The 2004 International Workshop of Definition and Classification of Cerebral Palsy definition includes the following: “The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, perception, cognition, communication, and behaviors, by epilepsy, and by secondary musculoskeletal problems.”¹ The Surveillance for Cerebral Palsy in Europe (SCPE) collaboration has reported that 31% of children with cerebral palsy (CP) have severe intellectual disability, 11% have severe visual disability, and 21% have epilepsy.² Thus, although CP is primarily a disorder of movement, many children with this diagnosis have other impairments that may affect their function, quality of life, and life expectancy. Children with a diagnosis of CP often have multiple medical issues that are best addressed by an interdisciplinary medical team, including a “medical home” with primary care physicians and additional assistance from multiple medical subspecialists. A comprehensive health plan implemented in the context of a well-defined “medical home” is a critical component to ensuring that the health needs of children with CP are adequately addressed.³⁴ Management of the multisystem-associated comorbidities requires a careful review of systems. Cerebral palsy is defined as a nonprogressive neurologic condition; however, as the child grows and matures physically and psychologically, the manifestations of the impairment are often not static. Recognition and appropriate
management of these manifestations requires knowledge of the comorbidities accompanying CP. Management of the associated medical conditions that accompany CP can have a significant impact on the health, function, and quality of life of the child and family. A change in status of one medical condition may have significant impact on other signs and symptoms, for example, bladder infection or constipation may have effects on global spasticity. Coordination of care is required among the team members caring for a child with CP to optimize medical management, function, and quality of life. Identification of the more common medical issues that are addressed in a review of systems of a patient with CP is outlined below by general systems. Neuromuscular and musculoskeletal conditions are not addressed here as these areas are discussed within another article in this issue (see Damiano and colleagues).

NEUROLOGIC

Epilepsy

Epilepsy is common in individuals with CP. The prevalence reported in the literature varies depending on the type of seizure and on the type of CP, as well as on whether mental retardation is also present. Overall, the prevalence of seizures in children and adults with CP has been reported to be between 15% and 55%.5–7 In individuals with CP and mental retardation, the prevalence rises to 71%.8

Epilepsy is particularly common in those with tetraplegic CP and in those with hemiplegic CP, with some studies finding epilepsy to be more prevalent in the former population,5,8,9 and others finding it to be more prevalent in the latter.7,10 In individuals with diplegic CP, prevalence has been estimated between 16% and 27%.6,7 Age of onset tends to be earlier in those with spastic tetraplegia and diplegia, and later in those with hemiplegia.7

Given the variety of different lesions seen in different types of CP, it is not surprising that individuals with different types of CP might experience different types of seizures. Frequently these may secondarily generalize.11 Partial epilepsy is the most common form of seizure activity in all children with CP, and is especially common in children with hemiplegia who have seizures12 with a prevalence of around 70% in this specific population.6 Generalized tonic-clonic seizures are more common in those individuals with spastic tetraplegia and diplegia.7,8,11

Electroencephalography (EEG) may assist in appropriate seizure diagnosis and optimal management of children with CP. In 1 study, abnormal EEG findings were assessed in 74 of 105 patients assessed with a diagnosis of CP, with slowing most often seen in children with tetraplegia and hemiplegia; most of the children with tetraplegia and diplegia demonstrate generalized abnormality.7 In children who have definite seizures, traditional EEG may show epileptic spikes when there are nonepileptic involuntary movements related to the child’s CP.6 Video EEG may be useful to address this difficulty.

Interepileptiform discharges seen on EEG are also frequently observed in patients with CP, especially in those individuals with hemiplegia.6 Although the appropriateness of “treating the EEG” is debated and data specific to individuals with CP are limited, interepileptiform discharges assessed during polysomnography have been found to be responsible for 23% of total sleep arousals in CP, and some investigators believe that such arousals may contribute to cognitive impairment.13

Overall management of epilepsy in individuals with CP, including pharmacologic management, is similar to that which would be undertaken in individuals without CP. One noteworthy consideration in this population, however, is the effect that baclofen, an often-used medication for spasticity management in individuals with CP, may
have on seizures. Although it is an analog of g-aminobutyric acid type B (GABA-B), an inhibitory neurotransmitter, reports associate its use with an increase in seizures; some indicate that this may be dose-related. Evidence of the effectiveness of the ketogenic diet specifically in children with CP is lacking.

