels of reproductive hormones start to decline gradually with sudden fluctuations on a day-to-day basis, which accounts for some of the common symptoms of perimenopause. Not all women experience or notice symptoms during this time. Women commonly transition from having regular menstrual cycles to having irregular cycles before the final menstrual period. In late perimenopause, anovulation becomes more common, leading to skipped menstrual cycles. Vaginal dryness is a common symptom late in perimenopause.³¹³

Menopause

Menopause signifies the permanent cessation of ovarian function and the end of a woman's reproductive potential. The process of reproductive aging unfolds as a

**Figure 20-1**

Female reproductive organs.

**Figure 20-2**

Expanded view of female reproductive organs.

continuum from birth through ovarian senescence to the perimenopausal and menopausal transitions into the postmenopausal phase.⁴⁵

The average woman experiences menopause by the time she is in her early fifties, but there is great variability in this time frame. Premenopausal women who have a

Box 20-1**COMMON SYMPTOMS FROM PERIMENOPAUSE THROUGH POSTMENOPAUSE**

- Hot flashes, flushing, sweats
- Vulvar or vaginal atrophy (dryness, burning, itching, dyspareunia)
- Anxiety, panic attacks, depression, mood swings, irritability
- Fatigue
- Urinary incontinence
- Insomnia, sleep disturbances
- Headache
- Decreased libido
- Prolonged bleeding, heavy bleeding, irregular menses, cessation of menses
- Heart palpitations, heart racing or pounding
- Short-term memory loss, difficulty concentration (brain fog)
- Changes in body composition: muscle loss, weight gain, central adiposity

hysterectomy experience surgical menopause. About 1% of women experience premature menopause known as *premature ovarian failure*, otherwise defined as cessation of menstruation before age 40 years.

The gradual cessation of ovarian function is accompanied by reduced estrogen levels. During the reproductive years the primordial ovarian follicles, from which ova are expelled, steadily decrease in number. By middle age, the ovaries, which each held about 300,000 eggs at puberty, have resorbed or shed nearly all of them.^{56,57} Ovarian production of estrogen and progesterone decreases significantly when the number of these follicles approaches zero. The reduced level of hormones results in a cascade of events altering the physiology of multiple systems leading to reproductive senescence.⁶⁷

Symptomatically, women may experience hot flashes, vaginal dryness, fatigue, anxiety, sleep disturbances, memory loss, reduced libido, mood swings, and irritability (Box 20-1). Changes in vaginal pH that accompany estrogen decline can also contribute to an increased number of bladder and vaginal infections in some women.

Hot flashes are unpredictable flushes of heat and excessive perspiration that frequently begin several years before menopause. They are thought to be caused by fluctuating estrogen levels but can also occur in association with thyroid disorders and infection or as a side effect of some medications such as raloxifene (Evista), which is prescribed for osteoporosis prevention. Hot flashes with profuse perspiration at night are called *night sweats*.

One or more of these symptoms occur during menopause and last into the postmenopausal years for some women. In addition, there is evidence of increased risk for developing depression, even among women who never had depressive symptoms before.^{55,56} The prevalence of urinary incontinence increases as women age, but the exact role of menopause remains unclear in this transition.^{31,32}

Menopause is a significant transition period that has been associated with adverse changes in body composition and fat distribution, including loss of lean mass,

increases in fat mass, and redistribution of fat from the periphery to the center.²⁹²

Estrogen has effects on various target organs in the body—not just the organs of reproduction. In fact, estrogen receptor sites are found throughout the body and in all organs of the body, including skin, blood vessels, bone, brain, heart, intestinal tract, and urinary bladder. Physiologic changes associated with declining estrogen include endometrial, vaginal, and breast atrophy; decreased thyroid function; hyperparathyroidism; and decreased renal function, insulin release, and response to catecholamines. A decline in estrogen triggers a decrease in serotonin. Since serotonin helps maintain sleep and decrease anxiety, a drop in serotonin adds to the episodes of anxiety and sleep disturbance and aggravates feelings of irritability, tension, palpitations, and chest discomfort.

Local changes of the reproductive organs also occur secondary to decreased estrogen levels. The myometrium, endometrium, cervix, vagina, and labia all become atrophic to some degree. In addition, the pelvic floor musculature loses strength and tone, which can contribute to the development of cystocele, rectocele, uterine prolapse, and stress urinary incontinence.

Although vaginal bleeding should stop with menopause, 80% of all gynecologic problems in women over age 60 years are related to postmenopausal bleeding (vaginal bleeding that occurs 1 year or more after the last period). Such bleeding can be a symptom of a life-threatening problem (e.g., cancer) or a benign condition (e.g., polyps) but always requires a medical evaluation.

Women receiving continuous combined hormone replacement therapy (ccHRT), which is estrogen in combination with progestin taken without a break, are likely to experience irregular spotting until the endometrium (vaginal lining) atrophies, which takes about 6 months. An evaluation is required only if bleeding persists or suddenly appears after 6 months. Those women taking sequential HRT (estrogen taken daily for 25 days each month with progestin taken for 10 or 12 days) normally bleed lightly each time the progestin is temporarily stopped.

Even though estrogen levels decline as women age, the ovaries continue to produce significant amounts of testosterone and androstenedione after menopause. As a result, levels of testosterone may not decline sharply at menopause for women whose ovaries are intact. Testosterone is a natural means of preserving bone and muscle mass and of alleviating menopausal symptoms, particularly the loss of libido.

Menopause and Hormone Replacement Therapy

Much has been written and debated about menopausal women and the need for HRT. With an estimated 1.5 million women each year (incidence) and a total of nearly 80 million women (prevalence) currently approaching or going through menopause, this issue will remain in the forefront of health care. Therapists do not evaluate the need for HRT or prescribe these medications, but clients frequently ask questions and seek additional educational information about this topic. Therapists themselves are often faced with making the decision about HRT use,

either personally or in relation to a close family member. Although an exhaustive discussion of this issue is not the focus of this text, a brief summary is warranted in today's health care environment.

The decision to use (or not use) HRT after menopause should be based on a thorough understanding of the risks and benefits of HRT and how that understanding applies to each woman based on her individual risks. Much remains unknown about the long-term effects of ccHRT, but studies have been ongoing and new information is available daily.^{278,327} At one time, health experts were convinced that estrogen would be essential for reducing heart disease in women; clinicians routinely offered it in HRT as part of a prevention plan. Data from the Women's Health Initiative (WHI) resulted in a halt to the routine use of estrogen and progestin in combination (Prempro) in 2002 and estrogen alone (Premarin) in 2004. When compared with a placebo group, it was clear that hormone users were experiencing more breast cancer, heart disease, stroke, and blood clots. Estrogen replacement showed some benefit, but it was not enough to outweigh the risks.³³³

No longer proved effective in reducing cardiovascular disease or preserving cognitive function, HRT is prescribed most often for short-term relief of menopausal-related symptoms such as hot flashes and vaginal dryness (Table 20-1). Current best practice suggests hormone therapy should be prescribed at the lowest effective dose for the shortest possible time.²⁵⁵ More recently, new findings from the Nurses' Health Study, which has followed more than 120,000 female nurses since 1976, suggest that starting hormone therapy earlier (within 4 years of menopause) may have a coronary benefit.^{115,189}

Estrogen remains beneficial in preventing osteoporosis. Scientists are trying to determine the lowest dose possible to protect bone in a safe and effective manner. It is not clear yet whether observed improvements in bone mineral density actually translate into a reduced rate of fracture. Studies continue investigation to find out more about the long-term effects of HRT (both unopposed estrogen and combined estrogen/progestin) using different preparations and different ways of administration (e.g., dermal patches, oral, or vaginal) at different ages (early menopause versus late postmenopause).

