Selective Functional Posterior Rhizotomy

A Guide for Parents

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Selective Functional Posterior (also called dorsal) Rhizotomy:

A surgical procedure to reduce spasticity

Many children with cerebral palsy have stiffness (spasticity) affecting their arms and legs. This spasticity makes moving hard work. It limits the movements that children can make and may interfere with learning to sit and walk. As children get older, contractures (permanent stiffening) of the joints and deformities of the spine and limbs may develop.

Spasticity *is stiffness in the arms and the legs.*

Traditionally, the effects of spasticity in children with cerebral palsy have been treated with:

- physiotherapy
- bracing
- orthopedic procedures to lengthen tendons that are too tight

The procedure of selective functional posterior rhizotomy is a newer approach to the problem of spasticity in the lower limbs. This surgery aims to reduce the spasticity itself. It involves surgery on the nerve roots which control the degree of tension in the muscles.

What causes spasticity in cerebral palsy?

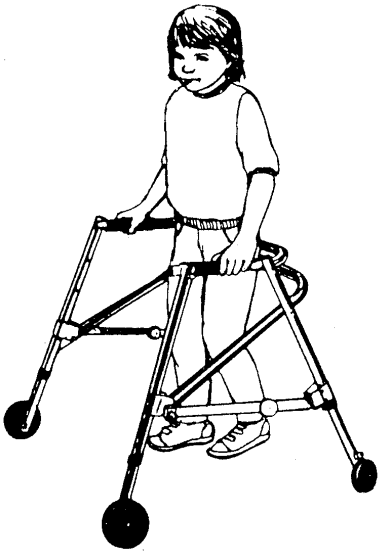
Normally muscles are not floppy. They maintain a certain firmness. This is called normal resting tone. Muscle tone (firmness) is the result of a balance between the nerve impulses (messages) coming from the limbs and those from the brain.

- Most impulses from the limbs cause the muscles to tighten up or contract (called excitatory impulses).
- Most impulses from the brain cause them to relax (called inhibitory impulses).

Excitatory Impulses: *nerve impulses that come from the limbs that cause the muscles to contract or tighten.*

Inhibitory Impulses: *nerve impulses that come from the brain that cause the muscles to relax.*

All nerve impulses travel to and from the brain through nerves within the spinal cord. In cerebral palsy, because part of the brain is damaged, there are fewer inhibitory (relaxing) impulses. Consequently, the balance is disturbed and the muscles in the limbs are tight or stiff (spastic).



How do selective functional posterior rhizotomies work?

There is no way to repair damaged parts of the brain. An alternative treatment for spasticity is to reduce the contracting (excitatory) impulses to the brain.

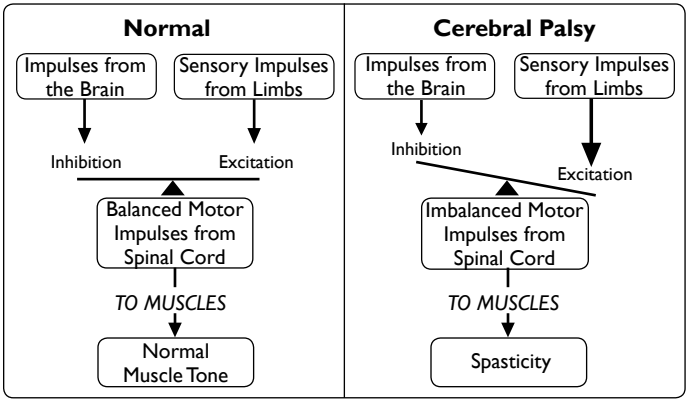
Nerve impulses coming **from** the limbs travel along **sensory nerves**. They enter the spinal cord through incoming sensory nerve roots. Within the spinal cord, there is a “nerve junction” where impulses from the limbs connect with those from the brain. Normally, the impulses returning to the limbs along the **outgoing** or **motor nerve roots** have been controlled by the inhibitory impulses from the brain. In spastic cerebral palsy, there are not enough inhibitory impulses to create the necessary balance within the spinal cord. By limiting the excitatory impulses reaching the spinal cord, this balance, hopefully, can be restored.

Sensory Nerves *transmit nerve impulses from the limbs to the brain through the spinal cord.*

Motor Nerves *transmit nerve impulses from the brain to the limbs though the spinal cord.*

Nerve Root *is the start of the nerve where it leaves the spinal cord.*

In a selective functional posterior rhizotomy, the sensory nerve roots, also called the **posterior or dorsal nerve roots,** are partly divided. Part of each nerve is saved so that the child will still have feeling in the limbs. Part is cut to reduce the amount of excitation (number of nerve impulses) going to the spinal cord.



In order to determine which nerves to cut and which nerves to leave, the **function** of the nerves is tested with electrical stimulation during surgery. Each sensory root is split into three to five little rootlets (like separating a piece of rope into strands). Each rootlet is then stimulated and the response in different muscles is measured electronically. This testing is done by the surgeon and a team of specially trained technicians.

