

Orthopaedic management of cerebral palsy

Many people with cerebral palsy require orthopaedic surgery to maintain or restore the best functional position, alignment and length of bones, joints, tendons and muscles in order to achieve the best function possible and also to alleviate pain or discomfort.

Orthopaedic management is a complex area that requires expertise and experience. Surgery is the only management option for fixed musculoskeletal deformities, such as contractures, torsion and joint instability. In contrast, oral medications, Botulinum toxin injections, selective dorsal rhizotomy and intrathecal baclofen therapy are used for managing hypertonia causing dynamic functional (but not fixed) deformity of joints.

In both children and adults, the aims of orthopaedic surgery are to:

- Optimise and maintain function to support participation and daily living skills particularly walking.
- Prevent or treat fixed deformities.
- Prevent pain and facilitate ease of care by preventing hip dislocation or severe spinal curves (scoliosis).

The physiotherapist and orthotist work closely with the orthopaedic surgeon during the assessment process and during rehabilitation following surgery. A child's physiotherapist is often the health professional who first recognises when dynamic deformities are turning into contractures, and recommends orthopaedic referral. If the facilities are available, it is preferable for children with cerebral palsy to have a gait laboratory assessment to analyse their gait pattern in order to plan the optimal surgical program to achieve the best possible outcome for them.

The hip

For those with moderate or severe motor impairment (GMFCS III, IV and V), hip displacement is prone to occur, often starting as young as 2–4 years. If untreated this may cause intractable pain and deformity.

In all children with cerebral palsy hip displacement should be detected early by hip surveillance through regular X-rays, to ensure the best outcomes. **Hip surveillance guidelines** are available to provide advice on frequency, dependent on GMFCS level, and recommended referral pathways. The Australian Hip Surveillance Guidelines can be accessed at www.ausacpdm.org.au/resources/australian-hip-surveillance-guidelines

Orthopaedic surgery is effective in keeping the hips in place if undertaken at the correct time. Teenagers and adults who are ambulant have a low

incidence of hip displacement because walking helps keep hips healthy. However, if the hips start to cause trouble (arthritis, pain or dislocation), they must be stabilised in order to maintain walking. This is usually done through bone surgery and, in very few, through hip replacement.

Subluxed or dislocated hips may be present in some adults. This may occur in those for whom hip surveillance was not available or provided. This needs to be considered in:

- Anyone with cerebral palsy may experience hip or knee pain. People who are able to communicate with language, either through speech or a communication device, may be able to describe this pain. For those not able to do so, those providing daily support must be alert for behaviour change that may indicate pain. This may include the person vocalising, screaming or grimacing when being moved in a way that flexes the hip (being positioned and moved in a hoist for example). Visual pain scales may also help.
- All people with severe cerebral palsy, particularly those not who do not walk and/or have a reduced range of hip movement.



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These resources are designed to support healthcare practitioners in the care of their patients with cerebral palsy in Australia. They were developed in partnership by The Royal Children's Hospital; the Centre for Developmental Disability, Monash Health; and Murdoch Children's Research Institute. They have been amended for use by healthcare workers globally in partnership with IAACD. The initial project was funded by an Avant Quality Improvement Grant 2017.



The knee

Lengthening of the hamstrings or transferring one of the hamstrings from below the knee to above the knee can dramatically improve straightening of the knee and the overall walking pattern and function.

The ankle and foot

Equinus deformity is the most frequent orthopaedic problem in children with cerebral palsy. In young children, toe walking is best treated conservatively with orthoses, botulinum toxin and with serial casting in some parts of the world, at times in combination with botulinum toxin. Older children may benefit from surgery to correct the deformity. It is essential that the calf muscles are not overly weakened by early surgical lengthening or by overlengthening at any age. Careful evaluation and planning is essential as there is a risk of unmasking muscle weakness, resulting in crouch gait and loss of function.

Some children with diplegia require orthopaedic surgery at several different 'levels' of their lower limb (for example, hip, knee, and ankle/foot). This is best done in a single operative procedure at a single admission to hospital and is called 'multilevel surgery'. It is of most benefit to children who walk independently or with the assistance of crutches. The best age is usually between 6 and 10 years old. The aims of surgery are primarily to improve function and participation. Surgery can also decrease deformities and improve both the appearance and efficiency of walking. A carefully planned intensive rehabilitation physiotherapy program is required to maximise the benefits from this surgery.

Upper limbs

Shoulder subluxations and dislocations may occur in adults with cerebral palsy, and require treatment. Pain or loss of function in the upper limbs has a major effect on independence in personal care for anyone, but impacts particularly severely on people who use their arms to use crutches, or transfer from and to their wheelchair, or propel or drive their wheelchair, or access their communication device.

Surgical procedures, for example tenotomies and tendon transfers, are sometimes performed to improve and maintain function of the upper limbs. To ensure an optimal treatment plan, assessment should be performed by a multidisciplinary team, including an occupational therapist who is skilled in this area. Surgery to the upper limb may also be undertaken for cosmetic purposes, after careful evaluation to guard against loss of function.

Scoliosis

Scoliosis may develop in children from about age 6–8 years, on average, and often gets markedly worse in adolescence. It may lead to:

- Increased respiratory problems (from deformity of the thoracic cage impacting on the function of lungs and sometimes the heart).
- Decreased mobility.
- Increased joint and muscle pain.
- Increased risk of pressure injuries and other skin lesions.
- Another consequence to consider is 'reduced hand function, due to needing hands to maintain balance and posture'.

Careful attention to posture is required (including specialised seating) to optimise comfort and function and minimise deterioration. Bracing is rarely tolerated in individuals with severe cerebral palsy and custom seating is usually the preferred, non-operative management. People with significant postural requirements need advice from an occupational therapist who specialises in this area to prescribe seating that optimises both comfort and function.

Surgery may be required to prevent further spinal curvature and its consequences and gain some correction, and is most frequently performed in adolescence. New 'growing rods' are being introduced to permit surgery when children are younger and before the spinal deformity becomes too severe.

Orthopaedic surgery on limbs or spine is usually extremely successful in terms of comfort, function and appearance, but these are major procedures with all the potential complications of orthopaedic surgery and the inadvertent loss of or decrease in functional ability. Such interventions are often frightening for people with cerebral palsy and their families to contemplate. The healthcare practitioner has an important role in supporting them over this crucial period in their lives.

Orthopaedic surgery forms part of a long-term treatment plan for some people with cerebral palsy. Any surgery needs a multi-disciplinary approach. Both children and adults with cerebral palsy need access to appropriate physiotherapy, orthotics and occupational therapy pre- and post-surgery to ensure that they achieve the best possible outcome.

Healthcare practitioners may have to advocate for appropriate services for patients, particularly those who live in regional and remote areas where these services may be more fragmented or limited.

REFERENCE

1. Graham, H.K.; Thomason, P.; Willoughby, K.; Hastings-Ison, T.; Stralen, R.V.; Dala-Ali, B.; Wong, P.; Rutz, E. Musculoskeletal Pathology in Cerebral Palsy: A Classification System and Reliability Study. *Children* **2021**, *8*, 252. <https://www.mdpi.com/2227-9067/8/3/252>