The Kronos Early Estrogen Prevention Study (KEEPS), a 5-year randomized trial, will evaluate the effectiveness of HRT in preventing the progression of atherosclerosis in recently postmenopausal women.¹²¹ The National Institutes of Health (NIH) has funded another study, the early versus late intervention trial with estradiol (ELITE), comparing the effects of estrogen started early after menopause compared with estrogen initiated 10 or more years after menopause.²⁰³

Whatever decision a woman makes should be in conjunction with her health care provider, keeping in mind that any decision made must be individualized for each woman and can be changed as new information becomes available.¹⁶ For the woman who cannot or prefers not to take long-term HRT, there are alternatives for preventing osteoporosis and heart disease and for modifying the transient and temporary symptoms of menopause. Drugs called *selective estrogen-receptor modulators* (SERMs) are

Table 20-1 Advantages and Disadvantages of Hormone Replacement Therapy (HRT)

Risks and Disadvantages	Benefits
Increased risk of heart attack in healthy women in the first year	Treats menopausal symptoms (e.g., hot flashes, night sweats, sleep disturbances, memory loss, fatigue, atrophic changes of vagina or urinary tract)
Increased risk of stroke in healthy women after 1 year	Maintains skin thickness and elasticity, prevents fine wrinkles
Increased risk of endometrial cancer (estrogen alone with progestin)	Prevents accelerated bone loss; maintains bone density; reduces risk of fractures by 50%
Increased risk of breast cancer with prolonged use (>4 years) of HRT	Reduces risk of colon cancer and stroke
Side effects (e.g., vaginal bleeding, fluid retention, weight gain, bloating, breast swelling and tenderness, headaches, mood swings, depression, skin irritation, constipation, loss of libido*)	May improve blood pressure
Increased risk of gallstones, blood clots	Prevention or delay of Alzheimer's disease (preliminary data)
Increased breast density and reduced specificity and sensitivity of mammography	Improves pain tolerance
Slight increased risk of dementia and Alzheimer's disease in women over 65 years	Increases production or prolongs action of serotonin
Contraindications/Precautions:	
History of blood clots	
Pancreatic or liver disease	
Hormone-sensitive breast or uterine cancer	
Migraine headache that is aggravated by estrogen	
Hypertension	
Recent heart attack	
History of uterine fibroids	
Endometriosis	
History of stroke or TIAs	
Benign breast disease	
Current breast or endometrial cancer	

TIA, Transient ischemic attack.

*Some side effects can be managed with a reduced dose, different schedule, or changing brands. Any woman experiencing intolerable side effects should see the prescribing physician for evaluation.

being tested to determine their effects in preventing bone loss, improving serum lipids, and reducing breast cancer risk. Tamoxifen is the most widely used SERM in the treatment and prevention of breast cancer; raloxifene is currently used in the prevention and treatment of osteoporosis in postmenopausal women. These pharmaceuticals stimulate estrogen receptors in some tissues but not in others. SERMs have no effect on symptoms associated with menopause. Alternately, antidepressants can help some women with severe hot flashes. The importance of lifestyle measures, such as exercising; maintaining a low-fat, calcium-rich diet; and not smoking, has been clearly demonstrated.

Natural substances called *phytoestrogens*, such as black cohosh, dong quai, rose hips, soy products, flaxseed, and ginseng used in conjunction with alternative approaches (e.g., yoga, meditation, and acupuncture), are becoming increasingly popular, but research results remain limited at this time.

Menopause and the Musculoskeletal System²⁵⁰

Estrogen suppresses inflammatory responses in many tissues, including skeletal muscle. In animal studies, females have less muscle damage after exercise and in association with muscle diseases such as muscular dystrophy. There is also a greater activation of repair processes in female animals. Muscle injury and slower rates of repair in postmenopausal women may be linked to lower levels of estrogen.^{308,309}

The musculoskeletal system is the site of several painful conditions that occur with increased incidence both

perimenopausally and postmenopausally. These include Colles' fracture, carpal tunnel syndrome (CTS), osteoarthritis of the basilar joint of the thumb, impingement and other rotator cuff diagnoses, and adhesive capsulitis.

Although menopause coincides with the appearance or worsening of fibromyalgia²³⁸ and many of the common arthritic conditions, it is also associated with the lessening of other conditions such as systemic lupus erythematosus, endometriosis, and migraine headaches. Hormonal changes associated with menopause may modulate these diseases and have either a beneficial or detrimental effect on the incidence and activity of several common problems.³³¹

Menopause and Connective Tissue. The question of why there is an increased incidence in the connective tissue disorders in perimenopausal and postmenopausal women has not been answered. In many research articles and clinical commentaries, the authors include brief thoughts or questions, usually in the discussion sections. The following are examples of some statements in research and clinical reviews found in the literature.

- Do fluctuations in female hormones play a role in the development of adhesive capsulitis, or is there a subtle, unrecognized autoimmune component of this syndrome?¹²⁰
- Significant hormonal and physical attributes specific to women render them more susceptible (to CTS), but the specific causation is not yet clear.²³¹
- The probable pathophysiology of this condition (i.e., deterioration of the palmar beak ligament) is known at least in part. The etiology of this deteriora-

tion, however, is not known. Is it pattern of use? Are there hormonal or lifestyle factors?²³¹

- Differences in physiology between men and women, including hormonal effects on the connective tissues and decreased total muscle cross-sectional area, may play a role (in orthopedic conditions).¹⁹⁵
- The association between the estrogen status and the collagen content of various structures is poorly defined at present. It is recognized that estrogen deficiency causes a loss of collagen from the skin, which results in skin thinning. Loss of collagen from around the urethra and within the trigone of the bladder may predispose to urinary dysfunction. The musculoskeletal aches and pains of which many postmenopausal women complain may be related to a loss of collagen from ligaments and other soft tissues.³²⁸
- Decreasing levels of anabolic hormones may be associated with musculoskeletal atrophy and decrease in function that are observed in older women.⁵⁸

From the literature to date, it is clear is that the reason for the increased incidence of some musculoskeletal disorders in women is not clear. When one is faced with an unanswered question, the first step is to seek clues from what is known. For example, it is known that tendons, ligaments, and bones are composed of type I collagen and that type II collagen is a major structural component of cartilage. Cartilage contains estrogen receptors, and estrogen can influence inflammatory diseases by altering cell turnover, metabolism, and cytokine release.²¹²

Other scientists have found decreased amounts of type II collagen in postmenopausal women with lumbar spine degeneration⁹⁷ and decreased type I collagen in the first layer of endopelvic fascia of the pelvic floor (i.e., the arcus tendineus fascia pelvis [ATFP]) in premenopausal and postmenopausal women.²¹⁰ There is an increase in degradation products of type II collagen in postmenopausal women when compared to age-matched premenopausal women.²¹⁶ Additionally, the degradation products were lower in women placed on HRT. When the values for degradation products are lower, it signifies that the collagen is not being degraded or decreased in amount. The end result is that the collagen is preserved. The muscle fiber membranes (sarcolemma) may also be protected from damage associated with trauma or exercise by estrogen receptors located in the membranes.³⁰⁹ It follows then that the loss of estrogen may result in the loss of protection against muscle damage.

There may be a correlation between the somatic changes that occur with aging and a decrease in the activity of the hypothalamic-growth hormone (GH) axis.¹³¹ The decrease in muscle and bone mass in older individuals may indeed result from this GH deficiency.²⁶⁴

The implication of hormonal involvement in musculoskeletal disorders is supported by several investigations.^{210,242} The decrease in type I collagen found in the AFTP of women is not present when the women are on HRT. The decrease in force per unit of a cross-sectional area of the adductor pollicis muscle that occurs around the time of menopause did not occur in a sample of women taking HRT.²⁴²

Both quadriceps and hand-grip strength decreased 10% in women not taking HRT.¹¹³ In other words, women going through menopause had a decrease in collagen; those with exogenous hormones were not experiencing the same loss of collagen or loss of strength as those women who did not take HRT.

Colles' Fracture. Colles' fractures, which are fractures of the distal radius, are seven times more likely to occur in women than men.^{236,280} The increased incidence of Colles' fracture in women is explained by the decreased estrogen level that is a principal cause of low bone mineral density associated with postmenopausal osteoporosis.^{231,236} Low bone mineral density in premenopausal women is also a common finding in premenopausal women with Colles' fracture.^{140,155}

It has been reported that approximately two-thirds of the risk for all osteoporotic fractures in postmenopausal women is determined by the premenopausal peak bone mass.⁵⁹ This fact stresses the importance of education of young women regarding methods to ensure the development of optimal bone mass. Additional factors include decreased balance, vision impairment, and regular walking, presumably reflecting the increased exposure to risk of falling.^{59,280}

Carpal Tunnel Syndrome. Medical diseases and physical conditions capable of causing CTS are common. For example, CTS has been found to be associated with menopause, hysterectomy, pregnancy, obesity, physical inactivity, and decreased physical fitness. Anything that can decrease wrist depth-to-width ratio can contribute to the development of this condition.

