

Post-Polio Corrective Spinal Surgery

Irwin M. Siegel, MD, Associate Professor of the Department of Orthopedics, St. Luke's Medical Center, Chicago, Illinois

Roughly one-third of all patients who have had poliomyelitis develop scoliosis (spinal curvature). This usually occurs early in the acute disease. No other scoliosis group benefits as much from spinal surgery as paralytic polio survivors. This is because they require a stable spine, balanced over a level pelvis, in order to stand and walk. A progressive curve of 50-60 degrees may indeed be an indication for correction and surgical stabilization. However, as with any operation, one can always make a patient worse if close attention is not paid to the specific conditions that must be met before surgery is undertaken. Among other things, these include cardiac and respiratory status adequate to survive the surgery, with close attention given to the special considerations of these operations in the post-polio patient.

The scoliotic curve in a polio survivor is usually long and may involve the thoracic as well as the lumbosacral spine. Trunk imbalance can cause an uneven pelvis, and the pelvis itself is often regarded as just another distal vertebra. Curves can increase after maturity, becoming painful if they have not been fused. Also, the patient can experience pain at the ends of a spinal fusion, where movement is usually increased to compensate for the loss of motion in the arthrodesed (fused) area of the spine. Ill-advised or overzealous spinal correction can cause serious loss of function, such as the ability to walk.

One alternative to surgery is bracing. The Milwaukee Brace (*Polio Network News*, Vol. 11, No. 2, p. 5) is an active orthosis requiring muscle strength and therefore usually not prescribed for a patient with neuromuscular disease. The TLSO (thoracic-lumbar-sacral orthosis) passively supports the back, usually producing better results.

Bracing is often indicated in the younger patient, but is also useful in the post-polio patient experiencing mechanical back pain. Light mesh garments (such as the Hoke garment) with stays are usually well tolerated. The fabrication of such a garment (which requires much patience and skill) is fast becoming a lost art. Consult your doctor, surf the network, search the Yellow Pages, or seek out an experienced orthotist who can provide you with a comfortable, functional appliance. For individuals using a wheelchair, various seating arrangements and spinal containment systems are available for back support. Modern techniques of vacuum molding can provide a custom-made seating system which should support the back and provide relief of pain. Seating assessments and recommenda-

tions are usually made by a physician working closely with an orthotist who specializes in seating.

The benefits of surgery include maintaining an upright posture, decreasing trunk fatigue, and freeing the arms from a supporting role for more functional tasks such as dressing, eating, personal care, or using a computer. Surgery may stabilize pulmonary function, avoiding respiratory compromise secondary to spinal deformity. However, one has to be cautious of increasing "dead space" with over-enthusiastic correction of spinal curvature. All of us have to push air in and out of our lungs from an area called the "dead space." This includes the trachea and the bronchi. We need muscle power to accomplish this. Straightening the spine too much can increase the "dead space." When this occurs, the patient experiences difficulty moving air in and out of the additional space and may require mechanical ventilation to do so.

In planning for a major operation on a post-polio patient, there are some serious matters to be considered. Most important is a thorough respiratory examination (particularly in a patient with a history of bulbar polio). This workup should include blood gases and sleep studies. All prospective patients should have a good cough. Coughing requires the use of all respiratory musculature. Those patients with a poor cough may be unable to clear the pulmonary secretions that accumulate post-operatively.

In general, if the vital capacity is less than 30-35%, a patient will require post-operative respiratory aid. Where the vital capacity is somewhat above 60-70%, he or she should tolerate surgery well, except for obese patients or those with severe sleep disorders. The nutritional state of the patient is too often overlooked. Remember that protein depletion directly correlates with increased morbidity, compromised healing, impaired immunity, and a greater risk of post-operative infection.

Finally, post-operative pain has to be considered. One theory holds that post-polio patients have increased sensitivity to pain, and some researchers feel that this is due to virus-induced brain lesions, as well as the anti-metabolic action of glucocorticoids on the brain produced during stress. Pain can be managed with anodynes, PCA (patient controlled anesthesia), and NSAIDs (non steroidal anti-inflammatory drugs), with care taken not to use medications which depress respiration.