The prognosis for individuals with CP and epilepsy is variable. It is known that children with hemiplegic CP and epilepsy have lower full-scale intelligence quotient (IQ) scores than those with hemiplegic CP without epilepsy, as well as poorer performance on a variety of memory assessments. Seizure relapse after antiepileptic drug discontinuation has been demonstrated to be significantly more likely in children with spastic hemiparesis than in individuals with spastic diplegia (61.5% versus 14.3%). Evidence supports attempting discontinuation of antiepileptic drugs in children with CP after they have been seizure-free for at least 2 years.

**Visual Abnormalities**

Children with CP have abnormalities of the visual sensory and motor pathways at rates exceeding those detected in neurologically normal children. Studies have demonstrated that visual abnormalities in children with CP vary from 10% to 100%. The premature infant may have severe visual impairment caused by retinopathy of prematurity (ROP). Children with less severe CP resemble the 1% to 4% of neurologically normal children who have infantile or refractive strabismus, whereas children with more severe CP have deficits that are either uncommon (eg, high myopia) or never seen (eg, dyskinetic strabismus) in neurologically normal children. Worse visual acuity has been associated with increased levels of severity on the Gross Motor Function Classification System (GMFCS). Children in GMFCS level V have been demonstrated to have a greater risk for high myopia, absence of any fusion, dyskinetic strabismus, more severe gaze dysfunction, optic neuropathy, and cerebral visual impairment. Rates of optic neuropathy and gaze dysfunction also trend higher with higher GMFCS levels. Cerebral visual impairment, defined as bilateral, subnormal, best corrected visual acuity for age that could not be attributed to an ocular motor deficit (eg, nystagmus) or a structural defect of the anterior afferent visual pathway (eg, bilateral optic neuropathy), is present in up to 16% of children with CP, averaged across all GMFCS levels.

All infants weighing less than 1500 g at birth or with a gestational age of 32 weeks or less should be screened for ROP by an ophthalmologist with experience in ROP screening until the blood vessels are mature, around 40 weeks from conception. Children with CP should have yearly eye examinations, preferably by a pediatric ophthalmologist who is comfortable working with children with disabilities.

**Hearing Abnormalities**

Hearing problems occur in approximately 30% to 40% of children with CP. Hearing loss is known to be especially prevalent in children with CP with kernicterus, congenital infections, low birth weight, or severe hypoxic ischemic injury. Additional antecedents of hearing impairment in CP may also include prolonged artificial respiration after birth, persistent pulmonary hypertension, and the use of extracorporeal membrane oxygenation. Conductive and sensori-neural impairments are found in children with CP, who should be screened by an audiologist. Screening should generally be performed at intervals similar to those of all infants and children, but increased in those with risk factors such as congenital infections and treatment with ototoxic antibiotics.
Cognition

Given the heterogeneous nature of the causes and clinical manifestations of CP, it is difficult to generalize regarding the relationships between CP and cognitive function. Children with CP have been estimated to have associated mental retardation in the range from 30% to 50%. Cognitive deficits tend to be most prevalent and severe in those with spastic tetraplegia, although children with spastic tetraplegia may have normal to near-normal intelligence. In children with spastic diplegia, there tends to be a general correlation between severity of motor deficit and level of cognitive deficit. The presence of a seizure disorder may also be related to increased risk for cognitive deficits. It is important to keep in mind that delayed or deficient language skills or dysarthria due to incoordination of muscles involved in speech or significant gross motor deficits can lead to false underestimation of intelligence.

The use of standard measures of intelligence for assessing children with CP poses challenges, as the test results must be interpreted in the context of the motor, speech, visual, and auditory difficulties that may be present in these children. Difficulty with visual acuity and upper extremity motor impairment, for example, may impair hand-eye coordination and affect performance on several tests, and may contribute to a verbal-performance IQ split, with performance scores more affected due to decreased motor control. Children with spastic diplegia entering school, with IQ scores assessed before and 2 years after entering school, who were placed in regular classrooms, demonstrated an increase in verbal IQ, but not in performance IQ, in comparison to those children who were in special education classes. Children with CP in special education classrooms demonstrated higher mean increases in Wechsler performance IQs in comparison with those in regular classrooms. Thus, children with CP in regular classrooms revealed increasing disparity between verbal and performance IQs. Advocacy for appropriate and optimal educational services at all levels of schooling and identification of potential resources to assist in obtaining these services should be provided, with anticipatory guidance given well before the start of kindergarten and through counseling at subsequent visits after the child is enrolled in school.