The muscle responses show which of the nerve rootlets are most responsible for the spasticity. These are cut. The others are saved to preserve feeling.

Which children benefit from selective functional posterior rhizotomies?

Only children with the **spastic variety of cerebral palsy** benefit from this operation. Children with other types of cerebral palsy do not. The operation is done on the nerves coming from the legs. The best candidates are those children who have spasticity only in the legs (spastic diplegia). Children who have some involvement of the arms may benefit, provided spasticity of the legs is the more significant problem.

Spastic Diplegia *is spasticity in the legs and lower body. Children with spastic diplegia are the best candidates for functional posterior rhizotomy surgery.*

The best age for this surgery is between three and eight years.

The surgery is done on children who will be able to do **more** if spasticity is reduced or for those where reducing their spasticity will make it easier to manage.

Which children are not candidates for this surgery?

Children with disorders other than spasticity are not candidates. These are children with:

- Dystonia – stiffness associated with twisting postures of the limbs
- athetosis – slow and continuous movements of the hands and feet
- ataxia – uncoordinated muscle movements

Children whose spasticity has already been reduced by orthopedic procedures may not be candidates for rhizotomy.

Children who have a significant scoliosis (curvature of the spine) may not be considered. The curvature could get worse as a result of rhizotomy procedure.

Children who do not have the muscle strength to move their muscles voluntarily may rely on their spasticity for function.

What preparations are required for surgery?

Arrange to be off work.

We suggest that one parent stay with your child throughout the one-week stay in the hospital, particularly if your child is very young. You can sleep on a cot near your child. Alternatively, accommodation is sometimes available at a moderate price at Easter Seal House, Heather House (on site) or Ronald MacDonald House. For more information on where you can stay, see the information for 'out-of-town' families on the BC Children's Hospital website at www.bcchildrens.ca/yourvisit. You can also ask to speak to a social worker and he/she can help you with accommodations.

Arrange for post-operative physiotherapy.

Frequent physiotherapy is needed following the operation to achieve the most from the procedure. Inform your child's regular physiotherapist of the surgery date. The physiotherapist should plan to see your child using the following schedule:

Months 1 – 3 after surgery	Months 4 – 6 after surgery	Months 7 – 12 after surgery
3 times per week	2 times per week	Once per week

These physiotherapy sessions are fully funded by the 'At Home' program.

Arrange for equipment.

Most children need some equipment. Discuss this with your physiotherapist and surgeon.

Wheel Chair: Even children who have been walking may use a wheel chair for some months after the surgery. You can arrange to borrow one from the Red Cross. A young child can use a well supporting stroller (not an umbrella stroller).

Walker: Most children begin standing and walking in a walker which gives support from behind. Discuss whether you should borrow or purchase one ahead of time.

Leg Splints: After the surgery, during your child's hospital stay, the occupational therapist will make short-term splints for your child to wear on the back of his/her legs. These will give extra support at the knees for standing and help with stretching. Your community physiotherapist will decide how often and when your child will wear the splints once you go home. Funding is available for the splints through the 'At Home' program. The occupational therapist will help you with this during your child's hospital stay.

Prepare your child.

Tell your child, in terms he or she can understand, of the plans for hospitalization and surgery, and the intensive physiotherapy afterwards.

You can find more information on how to prepare your child in the Family Resrouce Library at BC Children's Hospital. All information in the library is available on line at www.bcchildrens.ca/frl. Two pamphlets that are helpful are:

- Your Child's Surgery or Procedure
- Helping Your Child Manage Medical or Surgical Procedures

You can also ask to speak to a Child Life Specialist if you need some help to prepare your child.

Coming to the Hospital

The surgery date you have been given can be confirmed only when we are sure that there is a bed available. **Admission cannot be guaranteed until the actual day.**

Pre-operative assessments and testing will be done at the Pre-Admission Clinic. This could be a week or a day before the surgery. Assessments of muscle tone, range of motion, and motor function are done by the physiotherapist and occupational therapist. X-rays of your child's back and hips are taken. A parent should be present during these procedures.

Refer to these pamphlets for more information:

- The Preadmission Clinic
- Your Child's Surgery or Procedure

Please bring your child's shoes, braces and other appropriate equipment.

What happens during a rhizotomy?

The surgeon makes a vertical incision. There are two techniques used, depending on your child's situation. One technique has the incision lower down on your child's back and it is about 12 cm (5 in) long. The other technique has the incision higher up and is shorter (about 4 cm or 1.5 in). Your surgeon will discuss which technique will be recommended for your child.

The backbones (vertebral column) are opened. The covering of the spinal cord (dura) is opened. The sensory nerves are separated carefully from the motor nerves and then tested as described earlier. At the end of the operation, the dura is stitched. The backbones are reattached. The muscles over the backbones and the incision are closed. The operation generally takes 2 ½ - 4 hours. A blood transfusion is not required.

