Spasticity

Definition / Supporting Information

Spasticity is a clinical sign of muscle overreaction to rapid stretch. It is caused by an imbalance of nerve signals from the brain and spinal cord to muscles. It can mean muscles become very tight through involuntary muscle stiffness and spasms may occur in the form of involuntary muscle contractions. Controlling of muscle action can also be difficult.

While cerebral palsy (CP) is the most common condition associated with spasticity in children and young people, other important associated conditions include stroke, progressive neurological, metabolic conditions, hereditary spastic paraplegia, multiple sclerosis (MS), as well as traumatic injury to or tumours of the brain and spinal cord.

Spasticity is defined as a specific form of increased muscle tone (hypertonia) in which one or both of the following are present:

- The resistance to externally imposed movement increases with increasing speed of stretch and varies with the direction of joint movement
- The resistance to externally imposed movement increases rapidly beyond a threshold speed or joint angle

Spasticity is one positive component of the upper motor neurone syndromes (UMNS) caused by central nervous system (brain and spinal cord) pathology. Other positive components of UMNS are hyper-reflexia, clonus and co-contraction. The negative components of UMNS are weakness, impaired selective control, poor coordination and sensory deficits.

Commonly seen problems secondary to spasticity include impaired motor function affecting the person's ability to participate in society, pain from muscle spasms, motor development delay and difficulties with daily care.

Keywords / also known as: cerebral palsy, increased muscle tone

Essential History

Ask about:

- Antenatal factors
  - Preterm birth
  - Chorioamnionitis
  - Maternal respiratory tract infection
  - Genitourinary infection treated in hospital
  - Congenital infections

- Perinatal factors
  - Low birth weight (at increased risk if birth weight < 1.5 kg)
  - Chorioamnionitis
  - Neonatal encephalopathy
    - Sepsis
    - Hypoxic-ischaemic injury
  - Neonatal sepsis
  - Maternal respiratory tract infection or genitourinary infection treated in hospital
  - Congenital infections
- Postnatal factors
  - Meningitis or other infections
  - Traumatic head injury
  - Spinal cord injury
  - Stroke
  - MS
- Family history
  - Progressive neurological condition
  - Hereditary spastic paraplegia
  - Neuro-metabolic condition
- Early motor features
  - Movement abnormalities
    - Unusual fidgety movements
    - Paucity or asymmetrical movements as a baby
  - Tone abnormalities
    - Stiffness
    - Abnormal extensor posturing
  - Abnormal development of motor skills
    - Delay in head control, rolling, sitting and crawling
  - Feeding difficulties
- Developmental history
  - Commonly delayed motor milestones
    - Unable to sit by 8 months corrected gestational age (CGA)
    - Unable to walk by 18 months CGA
    - Persistent toe-walking
    - Hand preference before 1 year CGA
- Current difficulties
  - Pain
  - Weakness and fatigue
  - Loss of dexterity

‘Red Flag’ Symptoms and Signs

Ask about:

- Presence of known risk factors
- Family history of a progressive neurological disorder
- Loss of already attained cognitive or developmental abilities / developmental regression
- Development of unexpected focal neurological signs
- Magnetic resonance imaging (MRI) findings
  - Suggestive of a progressive neurological disorder
- MRI findings not in keeping with clinical signs of cerebral palsy

Look for:

- Signs of spastic cerebral palsy [NICE guideline NG 62, Recommendation 1.3]
  - Increased tone
    - Spastic catch (stiffness or increased resistance to movement)
    - Spasms
  - Pathological reflexes
    - Brisk tendon reflexes
    - Extensor plantar response
    - Clonus
  - Abnormal pattern of movement and posture in the lower limbs:
    - Internal rotation of the hip, hip adduction, equinus foot resulting in scissoring
    - Knee flexion
    - Plantar flexion of ankle
    - Crouching
    - Toe-walking
  - Abnormal pattern of movement and posture in the upper limbs:
    - Adduction and internal rotation of the shoulder
    - Flexion of elbow and wrist
    - Fisted hands often thumb in adduction
    - Pronation of forearm
  - Typical patterns seen in spastic cerebral palsy
    - Diplegic pattern (eg, lower limbs affected predominantly)
    - Quadriplegic pattern (eg, all four limbs affected)
    - Hemiplegic pattern (eg, arm and leg of one side affected)