Sleep

Sleep can be vulnerable due to many factors that are common in CP. Muscle spasms and other sources of musculoskeletal pain, decreased ability to change positions during the night, epilepsy and use of antiepileptic medications, and gastroesophageal reflux disease are a few of the many associated problems that can contribute to sleep disorders in children with CP. Abnormal sleep EEG patterns, including the absence of rapid eye movement (REM) sleep, abnormalities of the sleep spindles, and a high incidence of awakenings after sleep onset have been reported in 50% of children with CP. Primary alterations in sleep architecture, possibly related to brainstem dysfunction, have also been reported in certain patients with athetoid CP. Assessment of sleeping patterns and addressing associated factors that can contribute to difficulties is an important part of the review of systems in CP as there are many potential consequences of poor sleep including poor alertness and decreased cognitive performance. Children with CP may benefit from evaluation, after obtaining a thorough sleep history, including past medical history and risk factors, in a sleep disorders or pulmonary clinic setting. Polysomnography may be indicated, results of which may be helpful in guiding pharmacologic intervention.
PAIN

Pain is a common problem for individuals with CP, with more than half of adults and children with CP reporting pain as an ongoing health concern.\(^3^5\) Children with CP experience more pain than the population norms and the presence of pain seems to persist into adulthood.\(^3^6\) Children with more severe CP have been reported to have a higher pain frequency than children with less severe CP. Pain in children with CP has been associated with gender, occurring more commonly in girls, and with mobility, with accidental pain occurring more frequently in children with greater mobility. Adults with CP experience pain more frequently in the lower back, hips, and legs.\(^3^6,3^7\) Pain in individuals with CP is often associated with educational and social consequences.\(^3^7\) Despite these associations, there is a lack of information regarding pain characteristics in children with CP.\(^3^8\)

Pain in children with CP can be difficult to assess, particularly in the nonverbal child. Possible sources of pain include a range from common causes, such as neuromuscular (muscle spasms), musculoskeletal (hip dislocation, scoliosis) and gastrointestinal (gastroesophageal reflux, constipation), to less common causes, such as dental (abscesses), ophthalmologic (corneal abrasions), and urologic (bladder spasms). Accurate assessment of pain in children with CP presents a challenge for health care providers, as it is difficult to obtain reliable measures of pain in many children because of cognitive immaturity, inability to separate pain from fear and anxiety, and the subjectivity of pain.\(^3^7\) Numerous pain assessment scales have been developed that include self-report, physiologic measures, and behavioral measures and have been demonstrated to be appropriate across developmental levels. The overall validity of self-report of pain in children with CP is questionable, and observational assessment of pain is difficult because of idiosyncratic behaviors such as vocal abnormalities or facial peculiarities that can result in overestimates by those unfamiliar with an individual child’s typical pattern of behavior.\(^3^7\) Knowledge of behaviors and painful situations recognized by parents may help to better identify and subsequently manage pain in children with CP.\(^3^7–3^9\) When these children present with pain, credible information can be obtained from a parent or guardian who knows the child well and these observations of behavior may be an acceptable alternative to self-report of pain.\(^4^0\)

Often a thorough history and examination, with attention to the time course and temporal association (worse after meals or during diaper changes, for example) can suggest a potential cause and intervention.\(^3^5\) This may lead to exploration of several empiric interventions before achieving comfort in the child, but families are often willing to participate in this process as long as they are involved and informed.

GASTROINTESTINAL

Gastrointestinal and nutritional problems are common in children with CP and can create considerable challenges for practitioners and caregivers. The ways in which those challenges are addressed can significantly impact the health and quality of life of the individual with CP, as well as the quality of life of the child’s caregiver.