Women have smaller wrists (on average) compared to men so that any changes (e.g., ganglion, fibrous hypertrophy, or increased pressure) can result in compression of the nerve. Additional correlates of CTS include a prior Colles' fracture, inflammatory arthritis, hypothyroidism, diabetes mellitus, and use of corticosteroids and estrogens^{100,157,222,223} (see Box 39-1). In the general population, approximately 3% of women and 2% of men will have the symptomatic consequences of CTS, with the greatest occurrence in women older than 55 years of age.¹⁵

Explanations of the proposed pathophysiologic dysfunctions of the syndrome have been outlined in the literature and include increased fluid in the tunnel space, square wrists,²¹¹ higher pressures within the carpal canal, the presence of a ganglion or a lipoma, and fibrous hypertrophy of the tenosynovium.^{164,222} Increased pressure in the carpal tunnel results in ischemia of the median nerve, which impairs nerve conduction and causes pain and paresthesia (see further discussion in section on Carpal Tunnel Syndrome in Chapter 39).

As a possible explanation for the trend of increased CTS incidence in women, there are now more women in the workplace and their occupations may require prolonged repetitive motions of the small muscles of the hand. However, studies show physical inactivity and being overweight are more reliable risk factors than job-related factors.^{27,222,224} The effect of workplace demands as a predictor of CTS is uncertain and remains under investigation.²²¹

Participation in aerobic activity may relieve symptoms of CTS such as pain, clumsiness, and tightness.²²² Improve-

merits of aerobic capacity and decreased body fat associated with improved circulation and oxygen delivery may (or may not) have the potential to prevent or reduce suffering from CTS.^{225,226} Further study is needed to define the role of aerobic exercise and physical conditioning in the prevention and treatment of CTS.

Osteoarthritis of the Basilar Joint of the Thumb. The risk of developing osteoarthritis of the basilar joint of the thumb has been reported to be 10 to 20 times higher for women compared to men.²⁴⁰ There is a well-established relationship between CTS and basal joint arthritis. Scientific evidence to explain the link between these two musculoskeletal conditions is lacking. Both disease processes primarily affect postmenopausal women. This may be a coincidence or there may be an as yet unknown explanation. An anatomic basis is also possible because the carpal tunnel is the narrowest at the level of the trapezium. Any changes, such as basal joint osteophytes protruding into the carpal tunnel, could contribute to CTS.¹⁰⁵

Stability of this joint is required for a strong pinch and using a computer key board, and is also the basis for the increased fine motor control of this joint.²³¹ Complete destruction of the joint examined postmortem has been reported in approximately 50% of postmenopausal Caucasian women.²⁴⁰ Proposed etiologies include both hypermobility and the deterioration of the palmar beak ligament, a major stabilizer of the joint.¹⁶⁶⁻²⁴⁰

Adhesive Capsulitis. Seventy percent of all cases of adhesive capsulitis are reportedly women. Additional risk factors include age greater than 40 years,¹²⁰ trauma,²⁵³ diabetes,¹³ prolonged immobilization,¹¹⁴ thyroid disease,³³² stroke or myocardial infarction,¹¹⁴ and the comorbidity of autoimmune disease.³⁴

Menopause is often cited as a cause of adhesive capsulitis in women, but an earlier classic study seems to have ruled this out by demonstrating age to be the principal predictor. Women with earlier menopause do not experience adhesive capsulitis any earlier than their counterparts who experience menopause later.^{61,183}

Radiographs are found to be normal and laboratory tests do not show typical inflammatory or autoimmune indicators. However, it is currently believed that this condition results from both inflammation and fibrosis of the synovium and subsynovium.³¹² Pathologic studies confirm the presence of an active process of hyperplastic fibroplasia and excessive type III collagen secretion that leads to soft tissue contractures of the surrounding structures (coracohumeral ligament, rotator interval soft tissues, subscapularis muscle, and subacromial bursae).

It has been shown that shrinkage of the axillary area of the capsule, a thickening of the glenohumeral ligaments, and a thick and restricted glenohumeral joint capsule occurs with adhesive capsulitis.²⁰² These changes may occur in reaction to the abnormal presence of cytokines or lymphocytes.²⁷¹

Impingement and Rotator Cuff Tendonitis/Tears. Impingement of the cuff and biceps tendon on the acromion is more common in older women¹⁹⁵ and can be a source of irritation and pain that may progress to rotator cuff tendonitis or tears of the rotator cuff.

Normally, the muscles of the rotator cuff serve as stabilizers of the glenohumeral joint. If the musculotendinous units of the rotator cuff lose the ability to depress and stabilize the humerus during movement, the contraction of the deltoid muscle may cause the humeral head to migrate in the superior direction and compress or impinge subacromial tissues.

Risk factors include degenerative processes at the acromioclavicular joint and structural abnormalities of the acromion that result in decreased subacromial space.¹⁹⁵ Additionally, ligamentous laxity has been implicated in shoulder disorders.

SPECIAL IMPLICATIONS FOR THE THERAPIST

20-1

Menopause

For the therapist, knowing where a woman is in her life cycle and what medications, supplements, or other measures she is using are important parts of the personal medical history. Whether a postmenopausal woman is or is not taking HRT, the therapist remains a key health care provider in risk assessment, assessment and prevention of falls, and osteoporosis education.

Women with disabilities should be assessed for menopausal symptoms at an earlier age. Besides education and prevention for maintaining skin integrity and preventing pressure ulcers, vasomotor instability can be a real problem during menopause. For example, women who are predisposed to temperature fluctuations (especially for women with neurologic impairments such as multiple sclerosis), HRT may be needed.⁷⁴ Medical referral may be needed to evaluate specific problems of this type.

Surgical Menopause

Surgical menopause (hysterectomy) may increase the risk of moderate low back pain in women. A study from data taken from the Women's Health and Aging Study (WHAS) reported an increased chance of developing low back pain years after gynecologic surgery, especially surgical menopause.⁸⁵ Even when gynecologic procedures do not involve severing of muscle or nerve structures, stretching or ischemic injury during surgical retraction or compression can lead to biomechanical dysfunction. The result may be reduced core stabilizing force production. When accompanied by secondary muscle deconditioning from pain inhibition during the perioperative period, spontaneous recovery after surgery may not be automatic.^{85,129}

Low back pain and loss of muscle control after pelvic surgery and childbirth are often accompanied by pelvic pain and urinary incontinence. Multiparous women are at increased risk for chronic problems, whereas primiparous (first childbirth) women are more likely to experience declining back pain and resolving urinary dysfunction over time.³⁰⁵

The bottom line for the physical therapist is that gynecologic and obstetric events often compromise protective abdominal and pelvic musculature with

Continued.

immediate and long-term effects. Rehabilitation focusing on abdominal and pelvic muscles potentially injured during gynecologic surgery may be warranted.^{235,296} Restorative and preventive rehabilitation efforts after surgery should focus on restoring normal neurophysiologic and biomechanical function to the muscles of the lower abdomen and pelvis.⁸⁵

Muscle Mass and Menopause²⁸⁰

Examination of the literature related to the upper extremity strength of women leads to an interesting hypothesis regarding the reason for increased incidence of some upper extremity disorders. Because women have relatively weaker shoulder girdle muscles, they must work harder to cover the same distance or to do the same work. In addition, women are rarely encouraged to train or strengthen their upper body musculature, which handicaps them in sport and work activities that involve their upper arms.¹¹

In 1974, Wilmore published a classic study in which he measured the lower and upper extremity strength values of males and females.³³⁰ The data were presented not only in terms of absolute values (i.e., the weight in pounds that could be lifted), but also by strength per pound of body weight and the strength per pound of lean body weight (LBW), or body weight-subcutaneous fat. While the men were stronger than women in all lower and upper body absolute strength tasks, when the strength per pound of LBW was calculated, the results were different. Using values for leg press, two-arm curl, bench press, and grip strength, the results showed that the women were stronger than the men with respect to lower extremity strength, but that the women remained weaker with respect to upper extremity strength. A possible explanation may be that women and men participate in similar daily activities involving lower limbs, such as stair climbing, bicycling, and walking, but men participate in more activities that would result in the stimulation of muscle strength in the upper extremities.