Dura *is the outer cover of the spinal cord.*

What happens immediately after the surgery?

Your child goes form the operating room to the recovery room. There, your child is closely watched for about two hours before returning to the ward. See the pamphlet called the “Post anesthetic care unit” for more information about the recovery room.

For the first 24 – 36 hours, your child will be given some powerful pain killers such as morphine. These are given continuously through an intravenous line. Sometimes a muscle relaxant such as Valium is given along with the morphine. To ensure that the bladder empties completely, most children are catheterized for the first few days.

Intravenous *is a way of giving medicine directly into a vein.*

Catheterize *means that a plastic tube is inserted directly into your child’s bladder to remove urine.*

On the second day, your child's bed is leveled (which was tilted head-end down in order to prevent a spinal fluid leak).

On the third day, your child is assisted to sit up and gradually be more active with the help of the physiotherapist. With help, your child may begin to bear weight. Movements which bend or twist the lower spine are avoided. Stretching and strengthening exercises are taught to you and your child.

On the fourth day, the occupational therapist makes and fits splints on the back of the legs to help with stretching. These also provide extra support at the knees for standing. Some children feel ready to take a few steps on that day.

Most children are ready to be discharged on the fourth or fifth day after surgery.

What changes are expected after the surgery?

Many children have some tingling in the bottom of the feet which usually goes away within two weeks. In some children, the tingling will remain for many weeks. Some children may have less control over their bladder after surgery. This is usually a temporary problem.

Children with spasticity often use the spasticity to move their limbs. Immediately after surgery, when the spasticity is lessened, your child's limbs will be looser and seem weak. Your child often has less voluntary movement in the legs than before the operation. As your child learns

new ways of moving, this gradually improves over a few weeks.

What are the possible complications of the operation?

As with any major surgery, complications are possible. These include the risks associated with an anesthetic, bleeding or infection.

With a rhizotomy procedure, there is a possibility of spinal fluid leaking after the operation. A leak increases the risk of infections in the spinal cord and brain. To try and prevent a spinal fluid leak, your child is kept flat with the head of the bed tilted downwards for the first 24 – 36 hours. If a leak does develop, another stitch or patch may be added to seal the leak. This is done under an anesthetic. A leak has occurred only once in over 200 cases at BC Children's Hospital.

Other complications are related to nerve damage during the operation. Such damage might produce weakness, numbness, or even paralysis of the lower limbs, bladder and bowel. However, at BC Children's Hospital, there have been no serious complications thus far.

There is a concern that, in the long term, this surgery may result in scoliosis or curvature of the spine, but this occurs rarely. It is not known if the scoliosis which develops after many years is because of the rhizotomy or simply the result of having cerebral palsy. Scoliosis may be more likely to occur if there is already some curvature of the spine before surgery.

What happens after discharge?

Pain: Your child should have little, if any, back discomfort by the time he/she goes home. In the event that your child does have pain, you can give Tylenol™ in the appropriate dose. Call your doctor if the pain gets worse or does not improve.

Activity: Allow your child to do whatever activities feel comfortable. Do not allow rough-housing or a lot of bouncing, such as horseback riding. After 2 – 3 months, your child should be able to participate in all activities. If you have concerns about activities which your child normally enjoys, discuss this with your doctor.

Physiotherapy: The aim of rehabilitation is to stretch, strengthen and train normal patterns of movement. Your child must practice moving from lying to sitting, to all fours, to kneeling, to standing and walking. The adductors (inner leg muscles), hamstring muscles, and heel cords which have less spasticity often continue to be tight. Most can be stretched out in the first few months. Muscles used in standing and walking may seem weak. Many children have difficulty knowing how to use them (i.e. they feel a little “disconnected” from their legs). With repeated exercise, your child’s strength will improve.

Those children whose arm and trunk disability is so severe that they cannot learn to walk alone, can still learn to stand for transfers, and perhaps take a few steps with support.

Although the rhizotomies will reduce spasticity, old contractures that cannot be stretched may need to be corrected surgically.

The incision: Dissolving stitches are used in most cases. These do not need to be removed. If there are stitches to be removed, your family doctor or the surgical clinic at the hospital will do this. The surgeon will tell you when these should be removed. The incision needs no special care. Keep the skin around it clean by sponging. For 3 weeks after the operation, do not allow your child to lie in a tub of water. If the area becomes red, swollen, sticky moist or tender to touch, call your surgeon. The wound may be infected.

Follow-up: There are follow-up visits with the neurosurgeon, orthopedic surgeon and therapists at three months and one year after the surgery, and annually for several years. X-rays will be repeated from time to time to check for possible curvature of the spine.

Appointment Schedule

First appointment

Date: _____

Time: _____

Where: _____

Second appointment

Date: _____

Time: _____

Where: _____

Notes:

Developed by the health care professionals of the Department of Neurosurgery with assistance from the Department of Learning and Development.

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