Motility Issues in Individuals with Cerebral Palsy

Because the enteric nervous system is rich, and the activity of enteric neurons is regulated by input from the central nervous system, motility abnormalities are frequently noted in individuals with CP.\(^4^1\)
Esophageal dysmotility/gastroesophageal reflux/delayed gastric emptying

Gastroesophageal reflux disease (GERD), or the reflux of gastric contents into the esophagus, is a common problem in children with CP, with an estimated prevalence of up to 75%.41,42 The reason for this high prevalence is likely multifactorial, primarily related to central nervous system impairment but also due to prolonged supine positioning in individuals with impaired mobility, and, for individuals receiving enteric tube feeds, the consistency of the diet being predominantly liquid. Both of these latter factors have been found to be contributors to GERD in normal infants, who have a similarly high prevalence.43 Esophageal manometry has demonstrated alterations in esophageal motility in some children with CP, particularly those with spastic tetraplegia.44

Delayed gastric emptying has been reported in children with CP, with a prevalence of up to 67%.45 Inadequately treated delayed gastric emptying has been hypothesized to interfere with the treatment of reflux, although some studies have found no relationship between gastroesophageal reflux and delayed gastric emptying.41,46 Vomiting and esophagitis are frequently noted symptoms of GERD in CP.45 Tooth erosion due to the effects of reflux has been observed in children with CP, and, if not recognized and treated, may impair oral feeding.47,48 GERD can also place the individual with CP at risk for chronic aspiration, especially when dysphagia is also present.

When GERD is present, conservative interventions to address positioning and the thickening of feeds, if appropriate and tolerated, may be appropriate first-line measures. In general, the same medications used for the treatment of reflux in neurologically unimpaired individuals, including proton pump inhibitors and histamine-2 receptor antagonists, are also appropriate for use in children with CP. Recent research supports a role for baclofen in the treatment of GERD. Baclofen, a GABA-B receptor agonist, inhibits triggering transient lower esophageal sphincter relaxation and also inhibits gastric emptying, reducing reflux.49 Baclofen is also frequently used to treat spasticity, and may be especially useful in children with CP who have spasticity and GERD. If the symptoms of GERD are noted to persist despite medical therapies, surgical management is sometimes considered. Children with CP, compared with other individuals with neurologic impairment, have been demonstrated to be more likely to require surgical intervention for treatment of reflux.50 Prophylactic fundoplication accompanying gastrostomy tube placement is occasionally advised because of concerns that gastrostomy, or the increase in feeding that often is enabled following gastrostomy, may worsen or precipitate GERD. However, a recent Cochrane review focusing on children with “neurologic impairment” generally and not specifically on those with a diagnosis of CP, indicated that robust scientific evidence is lacking as to whether fundoplication is beneficial in patients undergoing gastrostomy.51 Other surgical procedures for the treatment of GERD, such as gastrojejunostomy tube placement or esophagogastric separation, are also occasionally used, but again there are little data specific to children with CP, as opposed to individuals with nonspecific “neurologic impairment.”

Constipation

Constipation occurs in 26% to 90% of children with CP.52,53 The cause of constipation in CP is multifactorial and may include immobility as well as slow colonic transit time.52 Constipation is a significant problem in many children with CP and can contribute to other complaints, including pain, spasticity, feeding problems, irritability, poor appetite, and subsequent growth impairments. If not monitored and treated appropriately, ileus and permanent intestinal dysmotility can develop and, in extreme cases, can
result in bowel perforation. Inquiring about the bowel habits and bowel program, if one exists, is an important area of the review of systems in evaluating a child with CP. Historical information may reveal extensive time periods between bowel movements, frequent episodes of diarrhea, and characteristics of bowel movements as hard and pelletlike sometimes requiring digital disimpaction, all of which suggests that evaluation of the bowel program is necessary. Abdominal radiographs are sometimes helpful in assessing stool load, but often historical information will be effective in identifying bowel motility issues.