It may be that the increased incidence of some musculoskeletal disorders in women could be prevented if women received instruction in strengthening of the muscles that are found to be weaker in those disorders. Women must be educated to build up their peak bone mass during puberty; perhaps they would benefit from increasing upper extremity strength as well.

When designing a strength-training program, it is also important to follow the concept of specificity of training when choosing the exercises. For example, since the rotator cuff muscles are implicated in shoulder impingement, specific exercises for these muscles should be included in the exercise regimen. Additionally, perhaps workplaces that require repetitive motions from workers should incorporate strengthening exercises into the daily routine of each worker beginning with the first day of employment.

The effects of musculoskeletal disorders on the lives of women in the United States have been summarized by the U.S. Department of Labor. The results showed that women experience less than one-third of all the

work-related injuries and illnesses that require days away from the work site, although they acquire 61% of all repetitive motion injuries.³¹¹ This is attributed to the fact that women are most often employed in production jobs versus skilled trades work, often working at stations designed for men.

As was stated earlier, the postmenopausal ovary decreases the production of estrogen. However, it is relevant to this discussion to note that increased muscle mass has been shown to correlate with increased levels of estrogen.⁴⁶ Physical activity may have an effect on hormone levels by influencing protein carriers and receptors.⁸⁸ Although cardiovascular activities, such as walking, are beneficial to maintaining condition and body weight and probably do prevent mobility disability, they do not substantially address the decline in musculoskeletal health of the older adult.²⁹⁸

The benefits of participating in a well-rounded program of cardiovascular exercise, flexibility, and strength training appear to be deterrents of many of the deleterious effects of aging and menopause.

Exercise and Menopause

The therapist can be proactive in helping women establish a program of physical activity and exercise to minimize the effects of aging and estrogen deficiency. However, studies on the effects of exercise in menopause have been limited thus far. There is an inherent difficulty in this type of exercise just by the very definition of "exercise" used in each study.

Studies show that regular physical activity may help reduce the tendency for weight gain and changes in body composition and fat distribution (central adiposity) that accompany aging and the menopausal transition. The adverse health consequences of excess body fat, especially central adiposity, are well known.²⁹³

Moderate-intensity activities have been advocated to reduce the many effects of menopause and aging. Vigorous intensity activity may help midlife women preserve a more optimal body composition and offer additional benefits.^{21,293} Endurance exercise training has positive effects on blood pressure and oxygen uptake regardless of menstrual status or hormone replacement.¹¹¹

Others suggest that moderate-intensity exercise does not seem to decrease the occurrence or severity of some symptoms (e.g., hot flashes or memory loss) in postmenopausal women but does have the potential to affect others (e.g., sleep disturbance).^{6,310} Strenuous exercise may be more effective with somatic and psychologic symptoms, including depression and anxiety.²⁰⁹

Assessing effects of exercise specifically on conditions associated with both aging and menopause (e.g., osteoporosis and cardiovascular disease) is more difficult. From the flip side of the issue, there also has been some interest in studying the effects of menopause on physical exercise capacity. Changes in peripheral vascular circulation associated with menopause in otherwise healthy women may have possible conse-

quences on exercise performance. It has been proposed that impaired exercise capacity or exercise intolerance may be helped by postmenopausal HRT.²⁰⁴

Menopause and Disability¹⁵⁴

With advances in health care, women with physical disabilities are living longer than previous generations and making the transition through menopause in greater numbers than ever before. For the 16 million women over 50 years of age with disabilities, there can be unique and challenging health concerns in clinical care. Because so little is known about menopause in women with physical disabilities, they are put in the position of having to educate both themselves and their health care providers about how they may experience menopause differently.⁷⁴

Women with disabilities experience menopause at an earlier age than their able-bodied peers, therefore the therapist may need to assess for early menopause.³¹⁴

The woman with a disability may have poorer general health and be at greater risk for comorbid disease. Estrogen loss compromises collagen content and vascular profusion of the skin, putting women who are wheelchair users or immobile at greater risk of skin breakdown and pressure ulcers.⁷⁴ Menopausal symptoms are similar for women with disabilities compared to the general population, but the effect of HRT and the potential interaction between HRT and other medications used to manage disabilities remains unknown.²⁰

The therapist can assess the impact the menopause transition may have on women with disabilities across three major areas: musculoskeletal system, cardiovascular system, and the integumentary system. For example, bone loss associated with perimenopause and on through the transition to menopause may be more pronounced in women with mobility impairments.⁷⁴

Whereas the able-bodied woman usually reaches peak bone mass by age 35 years, the woman with a disability may never reach that peak. The risk of bone fracture and related impairments is higher in women with disabilities, especially for those who take medications that may further impair bone health (e.g., corticosteroids, tricyclic antidepressants, or anticonvulsants).

The therapist may be very instrumental in helping women with disabilities develop creative exercise strategies, taking into account their reduced mobility and weight-bearing status. Stretching to counterbalance repeated positions and motions are as important as resistance training in this population group. Studies are needed to determine the most effective means of preserving bone in women with disabilities.

Limited mobility also impacts overall cardiovascular health and fitness. The risk of thrombosis related to hypercoagulation states associated with immobility may be made worse with exposure to hormone therapy, making this treatment option less likely for menopausal women with cerebral palsy, spina bifida, spinal cord injured, stroke, or other neurologic impairments.⁶⁰

Women with preexisting urinary problems may experience increasing difficulty controlling urination as the decline in estrogen results in atrophic changes of the lower urinary tract, widening the urethra and decreasing resistance to the flow of urine. Women with detrusor muscle instability or neurogenic bladder who previously could manage their bladder control may suddenly find themselves with an unexpected loss (or worsening of incontinence).³²⁴

Urinary incontinence combined with even minor skin changes associated with menopause can create major problems for women confined to a wheelchair. Attention to dry skin, hydration, strategies to manage incontinence, and pressure ulcer prevention are very important. The therapist must watch out for (and teach the client how to self-assess for) signs and symptoms of urinary tract infection, kidney and bladder stones, and any change in kidney function.³²⁴

Again, the therapist can be very instrumental in education and prevention by first asking the client about her urinary health and habits. Introducing or reinstituting or revamping a previous pelvic floor rehabilitation program can be very helpful during menopausal changes. If not contraindicated, hormonal therapy can help ease the skin and urinary changes, potentially making a big difference.

POST-POLIO SYNDROME

New studies through the Post-Polio Health International (PPHI) organization have documented the effects of post-polio syndrome on menopausal women. Women in late menopause have more severe post-polio symptoms and more difficulty with activities of daily living when compared to post-polio men of the same age. Hysterectomy rates were higher among post-polio menopausal women (35%) compared to the average rate for U.S. women (21%).

Symptoms of sensory loss and sleep disturbance typical of late polio are not easily differentiated from similar symptoms associated with menopause. This study highlights the need for other studies to explore the psychologic and physical impact of menopause on women with post-polio and other physical disabilities.¹⁵⁴

Menopause and Diabetes

As life expectancy increases, women are living a greater proportion of their lives in the postmenopausal phase, a time when the prevalence of type 2 diabetes also increases. The therapist should be aware that the consequences of cardiovascular disease, osteoporosis, and cancer are more pronounced in women who have type 1 or type 2 diabetes but especially women who have metabolic syndrome followed by the development of type 2 diabetes.

Women with type 1 diabetes frequently go through menopause at an earlier age than women who do not have diabetes. Premature or early menopause may be considered an unstudied complication of type 1 diabetes.⁷³ Risk factor assessment for any of these comor-

Continued.

bilities throughout the life cycle is especially important for any woman who has diabetes.

As the woman with diabetes approaches menopause changes in estrogen and progesterone affect how cells respond to insulin and, therefore, blood glucose levels. Menopause symptoms can mimic low blood glucose levels (e.g., moodiness or short-term memory loss).