Patients who have had polio are at more risk during surgery than those without such a history. Temperature has to be monitored because its decrease (hypothermia) can trigger cardiac arrhythmia. Hypotensive anesthesia coupled with blood loss may seriously lower blood pressure. Patients with neuromuscular disease undergoing surgery on their spines lose more blood than the average patient because they do not have

continued on page 6

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continued from page 5

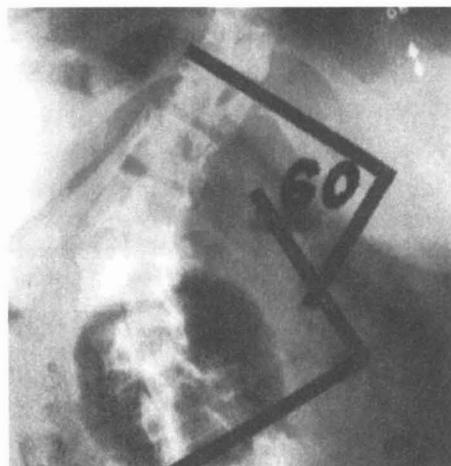
muscles which can contract to block off small bleeding blood vessels. Their bone is often osteoporotic and will bleed copiously. Many people are overdosed on aspirin or other drugs which increase bleeding. These should be discontinued at least two weeks prior to any anticipated surgery.

Monitoring the spinal cord during the operation is important. Somato-sensory evoked potentials can be observed so that in straightening the curve further damage to the cord is avoided. Finally, at the time of surgery other contractures such as those of the hips, knees, and ankles, can be released.

All of these matters should be taken into account prior to surgery as part of a detailed risks/benefits evaluation. Where the conditions as well as the indications for these operations are present, spinal stabilization performed by a skilled and experienced surgeon can often

Measuring Scoliosis Curves

The technique most often used to measure a curve was described by Dr. J.R. Cobb. The Cobb measurement is made by identifying the vertebrae at the ends of a scoliosis curve on an x-ray of the spine taken front to back, or back to front.



A line is drawn along the upper border of the upper end vertebra, and along the lower border of the lower end vertebra. The angle between these lines is the Cobb measurement. An angle of 0 degrees means the spine is perfectly straight, while an angle of 90 degrees means that the two vertebrae are at right angles to each other, signifying a severe curvature.

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OTHER SCOLIOSIS RESOURCES

Scoliosis Research Society, 6300 N. River Rd., Suite 717, Rosemount, IL 60018

The National Scoliosis Foundation, 72 Mount Auburn St., Watertown, MA 02172 (617/926-0397)

offer the post-polio patient correction of deformity, relief of pain, increase in the ability to perform tasks of daily living, improved mobility, and enhancement of lifestyle. □

Ensor E. Transfeldt, MD,
Twin City Scoliosis Spine Center, affiliated with
Abbott Northwestern Hospital, University of
Minnesota, Minneapolis, Minnesota

The Twin City Scoliosis Spine Center works in conjunction with the Sister Kenny Institute at Abbott Northwestern Hospital where Richard Owen, MD, has a special interest in post-polio problems.

A surgeon's job of actually doing surgery requires technical skills, but those technical skills are worth nothing without the team of people that assist in the care of the patient. We are treating people, not treating spines, so we need to consider other factors such as pelvic obliquity, limb deformities, ability to walk, pulmonary function, general medical condition, and nutritional, immunologic, and health status.

We also consider the mental and emotional well-being of a person undergoing surgery. Most deformity surgery is major surgery, and we cannot overemphasize that people need to be ready for the physical and emotional onslaught.

Patients with poliomyelitis are subject to the same conditions of degeneration as everyone else. They may undergo disc degeneration and even develop stenosis which may produce neurologic compression and confuse the diagnosis of a post-polio syndrome.

Scoliosis is a side-to-side curvature, but also a three dimensional deformity. Persons who from the side have an exaggerated hump have what we term a kyphosis. Persons who have an exaggerated hollow in the low back region have a lordosis.

Many times a rotation of the vertebrae is associated as well. The vertebrae do rotate on top of each other and on an x-ray may appear to show a straight spine, but, from another view, the rotation shows up. Attached to the vertebrae in the thoracic spine are the ribs, and as the vertebrae rotate the ribs rotate. The ribs produce the characteristic prominence, not the spine.