Treatment of bowel dysmotility also depends on information obtained during the clinical encounter. In cases of suspected obstipation, a clean-out program may be recommended, with use of medications impacting the upper and lower gastrointestinal tracts. The presence of hindgut dysmotility may lead some practitioners to limit or avoid the use of enemas associated with electrolyte derangements, such as tap water enemas and phosphate enemas; likewise, the presence of foregut dysmotility may lead some to avoid the administration of mineral oil by mouth due to aspiration risk. Typically, in cases of no significant concerns for either hindgut or foregut dysmotility, oral polyethylene glycol at doses of up to 1 mg/kg in addition to rectal suppository or enema is used. Pending good results following clean-out, a daily bowel program should be customized for the child. This program often includes a combination of stool softeners or oral promotility agents and a diet with the appropriate amounts of fiber and fluid. Attainment of regularly scheduled soft, formed bowel movements with minimal incontinence is the primary goal of the bowel program and timed evacuations are helpful in achieving this.

**Feeding/Growth Issues**

Feeding, and the challenges associated with it, is especially important in children with CP. Feeding dysfunction, as manifested by poor sucking, vomiting, and choking, may often precede the diagnosis of CP. Problems with feeding may ultimately lead to problems with nutrition and subsequently to problems with growth.

**Oropharyngeal dysphagia**

The ability to form and manipulate a bolus and then to swallow it safely is a complex task that involves the coordination of multiple muscles that receive input from the cranial nerves (V, VII, and IX-XII). Severity of motor impairment, in general, is associated with dysphagia. Children classified at GMFCS level V (most severe) have been demonstrated to have more significant dysphagia than those at GMFCS level IV. An impairment in the ability to swallow often places the child at risk for aspiration, frequently leading to respiratory infection. Although esophageal reflux may also contribute to aspiration, direct aspiration as a result of oropharyngeal dysfunction is more strongly associated with respiratory infection than esophageal reflux. Up to 97% of nonambulatory children with CP and dysphagia have been demonstrated to be silent aspirators.

The need for accurate assessment of the risk of aspiration is a critical reason for a proper evaluation of swallowing. In general, evaluation of dysphagia in the child with CP is similar to that for other children with dysphagia. Because children with CP often have abnormal tone, attention to positioning is particularly important when trying to optimize oral feedings.

Other difficulties with self-feeding may occur because motor impairments can make such feeding difficult or even impossible. Children with oropharyngeal dysphagia may eat more slowly and this may lead to longer mealtimes. In children with severe spastic tetraplegia, feeding can be the most time-consuming basic care need.
Children with dysphagia may prefer or be prescribed softer food textures and it is important to consider that softer foods may be less calorically dense, further contributing to inadequate caloric intake.

**Enteric tube feeding**

In children with CP in whom swallowing is not safe enough to allow oral feeding due to risk of aspiration, or in whom difficulties with feeding make it impossible or impractical to take in adequate calories by mouth, enteric tube feeds may be considered. This decision is often difficult, for the parent of the child for whom the procedure is being considered and for the practitioner caring for the child, because there are currently no randomized controlled trials addressing this issue. A recent longitudinal, prospective, multicenter cohort study, although not randomized or blinded, found statistically significant and clinically important increases in weight gain and subcutaneous fat deposition and reported that almost all parents noted a significant improvement in their child’s health after gastrostomy tube placement and a significant reduction in time spent feeding. Although promising, further studies are needed to gain a better understanding of optimal feeding management for children with CP.

**Growth and nutrition in children with cerebral palsy**

With the knowledge that increased caloric intake will likely be helpful in improving growth, the practitioner is still faced with the question of what is considered “appropriate” growth for the child with CP. This question may be more obvious in the case of the child with severe spastic tetraplegia, but in fact it is an important question across the spectrum of children with CP, with poor growth observed at all levels of severity. Children with mild CP are at risk, with undernourishment demonstrated in up to 30% of children with hemiplegia or diplegia. The analysis is further complicated as any assessment of appropriate caloric intake for growth needs to take into account that children with CP do not necessarily have the same caloric requirements as their peers in the general population. A high degree of variability in total energy expenditure (TEE) has been demonstrated in adults with CP, which appears largely attributable to high interindividual variation in energy expended in physical activity, thus making it difficult to provide general guidelines for energy requirements for this population. Ambulation status has been shown to be an important predictor of TEE and should be taken into account when estimating energy requirements. Formulas for calculating energy expenditure that take into account factors such as muscle tone, activity, and ambulation have been developed for adolescents with CP. In assessing linear growth in children with CP, one must take into account that height or length may be difficult to obtain reliably due to the presence of contractures; formulas using segmental measures have been developed. Body mass index (BMI; calculated as the weight in kilograms divided by height in meters squared) may not be a good indicator of nutrition in children with CP, primarily due to decreased muscle mass and decreased bone density. Because of these considerations, it may not be appropriate to use standard growth charts based on a nonneurologically impaired population. Growth charts for children with CP have been created, with some published in a usable form for clinicians.