- Spasticity of the upper extremities
  - The following patterns are often seen in patients with cerebral palsy, stroke, or traumatic brain injury (TBI):
    - Adduction and internal rotation of the shoulder
    - Flexion of the elbow and wrist
    - Pronation of the forearm
    - Flexion of the fingers and adduction of the thumb
    - Hip adduction and flexion
    - Knee flexion
    - Ankle plantar flexion or equinovarus positioning

Differential Diagnosis / Conditions

- Spasticity is associated with common neurological disorders:
  - Cerebral palsy
  - Stroke
  - Spinal cord and brain injuries
  - MS
- Spasticity can be mistaken for epileptic seizure
  - Is not followed by a postictal period
  - Is not as rhythmic or symmetrical as seizure activity
- Hypertonia is sometimes used synonymously with spasticity
  - Hypertonia is resistance to passive movement and not dependent on velocity
  - Spasticity is directly related to the speed of the passive stretch

Investigations

To be undertaken by non-specialist practitioners (eg, General Practitioner (GP) Team(s)):

- Thorough history and physical examination
- Early referral to a paediatrician or neurodevelopmental paediatrician to ascertain diagnosis
- Consider blood investigations to rule out infection
- Offer a hip x-ray to assess for hip displacement
  - If clinical concerns about possible hip displacement

To be undertaken by paediatric specialists (eg, Community / Orthopaedic / Neuro-disability / Paediatric Neurology Teams(s)):

- Following diagnosis, referral without delay to a specialist practitioner for further investigation should be actioned

- Consider MRI scans to help understand the underlying aetiology / cause of spasticity
  - Order MRI scan when the history and symptoms are suggestive of a progressive neurological disorder and are not in keeping with clinical signs of cerebral palsy
- Genetic and / or metabolic investigations if no definitive cause suggested from history / MRI
- Offer hip x-ray to assess for hip displacement [NICE clinical guideline CG145, Recommendation 1.1]:
  - If there are clinical concerns about possible hip displacement
    - Hip pain
    - Deterioration in range of movements at hip
    - Increasing hip muscle tone
    - Deterioration in sitting / standing
    - Increasing difficulty with perineal hygiene
  - At 24 months in children with bilateral cerebral palsy
  - Consider repeating the hip x-ray annually in children or young people who are at Gross Motor Function Classification System (GMFCS) level III, IV or V
  - Consider repeating the hip x-ray after 6 months in children and young people where the initial hip migration is greater than 30%
  - Consider repeating the hip x-ray every 6 months after this if the hip migration is increasing by more than 10% per year
- The network team is a team of healthcare professionals experienced in the care of children and young people with spasticity
  - The team provide local expertise in paediatrics, nursing, physiotherapy and occupational therapy
- Other services, including orthotics, orthopaedic surgery and / or neurosurgery and paediatric neurology, are not network services but may be provided locally or regionally
- Monitor the condition for:
  - Response to treatments
  - Worsening of spasticity
  - Development of secondary consequences of spasticity
    - Pain
    - Contractures
  - The need to change individualised goals

Treatment Approach

To be undertaken by non-specialist practitioners (eg, General Practitioner (GP) Team(s)):

- Treatment is usually not initiated by non-specialist practitioners

- However, non-specialist practitioners are key in building a close relationship with child and family to monitor the condition for:
  - Response to treatment
  - Worsening of spasticity
  - Development of secondary consequences of spasticity like pain and / or contractures
  - Identifying the need to change their individualised goals
- And for supporting patients or carers

To be undertaken by specialist practitioners (eg, Paediatrician / Community Paediatrician / Paediatric Neurologist / Physiotherapist / Occupational Therapist / Surgery / Neurodisability Team(s)): [NICE clinical guideline CG145, Recommendation 1.1]

- Perform assessment of muscle tone (the normal state of continuous passive partial contraction in a resting muscle)
- Physical and occupational therapy
  - Need for referral should be promptly assessed by a physiotherapist and, where necessary, occupational therapist
  - Initiate a 24-hour postural management strategy to:
    - Prevent or delay development of contractures or skeletal deformities
    - Enable the child to take part in activities
  - Active and passive stretches and regular exercises
  - Postural management (eg, improving posture in a wheelchair)
  - Offer a physiotherapy / occupational therapy programme
    - Focus on the individual's needs and goals
  - Task-focused active-use therapy such as temporary restraint of unaffected arm to encourage use of other arm
    - This should be followed by bimanual therapy
  - Muscle strengthening therapy
  - Training for parents and carers delivering these strategies
  - Sustained stretching
  - Strengthening of antagonistic muscle groups
  - Hydrotherapy
  - Hippotherapy
- Orthoses may be used for children and young people with spasticity based on individual needs:
  - Improving posture
  - Improving upper limb function
  - Walking efficiency
  - Preventing or slowing development of contractures
  - Preventing or slowing hip migration