Another problem that develops is that the whole trunk gets shifted to one side. The body is not centered over the pelvis and the legs. This requires a great more energy to stand or to walk.

The curve types resulting from polio do vary according to the area of the spine affected — the cervical, thoracic, or lumbar. The long C-shaped curve is very common. The original curve, called the primary curve, is usually due to an imbalance of the muscles. If that was the only curve one would lean over to one side. There are muscles that are not paralyzed which try to compensate for this so the body is centered over the pelvis.

This results in compensatory curves usually on either side of a primary curve.

Sometimes compensatory curves will progress and become fixed or structural curves. Frequently, it is important to operate early in a young person before the compensatory curves become structural curves.

Not a great deal is known about the natural history of scoliosis and poliomyelitis except that all curves progress. The pattern of progression in polio is certainly very different to idiopathic scoliosis in that the progression frequently occurs after skeletal maturity into adulthood. Early surgery is generally recommended in scoliosis for younger patients, but in adults there are other complicating factors.

Spinal surgery is considerably more difficult in polio than idiopathic scoliosis. For example, cosmetic correction tends to be successful in young patients. In adults the results tend to be much more variable. The only way to produce any significant correction cosmetically is to remove the prominent ribs which are associated with rotation. This is associated with a higher morbidity, and patients need to be aware of that fact.

The indications for surgery are curve progression, pain associated with bad curves, and, if spinal stenosis or spinal compression is evident, decompression. The goals are to correct the deformity, stabilize the spine, and produce a vertical torso or a body centered over the level pelvis.

Surgery of putting in implants and rods in patients with severe scoliosis is difficult. Disc spaces frequently become narrow and vertebrae become coalesced making it difficult to move them and create a correction.

Because pelvic obliquities and muscle contractures are common and complicate surgery, one needs to evaluate the presence and cause of pelvic obliquity. One must ask if the pelvic obliquity is because of the scoliosis or is it a result of something in the pelvis or something below the pelvis. Muscles go from the spine to the pelvis; from the spine to the lower legs, spanning right across the pelvis not attaching to it; muscles run from the pelvis to the lower legs. Any contractures, or imbalance, of any of the above muscle groups can result in a pelvic obliquity. One has to evaluate where the problem is — above the pelvis, in the pelvic region, or below the pelvis. One test is to lay the person on an x-ray table and move the pelvis to see how flexible the spine is at that level. If one can tilt the pelvis and create a level pelvis then the spine is flexible. One gentleman was recommended for surgery and this bending test showed a possible level pelvis. The problem was a muscle contracture of the iliotibial band below the pelvis which was corrected surgically by a simple release of the muscle.

Ambulatory status needs to be evaluated. Long fusions down to the pelvis could limit someone who walks

with crutches and needs the mobility of the lower lumbar spine.

Pulmonary function needs to be evaluated. Pulmonary dysfunction may be due to respiratory muscle paralysis or mechanical obstruction. Decreased lung volume can be caused by the collapse of the thoracic spine, the rib cage pushing in on the pelvis, or the abdominal contents being pushed upwards. Breathing ability does not equate to the ability to tolerate surgery. Certain tests do indicate whether or not surgery may help. There is some controversy about pulmonary function studies, but a study done at Twin City Scoliosis Center showed that patients with severe cor pulmonale or severe pulmonary dysfunction can be considerably improved by pre-operative traction. The thoracic cage is pulled away from the pelvis and the diaphragm is allowed freer excursion.

There are several methods of instrumentation including newer methods using segmental instrumentation. Fixation at multiple levels of the spine really does eliminate the use for braces which in fact restrict chest expansion and affect pulmonary function. The type of instrumentation is not as important as the technique of the surgery and the judgments considered before surgery.

Complex problems need the team approach and that includes the physicians, the surgeons, the physiatrists, the therapists, the nurses, and a program of intense rehabilitation. The family is an integral part of the team and should be included during the decision-making process and fully understand what is going to occur. □

INTERNATIONAL POLIO NETWORK

5100 Oakland Avenue, #206
St. Louis, MO 63110-1406 U.S.A.
314/534-0475
314/534-5070 Fax

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