Other indicators of nutrition frequently used in the general population, but found to be unreliable in children with CP, include serum prealbumin and albumin concentrations. There is little to no correlation of these values with anthropometric measures (e.g., skinfolds, midarm fat area), growth (height), severity of CP, feeding dysfunction, or general health. Several measures of nutritional status, including weight-for-height percentiles, arm circumference, BMI, lean BMI, head circumference to arm...
circumference ratio, triceps and subscapular skinfold thickness, have been evaluated and triceps skinfold thickness less than 10% for age/sex has been identified as the best indicator of malnutrition in children with CP.73

Micronutrient deficiencies in children with CP have been identified and associated with a low intake of iron, folate, niacin, calcium, vitamin E, and vitamin D, even among those who were receiving nutritional supplements.74 Similarly, decreased levels of vitamin D and calcium in nonambulatory tube-fed children with CP have been identified.75 (A detailed discussion of vitamin D and calcium and their relationship to bone growth in children with CP is provided in Houlihan and colleagues, this issue.)

Although most studies on malnutrition in children with CP focus on the problems associated with being underweight, some children with CP may be overweight. There is a rising prevalence of obesity (7.7%–16.5% during the past decade, and comparable to the general population during the same time period) in ambulatory children with CP.76 This is especially significant as heavier children with CP may be less well equipped to handle the impact of increased weight, as indicated by a decrease in gait speed and an increase in VO2.77

Growth in children with CP is unquestionably a complex issue, and currently there are few data to guide clinicians regarding what constitutes ideal, or even adequate, growth and nutritional status in this population.69 However complex, it is an issue worth tackling, because data suggest that improved growth correlates with improvements in gross motor function measure (GMFM) scores and in measures of social participation.78,79

**Sialorrhea**

Sialorrhea, or drooling, is a problem for many children with CP, particularly in those with spastic tetraplegia. Reasons for drooling can include low oral muscle tone with poor lip closure, inadequate jaw closure, postural problems, dysphagia, inability to recognize salivary spill, and dental malocclusion. Effects of drooling can include chapping of the skin around the mouth, dehydration, dental enamel erosion, and odor, as well as social stigmatization, which can be significant for the family and the child.80 A spectrum of treatment options is available for reduction of drooling. Conservative management including oral motor therapy with occupational or speech therapy is often the first line of treatment. Anticholinergic medication, such as glycopyrrolate or scopolamine patches, blocks parasympathetic innervation to the salivary glands and can be used. Side effects of these medications, including blurred vision, urinary retention, and sedation with glycopyrrolate, and heat insensitivity and increased irritability with scopolamine, often result in discontinuation. Focal treatment with botulinum toxin injections into the parotid and submandibular glands is another treatment option that is becoming more used, however it is limited due to the duration of its effectiveness. Surgical interventions including salivary gland excision, salivary duct ligation and duct rerouting are additional options, with limitations including discomfort and accelerated tooth decay.81

**Dental**

Dental problems in children with CP include pain, enamel erosion, and malocclusion, as above. Children with CP are additionally at increased risk for dental problems due to abnormal oral motor reflexes, swallowing difficulties that lead to retention of food particles in the mouth, and medications with detrimental influences on the oral environment. Regular dental care should be provided every 6 months. Positioning challenges can often be met without use of a general anesthetic. However, for some children with CP, anesthesia is required to provide complete evaluation and
restorative care, with the major goal of preventing problems associated with poor
dental health, including pain, decreased appetite and poor nutrition, and infection.\textsuperscript{82}