Sleep disturbance and weight gain associated with menopause make it harder to control blood glucose levels. There is an increased risk of urinary tract infection, especially for the menopausal/postmenopausal woman on insulin and/or who has had diabetes for 10 or more years.³⁰ During the postmenopause years when female hormone levels remain low, insulin sensitivity may increase with a drop in the expected blood glucose levels.²⁵⁶

There are conflicting reports on the role of HRT for postmenopausal women who have type 2 diabetes mellitus. Whether HRT improves glycemic control or worsens insulin sensitivity remains unproved. Results may vary according to the type of HRT, age of the woman, and route of administration.^{108,165}

type of sport (e.g., soccer, basketball, or volleyball), contact versus noncontact, training, and anatomic and biochemical differences.³¹²

Obesity also has significant consequences for the reproductive system and contributes to menstrual disorders, infertility, miscarriage, poor pregnancy outcome, impaired fetal well-being, and diabetes mellitus. Weight loss has marked effects on improving the menstrual cycle, promoting ovulation, and fertility. Fertility is improved through exercise and balanced nutrition possibly through changes in sensitivity to insulin.²³³

Mood disorders, including depression and postpartum depression, anxiety, and vulnerability to autoimmune and inflammatory diseases seem to follow estradiol (one of three estrogen compounds present in the body) fluctuations.³⁴ Exercise has been shown effective in elevating mood, decreasing risk of cancer, and ameliorating some of these symptoms and conditions for most people.

Physical activity and exercise may be an effective strategy to offset some of the negative consequences of estrogen depletion on muscle mass and tissue distribution associated with menopause. Results of the Erlangen Fitness Osteoporosis Prevention Study (EFOPS) in early postmenopausal women suggests a program of mixed high-intensity exercise effectively compensates for most negative changes related to the menopausal transition.¹⁵⁹

The results of this study showed that exercise can stop early postmenopausal bone loss, stabilize bone mineral density, increase physical fitness, and decrease coronary heart disease risk factors. Exercise had positive effects on the body composition of the women involved in the study and most importantly, the effects of exercise can be maintained with regular exercise over time.¹⁵⁹

EXERCISE AND THE REPRODUCTIVE SYSTEM

Exercise increases cardiovascular fitness, reduces adiposity, and aids in maintaining muscle mass and bone density in women of all ages from adolescents to frail older people. On the other hand, too much exercise can have negative effects on the reproductive and skeletal systems, including primary and secondary amenorrhea (absence of menstruation) caused by low body weight and improper nutrition (see further discussion in the section on Eating Disorders in Chapter 3).

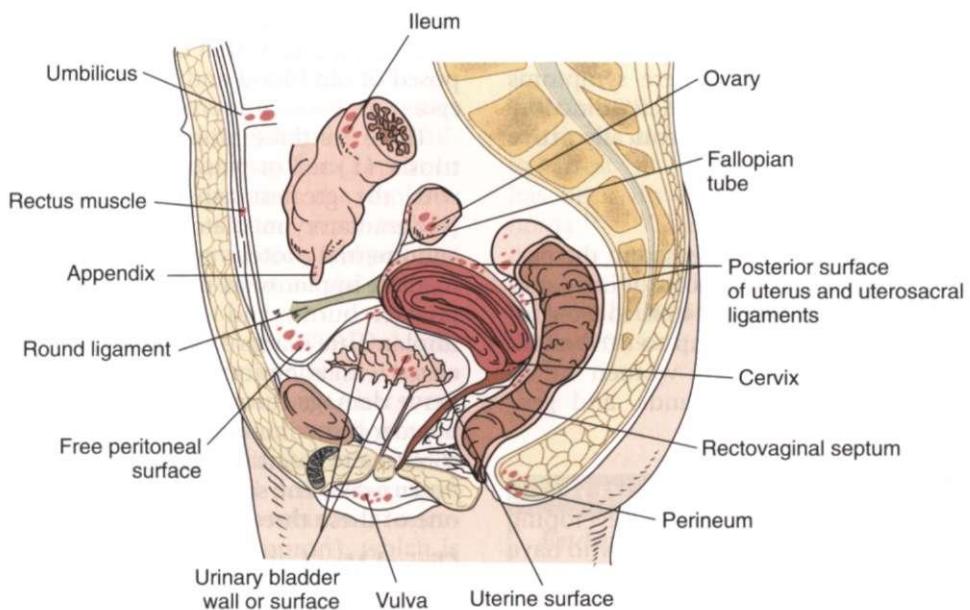
The female athlete is at particular risk of reproductive system disruption with strenuous exercise. Hypothalamic dysfunction can result in delayed menarche (first menstruation) and disruption or cessation of menstrual cyclicity. When energy expenditure exceeds dietary intake, gonadotropin-releasing hormone (Gn-RH) is suppressed, resulting in hypoestrogenism and subsequent compromised bone density and infertility. Failure to attain peak bone mass combined with bone loss predisposes female athletes to osteopenia, osteoporosis, and stress reactions or fractures. Increasing caloric intake to offset high-energy demand may be sufficient to reverse menstrual dysfunction and stimulate bone growth, but many of these young women restrict calories.^{321,322}

There is a known difference in the rate of male and female athletic injuries such as anterior cruciate ligaments injuries. No definitive explanation has been found. It is natural to assume the hormonal differences (including changes during the menstrual cycle and the use of hormonal contraceptives by women) between men and women is the most likely source for this difference in injury rate.⁴ Other factors under investigation include

SEXUAL DYSFUNCTION

The participation of a physical therapist in the management of sexual dysfunction is an increasing phenomenon. More and more adults (men and women) are experiencing altered sexual function and sexuality as a result of medical treatment and medications. For example, being able to enjoy sex after cancer treatment is a significant and necessary part of the recovery process. Altered body image and hormones affect both men and women after treatment (surgery, drugs, radiation) for cancer of the reproductive organs. Menopause may be triggered prematurely in some women. An excellent resource about the side effects of radiation and chemotherapy on sexual desire and performance along with helpful suggestions is available.²⁷³

Other medical problems, such as diabetes, arthritis, depression, pelvic floor disorders, spinal cord injuries and other causes of neurologic impairment, menopause, prostate problems, and cardiovascular disease, can result in sexual dysfunction. Addressing these issues can have a positive effect on sexuality and quality of life. Most of these conditions can be managed with medications, lifestyle changes, and exercise. The therapist can be very instrumental in helping clients discuss sexual problems more readily and with less embarrassment and in helping

**Figure 20-3**

Potential sites of endometrial implantation.

them obtain the appropriate medical intervention, often including physical therapy intervention.

People who have been sexually victimized or traumatized are also seeking professional help for the first time. Sexual abuse occurs in approximately 1 of every 3 girls younger than 14 years and 1 of every 7 boys; only a small proportion of these cases are ever reported. Sexual abuse, marital (or partner) rape, and assault occur in the adult population; the prevalence of these events remains unknown, but social scientists estimate that 20% to 25% of the U.S. population is affected. Women with disabilities are at increased risk of abuse, including sexual violence.

There is an increased incidence of obesity, incontinence (urinary and fecal), fibromyalgia, infertility, pelvic pain, and behavioral components (e.g., eating disorders, obsessive-compulsive disorders, or learning difficulties) associated with sexual abuse.

DISORDERS OF THE UTERUS AND FALLOPIAN TUBES

Endometriosis

Overview

Endometriosis is an estrogen-dependent disorder defined by the presence of endometrial tissue (lining of the uterus) outside of the uterus. The disorder becomes apparent in the early teen years after menses have begun, and its symptoms continue until menopause. Each month as the woman's body prepares for a fertilized egg, the uterus becomes engorged with blood, providing a fertile place for the egg to attach and begin growing. If and when the unfertilized egg passes out of the body, the uterus sloughs off the lining of blood and the woman has a flow of menstrual blood for about 3 to 5 days.

Endometriosis occurs when the uterus sheds this blood up into the body, rather than down and out through the vagina. Endometrial tissue found outside of the uterus on other organs or structures within the pelvic cavity and the body responds each month the same way as the endometrium during the menstrual cycle. The misplaced tissue engorges with blood just as it would when lining the uterus. The blood cannot drain out of the body and the result is lesions, or "chocolate cysts," wherever the endometrial tissue is located with subsequent swelling, bleeding, and scarring.⁷⁰ These pockets of blood can be deposited anywhere in the body. The most common sites of ectopic implantation include the ovaries, fallopian tubes, broad ligaments, pouch of Douglas, bladder, pelvic musculature, perineum, vulva, vagina, or intestines (Fig. 20-3).

