MANAGEMENT OF PEDIATRIC SPASTICITY
Pediatric Neurosurgery at Children’s Memorial Hermann Hospital

A leader in pediatric neuroscience, Children’s Memorial Hermann Hospital offers a full range of care for children with all types of neurological disorders. A multidisciplinary team approach combines the expertise of affiliated pediatric neurosurgeons, pediatric neurologists, physical medicine and rehabilitation physicians, and neuroradiologists, as well as physical therapists and occupational therapists, to ensure every child receives the best care available.

Skilled medical professionals use the most sophisticated surgical, diagnostic and imaging equipment, including advanced MRI techniques, intrathecal baclofen trials and therapy evaluations. The focus is on matching the right child with the right therapy, using minimally invasive approaches whenever possible. Research affiliations with The University of Texas MD Anderson Cancer Center, Memorial Hermann Mischer Neuroscience Institute at the Texas Medical Center, and McGovern Medical School at UTHealth allow research to be directly translated into patient care and offer access to the widest possible range of innovative treatments, including clinical trials.

Children’s Memorial Hermann Hospital is committed to providing young patients and their families with remarkably responsive service and genuine personal attention. We are committed to lifelong care and assist in providing a smooth transition to post-pediatric care through Memorial Hermann’s adult neurology program and with TIRR Memorial Hermann – one of the top two rehabilitation facilities in the country.
What is spastic cerebral palsy?
Spastic cerebral palsy is the most common type of cerebral palsy, a neurological disorder that affects movement, muscle tone or posture and occurs in approximately one in 500 live births. Caused by damage to the motor control centers of the developing brain, cerebral palsy can occur during pregnancy or childbirth or at any time up to about the age of 3 years.

Spasticity, an abnormal imbalance between excitatory and inhibitory neurotransmitters that send signals to muscles, results in increased muscle rigidity and tone. It generally impairs movement either in the legs (spastic diplegia) or one entire side of the body (spastic hemiplegia) but may also affect three limbs (spastic triplegia) or all four limbs (spastic quadriplegia).

Symptoms
While intellect and language skills are usually normal, children with spastic diplegia or hemiplegia often walk on their tiptoes and have trouble relaxing the muscles of their legs sufficiently to have a normal gait. Children with spastic quadriplegia are often wheelchair-bound and have difficulty moving without assistance or powered mobility devices.

Spastic diplegia involves muscle stiffness predominantly in both of the legs, although the child’s hands may be clumsy. Toes point up when the bottom of the foot is stimulated, and tightness in certain leg muscles can make the legs move like scissors.

Spastic hemiplegia affects the arm, hand and leg on one side of the body. The arm and leg of the affected side are frequently shorter and thinner. Children with spastic hemiplegia generally walk later in development and on their tiptoes because of tight heel tendons.

Spastic quadriplegia affects all four extremities. The arms, legs and body are spastic. Due to the immobility and spasticity over time, children with spastic quadriplegia rarely walk and often become wheelchair-bound with contractures of their tendons.

Diagnosis
Diagnosing cerebral palsy involves monitoring a child’s development over a period of time, screening for developmental delays and medical evaluation. Developmental delays in movement generally appear in children between nine to 30 months of age.

A pediatrician or neurologist can evaluate your child for increased rigidity and tone of the lower extremities. The doctor may order an MRI of the brain to look for periventricular leukomalacia, a brain injury that involves the thinning of brain tissue around the fluid-filled areas called ventricles. The tissue along the sides of the ventricles tends to affect movement of the legs, which is why spastic diplegia and periventricular leukomalacia are related.

Other common diagnostic tools include X-ray computed tomography (CT scan) and genetic or metabolic testing. Once the original diagnosis is made, the Texas Comprehensive Spasticity Center team at Children’s Memorial Hermann Hospital – comprised of an affiliated pediatric neurosurgeon, neurologist, physical medicine and rehabilitation physician as well as physical and occupational therapists – evaluates your child to determine the optimal therapies to improve mobility.

Periventricular leukomalacia or PVL (white arrow) is a common brain MRI finding seen in patients with spastic diplegia. PVL reflects preferential injury to the descending leg motor fibers, explaining why the legs are more affected than the arms. This finding is correlated to a favorable outcome after selective dorsal rhizotomy (SDR).
Treatment Options
Although there is no cure for spastic cerebral palsy, a number of treatment options exist that can alleviate the symptoms and in some cases allow a patient to gain greater functioning in the affected limbs.

Oral Baclofen or Muscle Relaxants
Oral medication, the least invasive treatment, may be used to relax stiff or contracted muscles. These drugs may not always be effective and have side effects ranging from drowsiness and changes in blood pressure to the risk of liver damage, so their use requires continuous monitoring. Oral medications are most appropriate for children who need only mild reduction in muscle tone or who have widespread spasticity.

Botulinum Toxin (Botox®)
Botox, administered by local injection, relaxes contracted muscles by keeping nerve cells from overactivating them. Muscle relaxation occurs within days and peaks after a month, with the effect lasting three to four months. This treatment requires repeated injections.

Intrathecal Baclofen (ITB)
An implanted programmable pump infuses baclofen directly into the patient’s spinal fluid via a catheter inserted into the spinal canal. The pump requires periodic replacement and can be removed. This treatment requires refilling of the pump and frequent monitoring to ensure the appropriate dosage is dispensed; failure of the pump poses a risk of life-threatening withdrawal. ITB is usually used in spastic quadriplegics (where both arms and legs are affected) with poor trunk control and who have had multiple orthopedic surgeries and are unable to become independent walkers.

Select Dorsal Rhizotomy (SDR)
SDR is most effective for patients two to 40 years of age with spastic diplegia or spastic hemiplegia who have good trunk control and have not had multiple orthopedic procedures. Selective dorsal rhizotomy can provide an immediate, permanent reduction in spasticity and the potential to walk independently within one to two years with intensive postoperative physical and occupational therapy. A young patient with a strong commitment to succeed can achieve independent walking, like the 3-year-old in the series of photos to the left.

The surgical procedure requires a one-level laminectomy, where the spinal canal is unroofed at one level in the mid-lower back. Next, the dorsal sensory nerve roots are exposed. They are divided into rootlets and tested one by one with around 75 percent of the most spastic rootlets cut. Overall, surgery takes about two and a half hours with five total days in the hospital, followed by six to 12 months of required intensive physical rehabilitation. Some patients may need a postoperative muscle stretching with serial casting or even a muscle/tendon release (a procedure performed by an orthopedic surgeon that lengthens the muscle or tendon so the leg or foot can straighten out properly). The postoperative mobility results are excellent in the right patients.

Collaboration with Parents and Referring Physicians
Because nothing is more important to a child’s success than a family support system, the affiliated physicians at the Texas Comprehensive Spasticity Center carefully coordinate care with parents and the referring physician. Consistent sharing of all documentation, treatment protocols and continuing care plans ensures optimal benefits for each child. For patients who live outside the immediate Houston area, staff physical and occupational therapists will assist therapists closer to the child’s home to make certain that treatment continues uninterrupted between visits to Children’s Memorial Hermann Hospital.
Texas Comprehensive Spasticity Center Team
The complex needs of a child with cerebral palsy require carefully coordinated care. An affiliated team includes a pediatric neurologist who specializes in movement disorders, a pediatric orthopedist and a pediatric rehabilitation physician, plus physical and occupational therapists and a clinical nurse coordinator. This multidisciplinary approach ensures the most comprehensive, specialized treatment for each young patient, beginning with evaluations – observation, videos and medical tests – and continuing through treatment and therapy.

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