  - Relieving discomfort or pain
  - Preventing or treating tissue injury
- Pharmacological therapy
  - Consider oral diazepam or baclofen if spasticity is contributing to the following:
    - Discomfort or pain
    - Muscle spasms
    - Functional disability
    - Diazepam can be used if a rapid effect is desirable
    - Baclofen can be used if a sustained long-term effect is desired
  - Other oral medications may include:
    - Dantrolene
    - Tizanidine (not recommended for children <18 years)
    - Clonidine
  - Botulinum toxin type A treatment may be used when spasticity is:
    - Impeding fine or gross motor function
    - Focal spasticity
    - Compromising care and hygiene
    - Causing pain
    - Impeding tolerance of other treatments, such as orthoses
    - Causing cosmetic concerns to the child or young person
  - Consider treatment with intrathecal baclofen if, despite the use of non-invasive treatments, spasticity or dystonia are causing difficulties with any of the following:
    - Pain or muscle spasms
    - Posture or function
    - Self-care
- Indications for orthopaedic assessment may include:
  - Concern for hip displacement / spinal deformity
  - Limited limb function (due to muscle shortening, contractures or bony deformity)
  - Contractures causing difficulty with skin hygiene
  - Cosmetic appearance of upper or lower limb causing significant concern
- Orthopaedic surgery
  - Contracture release
  - Tendon transfer
  - Osteotomy
- Selective dorsal rhizotomy
  - Consider this procedure to improve walking ability in children and young people with spasticity at GMFCS level II or III (see Cerebral Palsy Alliance Research Foundation)

Spasticity can have a devastating effect on function, comfort, and care delivery, and it also may lead to musculoskeletal complications. Spasticity does not always require treatment, but when it does, a wide range of effective therapies (used alone or in combination) is available.

The negative impacts of spasticity on health and quality of life include the following:

- Orthopaedic deformity (eg, hip dislocation, contractures, and scoliosis)
- Impairment of activities of daily living (eg, dressing, bathing, and toileting)
- Impairment of mobility (eg, inability to walk, roll, and sit)
- Skin breakdown secondary to positioning difficulties and shearing pressure
- Pain or abnormal sensory feedback
- Poor weight gain secondary to high caloric expenditure
- Sleep disturbance
- Depression secondary to lack of functional independence

When to Refer

Refer to paediatric specialist if:

- Hypertonia or spasticity is present
- Condition is having an impact on health and quality of life
- Consider an assessment by an orthopaedic surgeon if hip migration > 30% or is increasing by more than 10% per year
- Any red flag symptoms and signs

‘Safety Netting’ Advice

Advise parents or carers to seek further care for their child if any ‘red flag’ symptoms or signs develop, or any symptoms that may be specific to medications used to treat spasticity.

Patient / Carer Information

**Please note: whilst these resources have been developed to a high standard they may not be specific to children.*

- Treating spasticity in cerebral palsy by cutting selected nerves in the lower spine (selective dorsal rhizotomy) (Web page), Information for people who use NHS services, National Institute for Health and Care Excellence

Resources

National Clinical Guidance

Cerebral palsy in under 25s: assessment and management (Web page), NICE guideline NG62, National Institute for Health and Care Excellence

Developmental follow-up of children and young people born preterm (Web page), NICE quality standard NG72, National Institute for Health and Care Excellence

Spasticity in children and young people overview (Web page), NICE pathway, National Institute for Health and Care Excellence

Spasticity in under 19s: management (Web page), NICE clinical guideline CG145, National Institute for Health and Care Excellence

Selective dorsal rhizotomy for spasticity in cerebral palsy (Web page), NICE interventional procedures guidance IPG373, National Institute for Health and Care Excellence

Suggested Resources

**Please note: these resources include links to external websites. These resources may not have national accreditation and therefore PCO UK cannot guarantee the accuracy of the content.*

Botulinum toxin for muscle spasticity (Web page), Medicines for Children

Cerebral palsy (Web page), Surveillance of Cerebral Palsy in Europe

Gross Motor Function Classification System (GMFCS) (Web page), Cerebral Palsy Alliance Research Foundation

Hereditary spastic paraplegia (Web page), the NHS website

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