Although less common, endometrial tissue can also be found in the abdominal cavity, implanted on the kidneys, small bowel, appendix, diaphragm, pleura, and bony elements of the spine. Whereas it was once thought that the blood just reached the pelvic and abdominal cavities, coating the viscera contained within, it is clear now that endometrial tissue migrates throughout the body. It has been recovered from bone, lungs, and even the brain.¹⁰³ Rarely, ectopic tissue has been found in joints, the nose, and the lungs.³¹⁵

Wherever this tissue migrates, it is biochemically and endocrine active, behaving as if it were still under the control of the hormonal system. Every month during the menses, a woman with endometriosis develops a host of symptoms that depend on where the uterine tissue resides. During menstruation, the dislocated tissue is responding just as the uterine lining, but since it cannot shed as the endometrium does, it remains where it is, eventually forming scar tissue and irritating the affected area.

The American Society of Reproductive Medicine (ASRM) has classified endometriosis as I (minimal),

II (mild), III (moderate), IV (severe), or V (extensive). Despite this classification system, a woman can have severe disease without symptoms or severe symptoms with minimal disease. This is most likely determined by the type of endometriosis and how biochemically active are the implants.

Incidence

The incidence of endometriosis has increased in the past 40 to 50 years in Western countries. Reports of incidence vary from as low as 7% to as high as 40% to 60% of all women. Endometriosis is found in up to 50% of all infertile women. Endometriosis affects women of all ethnic origins, socioeconomic backgrounds, and geographic locations.^{3,15}

Etiologic and Risk Factors

Any woman of childbearing age is at risk of developing endometriosis, but it is more common in those who have postponed pregnancy. In addition, other risk factors include early menarche; regular menstruation but 27-day or shorter cycles; and menstrual periods lasting 7 days or longer. The cause of endometriosis is unknown, although the high prevalence among family members suggests a genetic predisposition. A daughter with a maternal history of endometriosis has twice the chance of developing endometriosis herself.

The most widely espoused theory suggests that endometrial cells are flushed into the pelvic cavity through retrograde menstruation, a condition in which some of the menstrual flow backs up the fallopian tubes into the pelvic cavity. This retrograde menstruation has been shown to occur in up to 90% of women, but it is unclear why endometrial cells implant in some women and not in others. Since the fimbrial openings of the fallopian tubes are in the posterior aspect of the pelvis, more of the endometrial implants are found on posterior structures, sometimes giving rise to low back pain.

Another strongly held hypothesis is a dysregulation or dysfunction of the immune system that allows these cells to locate and survive where they do not belong. The cells from the uterine lining are resistant to the body's normal defense mechanisms and are not readily cleared away when they happen to stray outside the organ.

Other theories include the (1) dissemination of endometrial cells through the lymphatics or vascular system (explains presence of tissue in lungs); (2) metaplasia of the mesothelium (Meyer's theory), that is, endometrial cells change from one type of cell to another, whereby the endothelium undergoes transformation able to produce the same reproductive hormones (explains presence of tissue in joints); (3) intraoperative implantation associated with procedures such as hysterectomy and episiotomy; and (4) abnormal differentiation of precursor epithelial cells during early embryology, whereby these cells are seeded before birth.

Pathogenesis

Once endometrial cells migrate to other parts of the body, they can form pockets of tissue referred to as implants. These implants swell in response to the cyclic

surge of estrogen and progesterone-forming cysts on the underlying organs that contain a dark, syrupy fluid composed of old blood and menstrual debris called *chocolate cysts*.

There are three primary pathologic types of endometriosis: (1) red or petechial implants are the most active with the greatest capacity to produce prostaglandins (inflammatory mediators) and also capable of producing endometrial protein and hormones; (2) brown or intermediate implants are moderately active and precursors to powder burns; and (3) black or brown powder-burn implants are inactive with little cellular material but associated with adhesions that stretch organs and cause direct nerve damage through devitalization and ischemia. The powder-burn implants adhere structures together, contributing to infertility, and are sometimes referred to as a *frozen pelvis*. The severity of the disease depends on which one of these three types is present.

Clinical Manifestations

The symptoms and signs associated with endometriosis depend on the location of the implants, but pain and infertility are the two major symptoms. Abdominal pain, fatigue, and mood changes are common beginning 1 or 2 days before the onset of the menstrual flow and continuing for the duration. The therapist may hear reports of intermittent, cyclical, or constant pelvic and/or low back pain (unilateral or bilateral).

Dysmenorrhea (painful menstruation) will be the chief complaint if the implants are on the uterosacral ligaments. These lesions swell immediately before or during menstruation, resulting in pelvic pain. Dyspareunia (painful intercourse) is also associated with this condition because penile penetration during intercourse can aggravate the local adhesions.

Pain during defecation can occur when there are adhesions on the large bowel. The fecal material moves through the intestine, stretching and aggravating the scar tissue. Surprisingly, the extent of the disease does not always correlate with the intensity of the symptoms. A woman with widespread lesions may be asymptomatic, whereas a woman with few implants may have considerable pain.

Other symptoms can include low-grade fever; diarrhea; constipation; rectal bleeding; and referred pain to the low back/sacral, groin, posterior leg, upper abdomen, or lower abdominal/suprapubic areas. Bleeding from anywhere else (e.g., nose bleeds, coughing up blood, or blood in urine or stools) is less common but still possible.

MEDICAL MANAGEMENT

DIAGNOSIS. Although the classic triad of dysmenorrhea, dyspareunia, and infertility strongly suggests the presence of endometriosis, accurate diagnosis requires direct visual examination by laparoscopy or laparotomy. One advantage of laparoscopy is that the technique is also therapeutic in that lesions can be removed immediately. Ultrasound and magnetic resonance imaging (MRI) are generally used to examine the pelvis, but MRI is more sensitive in detecting the implants. Researchers are trying to develop a radioimmune assay to measure endocrine protein asso-

dated or present with this disease toward the eventual development of a blood test.

TREATMENT. There is no cure for endometriosis; the goals of medical treatment are preservation of fertility (if fertility is an issue) and pain relief. Pregnancy does appear to suppress the disease, and in animal studies, the implants disappear during pregnancy.³¹⁵ Assisted reproduction may be recommended to stimulate ovulation and perform in vitro fertilization with transplantation of the embryo into the uterus.

Nonsteroidal antiinflammatory drugs (NSAIDs) may sufficiently relieve the pain, or other analgesics can be administered before or during menstruation. Other medications are used to inhibit ovulation and lower hormone levels to prevent the cyclic stimulation of the endometrial implants. Eventually, the implants will decrease in size. These medications include danazol, a combination estrogen-progesterone acetate; leuprolide (Lupron), which is injectable once per month into the muscle; goserelin, which is injectable under the skin, and nafarelin nasal spray, a Gn-RH (these analogs act on the hypothalamus-to-pituitary interface to shut down the ovaries by blocking the ability to produce gonadotropins such as follicle-stimulating hormone [FSH] and luteinizing hormone [LH]).

Danazol is a synthetic male hormone that inhibits the monthly surge of LH, reduces estrogen production, and influences the way estrogen affects endometriosis. Primary adverse side effects include weight gain, edema, decreased breast size, acne, oily skin, headache, muscle cramps, and deepening of the voice. It can also adversely affect lipid metabolism and raise blood pressure.

Birth control pills may be used to reduce painful symptoms and inhibit menstrual periods, which stop the growth of endometriotic implants, but these do not cause complete regression of implants already present. Once the woman goes off the pill, these implants become active once again, sometimes with a rebound effect (symptoms are much worse).

Surgical intervention is another approach that is used less commonly than even 10 years ago because the etiology remains unchanged and regrowth occurs rather quickly. If the endometriosis is mild without extensive adhesions, laparoscopic cauterization or laser surgery may be indicated. If the woman is over 35 to 40 years of age, disabled by the pain, and childbearing is completed, a total hysterectomy, bilateral salpingoophorectomy (removal of ovaries and fallopian tubes), and implant removal are considered.

Nontraditional therapies, such as yoga, aromatherapy, reflexology, naturopathic medicine, and homeopathy, may be useful adjuncts to allopathic medicine. Many women are using this type of alternative/complementary intervention combined with diet and nutrition to self-treat without medications. Numerous resources are now available in this area.^{18, 68, 83, 206}

The future treatment of endometriosis may be based on the development of remodeling enzymes that work to remodel tissue at the cellular level. Understanding the mechanisms of growth factors for the growth and development of epithelial cells, the immune system, and

implant physiology will help researchers develop more specific intervention techniques.