**RESPIRATORY**

Children with CP have an increased incidence of primary respiratory disorders due to
the nature of neurologic and anatomic dysfunction that is present in varying degrees.
Chronic pulmonary complications can include recurrent pneumonia, atelectasis, bron-
chiectasis, and restrictive lung disease. One of the most common pulmonary symp-
toms is noisy breathing, which can be associated with anatomic or functional
obstructions, excessive secretions secondary to gastroesophageal reflux or swallow-
ing dysfunction, ineffective cough, or a combination of 2 or more of these factors.
Airway hyposensitivity and ineffective cough can contribute to ineffective clearance
of secretions from the respiratory tract and subsequent wheezing, pneumonia, and
atelectasis. Chronic accumulation of secretions can lead to bronchiectasis, a condition
of permanently dilated and damaged airways.\textsuperscript{83}

A complete pulmonary assessment should include a thorough history including
information related to respiratory events encountered from birth, including the pres-
ence of meconium aspiration, hyaline membrane disease, supplemental oxygen
need, bronchopulmonary dysplasia, tracheomalacia, laryngomalacia, and time of
any ventilator support. Inquiries regarding childhood pulmonary issues should include
the presence or absence of recurrent lower respiratory tract infections, atopy,
wheezeing, sleeping disturbances, gastroesophageal reflux with aspiration, upper
respiratory infections related to recurrent ear or sinus infections, or exposure to poten-
tial environmental irritants to the lung.\textsuperscript{83}

**ENDOCRINE**

Puberty occurs in most adolescents with CP within the normal age range. Adolescents
with CP with cognitive deficits may require assistance in understanding pubertal
changes as well as the strong emotions that accompany these changes.\textsuperscript{23} The Amer-
ican Academy of Pediatrics consensus is that sexuality should be discussed with chil-
dren with disabilities to protect them from exploitation, sexually transmitted diseases,
and unplanned pregnancies.\textsuperscript{84} Objectives of the consensus statement on sexuality
education include teaching children and adolescents with disabilities how to express
physical affection in a manner appropriate to their chronologic, rather than develop-
mental, age; discouraging hugging strangers; teaching what is appropriate touch
from others; and when to alert parents that the inappropriate touch is occurring.\textsuperscript{84}

**UROLOGY**

Children with CP are at risk for several problems related to the urinary tract, including
incontinence, urgency, frequency, difficulty with initiating void, retention, and infec-
tions.\textsuperscript{54} Spasticity and hyperreflexia of the skeletal muscles may be accompanied
by spasticity of the detrusor, leading to small, frequent voids and a contracted, low-
capacity bladder. More than one third of children with CP present with dysfunctional
voiding symptoms.\textsuperscript{85} The predominant urodynamic abnormality is classified as a pure
upper motor neuron lesion with neurogenic detrusor activity, followed by detrusor
sphincter dyssynergia.\textsuperscript{86} Recognizing problems with lower urinary tract function and
preventing damage to the upper urinary tract are important areas of management in
the care of children with CP. The likelihood of discovering a urinary tract abnormality
in children with CP who do not have symptoms of a urinary disorder is small, and
therefore routine screening tests or routine referral of asymptomatic children with CP to a urologist is not recommended.\textsuperscript{87} Primary incontinence has been reported in 23.5\% of children and adolescents with CP between the ages of 4 and 18 years.\textsuperscript{32} The attainment of continence involves maturation of the urinary tract and the autonomic nervous system, as well as of cortical functions. Intellectual, communication, and fine motor skills are also required for children with CP to access the bathroom and manage undressing. Accommodations such as adaptive equipment including commodes, raised toilet seats, handrails, and clothing modifications also assist in achieving and maintaining continence.

SUMMARY

The medical issues associated with the diagnosis of CP can have significant interplay with the neuromuscular issues that most physiatrists manage in the clinical setting. Identification and appropriate management of these common comorbidities is helpful in the treatment from the primary care and subspecialist viewpoints and can have significant impact on the quality of life of the patient and family. Some of these issues are prevalent across all GMFCS levels of severity, whereas others are focused more on those with classifications of GMFCS IV and V. Performance of a complete review of systems to address the potentially complex medical comorbidities and subsequent application of appropriate screening tools can assist in achieving optimal outcomes for children with CP and their families.

REFERENCES