PROGNOSIS. As mentioned, there is no cure for endometriosis, although pregnancy and menopause appear to arrest its continued development. Endometriosis has been linked with reproductive cancers and melanoma.^{136, 291} The link between endometriosis and these diseases remains unclear, although a genetic predisposition or shared exposures to environmental toxins (especially dioxins) have been suggested, but the findings are inconsistent and inconclusive.^{275, 341}

SPECIAL IMPLICATIONS FOR THE THERAPIST 20-2

Endometriosis

PREFERRED PRACTICE PATTERNS

4C: *Impaired Muscle Performance*

4D: *Impaired Joint Mobility, Motor Function, Muscle Performance, and Range of Motion Associated with Connective Tissue Dysfunction*

As common as this disease is, therapists often encounter endometriosis as a primary diagnosis, as a comorbidity, or as an undiagnosed condition. Many women note that their back or pelvic pain is cyclic. Therapists often justify this observation with an explanation that the hormonal changes associated with menstruation can result in ligamentous laxity, thereby stressing the joints of the pelvis. This is only one possible scenario.

Therapists need to consider all possibilities, including pelvic disease. Dyspareunia is a common complaint associated with sacroiliac, lumbar, or hip dysfunction. If the painful intercourse is related to endometriosis, the pain will be present regardless of position. If the pain is related to joint dysfunction, typically certain intercourse positions will be comfortable and others painful.

Endometriosis may account for false-positive findings during the therapist's physical examination. For example, if there are endometrial implants on the psoas major muscle, local palpation and length or strength testing of the psoas may be provocative. The therapist may be led to believe the psoas is the origin of the pain complaints. Endometrial implants on pelvic floor muscles and ligaments, sacroiliac ligaments, and abdominal wall muscle may lead to similar false-positive findings.

The medications commonly given to treat endometriosis can result in a variety of side effects that can account for a woman's symptoms. Gastrointestinal (GI) system complaints (dyspepsia, nausea, and so on) may be related to the pain or the antiinflammatory medication being taken. The Gn-RH medications can result in hot flashes and vaginal dryness. Danazol can cause weight gain, acne, decreased breast size, and hirsutism.

Uterine Fibroids

Overview

Uterine fibroids (benign tumors of the uterus) forming on the outer surface of the uterus or within the walls or lining of the uterus are common, presenting in up to one-quarter of all women of childbearing age and constituting the primary reason women have hysterectomies.

Clinical Manifestations

Usually, uterine fibroids are asymptomatic, but in 10% to 20% of women with these tumors, pain and abnormally heavy bleeding during or between menstrual periods are common. Often these women become anemic, experiencing fatigue and weakness that contribute to an impaired lifestyle.

Fibroids can and often do grow to the size of a grapefruit or larger. Growth is related to estrogen and possibly progesterone; fibroids often regress after menopause. Fibroids can place pressure on the bladder resulting in constipation, urinary frequency, and nocturia. Pressure on spinal nerves can also cause low back pain (Fig. 20-4).

MEDICAL MANAGEMENT

TREATMENT. Pharmacotherapy to control fibroid-related symptoms may include NSAIDs for pain control or hormonal agents that lighten or stop the period. Other options may include surgical removal through a procedure called *myomectomy*. One way to perform this operation is to pass a fiberoptic scope through the vagina into the uterus (called *hysteroscopy*) to remove the tumors. Fibroids embedded in the uterine wall usually require a laparoscopy or more invasive open abdominal surgery. Hysterectomy (removal of the entire uterus) may be needed.

A new, less invasive technique, called *uterine fibroid embolization* (UFE), is performed with the woman under local anesthesia and mild sedation and involves the radiologist inserting a catheter into the femoral artery through a small incision in the groin and then snaking the catheter into the uterus. Tiny plastic or small sponge particles (polyvinyl alcohol) are injected that block off the blood supply to the smaller arteries supplying the fibroids, causing them to shrink and die. Another alternative to hysterectomy is endometrial (or balloon) ablation

in which the uterine lining is destroyed (but not the uterus) through electrical energy or heat from a balloon-tipped catheter inserted into the vagina, through the cervix, into the uterus. The balloon is then filled with a sterile solution until it conforms to the shape of the uterus and heated until the heat destroys the endometrial tissue.

Eliminating red meat and ham from the diet and eating green vegetables, fruit, and fish appear to have a protective effect. Presumably, diet influences levels of the estrogen hormone, which is known to affect fibroid growth.⁵³

SPECIAL IMPLICATIONS FOR THE THERAPIST 20-3

Uterine Fibroids

Recovery after UFE may require a few weeks before the woman feels "back to normal." Fatigue may persist and occur rapidly without warning for the first month after the procedure. Subjectively, some women report an immediate sense of relief from pain and congestion with gradual decrease in abdominal distention.

The therapist may need to address compensatory postures and gait for those individuals who had pain long enough to cause such changes. Assess for abnormalities and asymmetries in muscle strength and function throughout the abdomen, trunk, pelvis, and hips.

Endometrial Carcinoma (Uterine Cancer)

Overview and Incidence

Endometrial carcinoma is commonly known as uterine cancer, but technically the term *uterine cancer* refers to all cancers found in the uterus body and the cervix. Cancer of the lining of the uterus (endometrium) is the fourth most common cancer in women and the most common cancer of the female reproductive organs, accounting for approximately 7400 deaths per year in the United States.¹⁴⁸ There is no apparent genetic component to endometrial cancer, but rather, environmental, social, and lifestyle factors are the most important.³⁰²

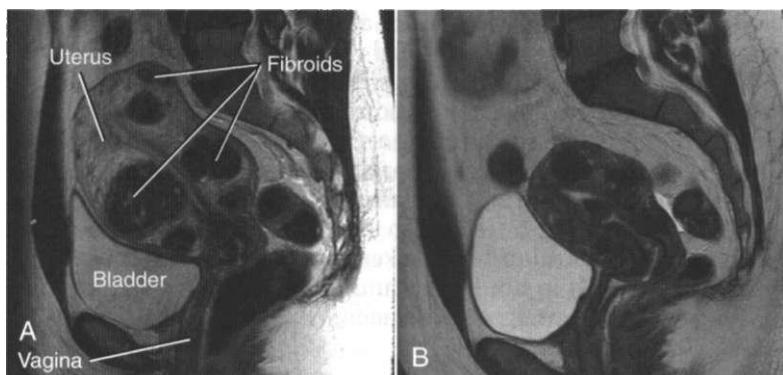


Figure 20-4

Uterine fibroids. **A**, MRI image of uterine fibroids. Note the position in relation to the sacrum, bladder, and pubic bone. Pressure on nerves and soft tissue in this area can cause painful pelvic, abdominal, low back, and sacral pain. **B**, MRI image of fibroids after uterine fibroid embolization (same patient). (Courtesy Robert L Vogelzang, MD, Chicago.)

Risk Factors

Endometrial carcinoma is most common in women who are older (average age 60 years), white, affluent, obese, and of low parity. In fact, 75% of cases occur in postmenopausal women; the remaining 25% occur in premenopausal women, including 5% in women younger than 40 years. Hypertension and diabetes mellitus are also predisposing factors.

Any condition that increases exposure to estrogen unopposed by progesterone is a risk factor for uterine cancer. For example, obesity, polycystic ovary syndrome (PCOS), estrogen therapy, and some hormonal contraceptive formulations increase a woman's exposure to unopposed estrogen and therefore increase the risk of endometrial cancer.

Tamoxifen (Nolvadex) therapy, estrogen replacement therapy without progestin, and the presence of estrogen-secreting tumors are also risk factors. Although tamoxifen is used as an antiestrogen treatment for breast cancer, in postmenopausal women with an intact uterus, it can enhance rather than suppress the action of estrogen. This action causes endometrial overgrowth, resulting in an increased incidence of uterine cancer in this population.

A great deal of attention has been paid to the possible induction of endometrial cancer by the antiestrogen tamoxifen, which has led to the development of new SERMs. The National Cancer Institute's Study of Tamoxifen And Raloxifene (STAR) trials to compare these two drugs and their side effects are ongoing. The current data on raloxifene after 10 years continue to show a preventive benefit for breast cancer with less risk of uterine cancer compared to tamoxifen.

Cigarette smoking, physical activity and exercise, and the use of hormonal contraceptives appear to decrease the risk. In fact, women who exercise are 80% less likely to develop endometrial cancer than women who do not exercise at all.³⁰² There is a strong link between obesity and endometrial cancer. Risk factors vary based on premenopausal versus postmenopausal status.

Pathogenesis

Epidemiologic and clinicopathologic evidence points to two separate types of endometrial cancer. Type I (low grade) is the most common type. It is hormonally related, associated with hyperplasia, and tends to have a better prognosis. Most of the risk factors listed refer to type I endometrial carcinoma.⁸ Type II endometrial cancer (high grade) accounts for approximately 10% of all uterine cancer. It is not hormonally related, is associated with endometrial atrophy, and has a worse prognosis.⁸

Clinical Manifestations

Unlike ovarian cancer, endometrial cancer has a major identifiable symptom in its early stages: abnormal bleeding (present in 80% of all cases). Irregular bleeding is a normal consequence of menopause, but the woman who is at least 12 months past menopause (cessation of menses) and now presenting with abnormal vaginal bleeding is the most typical presentation of endometrial

Box 20-2

STAGING FOR UTERINE CANCER

The International Federation of Gynecology and Obstetrics (FIGO) classification system has the following broad continuum:

- O: Carcinoma in situ, preinvasive
- IA: Tumor limited to endometrium
- IB: Invasion to less than one-half of the myometrium
- IC: Invasion to more than one-half of the myometrium
- IIA, IIB, IIIA, and IIIB: Vaginal metastases
- IIIC: Metastases to pelvic or paraaortic lymph nodes
- IVA: Tumor invades bladder or bowel mucosa
- IVB: Distant metastases, including intraabdominal or inguinal lymph nodes

cancer. Metastases to the lymphatic system can result in abdominal or lower extremity swelling.

MEDICAL MANAGEMENT

PREVENTION. At the present time, the best prevention plan is to maintain a healthy weight through diet and regular physical activity. A plant-based diet rich in vegetables, whole grains, and beans is advised.¹⁷³

DIAGNOSIS. Abnormal bleeding in any woman of any age must be medically evaluated. Women with increased risk and those with postmenopausal bleeding or vaginal discharge should be screened for endometrial cancer. When metastatic spread occurs, the most common sites are lymph nodes, lung, or liver. More rarely, bone metastases with isolated lesions to the femur, tibia, fibula, and calcaneus may occur.¹⁸⁶

Endometrial sampling is currently the most accurate and widely used screening technique, but ultrasonographic measurement of endometrial thickness and hysteroscopy have also been used. Staging has changed significantly over the last 25 years and is now determined surgically using the International Federation of Gynecology and Obstetrics (FIGO) classification (Box 20-2). For complete TNM and FIGO staging, see the National Comprehensive Cancer Network (NCCN) Clinical Practice Guidelines in Oncology: Uterine Cancer, available at http://www.nccn.org/professionals/physician_gls/PDF/uterine.pdf

Other less invasive methods of staging are under consideration such as laparoscopic-assisted vaginal hysterectomy with lymphadenectomy.¹⁹ Contrast-enhanced MRI may help decrease the number of unnecessary lymph node dissections.⁹⁴

TREATMENT. Endometrial cancer is usually treated surgically with total abdominal hysterectomy and bilateral salpingo-oophorectomy. The plane of excision lies outside the pubocervical fascia and does not require unroofing of the ureters.¹⁹

Progestin therapy may be used in those women who decline surgical intervention,³⁹ and hormonal therapy (including progestin and antiestrogen tamoxifen for some women) has been used with recurrent disease. Most of these cancers are detected at an early stage when they are highly curable.

Women with advanced stages of endometrial cancer may not be candidates for operative intervention in the presence of tumor fixation or deeply invasive cancer. Medically inoperable cases may be treated with radiotherapy alone (external-beam pelvic radiotherapy or vaginal brachytherapy). Radiation may be used when the tumor spreads outside the uterus or in the case of advanced or recurrent disease after failed hormonal therapy. Cytotoxic combination chemotherapy also has been used with varying results.

PROGNOSIS. Early detection makes this disease curable, but recurrences can occur; most recurrences occur within the first 3 years after surgery. Endometrial lining involvement of less than 50% is associated with 100% survival, but this drops precipitously when tumor growth involves more than one-half of the endometrium, especially with local or distant metastases.⁹⁹

SPECIAL IMPLICATIONS FOR THE THERAPIST 20-4

Endometrial Carcinoma (Uterine Cancer)

PREFERRED PRACTICE PATTERNS

4B: Impaired Posture

4C: Impaired Muscle Performance

6H: Impaired Circulation and Anthropometric Dimensions Associated with Lymphatic System Disorders

Physical activity and exercise are known to decrease the risk of endometrial cancer. This is yet another area of preventive medicine in which the therapist can be very instrumental in conducting a screening examination consisting of a few questions and prescribing an appropriate exercise program.

Questions may include past personal or family history of endometrial (or other) cancer, presence of menses or menopause, use of HRT or nutraceutical supplements (e.g., rose hips, dong quai, or soy), presence of osteoporosis or bone density testing results, and current exercise/physical activity levels. Any time a woman who is at least 12 months after menopause and not taking hormone replacements reports vaginal bleeding, a medical evaluation is required.

For the woman who has been treated for endometrial cancer with lymphadenectomy and/or radiation, posttreatment lymphedema and other potential side effects (see Chapter 5 and Table 9-8) may require physical therapy intervention.

Cervical Cancer

Overview and Incidence

Every year in the United States, approximately 11,000 women are diagnosed with cervical cancer and 3700 women die of this disease (288,000 worldwide deaths).¹⁴⁸ Mortality has declined dramatically since the 1930s when the Papanicolaou (Pap) smear was introduced. It is now largely a preventable disease with preventive sexual practices, regular screening, and intervention at the precancer-

ous stage. Twenty-five percent of new cases of cervical cancer develop in women 65 years and older.

Etiologic and Risk Factors

Clinical studies have confirmed that the transfer of human papillomavirus (HPV), also known as papillomas or genital warts, during unprotected sexual intercourse is the primary cause of cervical cancer. HPV is the most common sexually transmitted disease (STD) in the United States affecting more than 50% of sexually active adults. The CDC estimates that 7.5 million Americans become infected with genital HPV each year. A new study suggests HPV infection rates are higher than previously thought, and perhaps as many as one-third of all American women are infected.⁷⁸

More than 70 types of HPV have been identified; 23 of these infect the cervix, and 13 types are associated with cancer. Infection with one of these viruses does not necessarily predict cancer, but the risk of cancer is increased significantly, and a link between HPV infection and female cervical cancer and male anal cancer has been demonstrated.¹²⁸

Other risk factors include maternal use of diethylstilbestrol (DES), smoking (even passive smoking), hormonal contraceptive use, high parity (number of births), low socioeconomic status, ethnic background (black women experience a 72% higher incidence compared with whites),²⁵¹ young age at first intercourse (17 years or younger), multiple sexual partners (5 or more),⁵⁰ and the presence of other STDs.¹⁴⁸

Alcohol and other drugs are additional risky behaviors that may play a role in young age of first sexual intercourse and more than five sexual partners. Impaired judgment from alcohol and other drug use can lead to unsafe sexual practices and with risky partners (partners more likely to have sexually transmitted infections [STIs]) contributing to HPV infection.¹⁵¹

Women infected with human immunodeficiency virus (HIV) are at increased risk for cervical intraepithelial lesions (the precursors to invasive cervical cancer), presumably associated with a high rate of persistent HPV infection.⁸⁰ Other immunocompromised women (e.g., organ transplant recipients and women receiving immunosuppressants) are also at increased risk.

Pathogenesis

The common unifying oncogenic feature of the vast majority of cervical cancers is the presence of HPV. More than 99% of cervical cancers contain at least one high-risk HPV type (16, 18, 31, 45); approximately 70% contain HPV types 16 or 18.¹⁵² The molecular basis for oncogenesis in cervical carcinoma can be explained to a large degree by the regulation and function of the two viral oncogenes *E6* and *E7*. The ability of HPV to target the function of tumor suppressors is typical of DNA tumor viruses. The *E6* gene product binds to the *p53* tumor suppressor gene and induces *p53* degradation. *E7* targets another tumor suppressor that functions like *p53* in cell cycle control and inactivates it.¹⁴⁷

As a result of these molecular disruptions, dysplastic changes occur in the thin layer of cells known as the *epithelium* that covers the cervix. The cells found covering