

Sixth International Post-Polio and Independent Living Conference Post-Polio Corrective Surgery: Then and Now

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Then ... Most of the surgery done in the past still is applicable today, however, there is some limitation in response due to aging of the muscles and tendons.

The purpose of surgery is to improve function. The first reconstructive surgery ever conceived was heel cord (Achilles tendon) lengthening which actually was done with a simple snip in 1821 even before anesthesia was developed. The back of the ankle became tight, and if the heel cord was lengthened, a flat foot resulted. The benefit did not necessarily last unless the surgeon transferred muscles to the front of the foot. On a positive note, the residual return usually was less severe than the initial problem.

Another early surgery to provide a stable foot, for one without muscles, was to fuse everything and was called a pantalar arthodesis. More commonly, the surgeon fused just the foot (a triple arthodesis) leaving the ankle free to provide early knee stability for optimum weight bearing. Total fusion got rid of braces and was considered a great success in the early '40s and '50s. Now it is a disadvantage because the total foot fusion is creating increased demand at the knee. My recommendation is not to get it done if you have not had it done.

Tendon transfers to the heel were also done. One obscure but critical problem was a weak calf which secondarily led to foot deformities and unstable knees. Transferring the tendons of other muscles to the heel restored posterior ankle control and made both the foot and knee more stable. The common growth deformity from a weak calf was a very vertical heel and high arch which resulted in a great deal of instability. Muscles were transferred to the back of the heel. In just three years, the growing foot would respond with a flatter arch and better heel and much more stable foot. By changing the pattern of muscle force we actually influenced bone growth. Obviously, once the foot has finished growing that would not be an outcome. One can use the same procedure for stability in an adult today but it will not change the shape of the foot without an accompanying osteotomy.

Another early surgery was done on the upper extremity. Both a problem and a salvation for polio survivors is paralysis of the muscles controlling the shoulder joint with the shoulder blade muscles preserved. The result is a flail arm and inability to use a functional hand. These areas have a different nerve supply than the muscles to the shoulder joint. A solution was to fuse the shoulder blade and the upper arm bone, i.e., a shoulder fusion which gave a stable arm for hand function as well as reach. Many young girls who had polio in their upper body could flip their arm up on top of their head and fix their hair and did not choose the shoulder fusion. A shoulder fusion was a great advantage if one could not control the hand and use it. It is still a good procedure. I actually did one about two years ago on an adult woman, and now she is able to place her functioning hand in useful positions.

A tendon transfer in the hands to make a pinch by bringing the thumb across is an old procedure. Today, I have found that people substitute so well there are no candidates.

If one did not have any muscles in the hand and wanted stability, we grafted a bone between the first finger and the thumb. This was excellent for people who were fully ambulatory or wheelchair users, but was not good for people who used their hands for transferring because the hand could no longer be flattened for weight bearing.

A challenge to orthopedists then and now is the polio survivor who has no quadriceps and uses hip or calf muscles to lock the knee back in a recurvatum to walk. In the late '50s I designed a procedure which transferred every available tendon and the iliotibial band and put them behind the knee and called it a triple tenodesis. It worked great in the growing child and resulted in a straight knee, because while they were growing this surgery was kept tight. Once the child stopped growing the surgery gradually loosened. It is not recommended in adults. The reason is there is nothing to keep it tight, and the person still does not have a quadriceps. Surgery, of course, cannot create a quadriceps, it can only stabilize the knee. If you have no quadriceps today, and your recurvatum has become painful or unstable, a protective brace which still allows free knee flexion for swing is the best answer.

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Now... The procedures for polio now are the same as then, but fewer are done. The goals for surgery are very much the same — rebalance the muscle forces. Even a weak muscle, totally unopposed across a joint with nothing to balance it on the other side, needs to be in balance. Surgery aims to correct limb deformities, improve function, and to stabilize the spine or limb. Post-Polio Corrective Surgery: Then and Now continued from page 3

Previously the goal was to eliminate braces. But now the goal is to improve bracing options. Older individuals have less muscle power and polio-affected muscles have been working extra hard.

Surgery cannot increase muscle function or make people as if they never had polio. In fact, when transferring a muscle a little bit of strength is actually lost. Limb surgery can lengthen a tight ligament; eliminate the deforming muscle forces; redirect muscle force for better function or balance; stabilize joints or the spine. When dealing with older individuals, resurfacing arthritic joints with a joint replacement technique or correcting malalignments may be needed.

The Albert Einstein Medical Center experience based on the first 200 consecutive people.

Lengthening the heel cord (Achilles tendon) is the simplest and the most common procedure done. It was recommended to 25 patients; nine refused; two required additional procedures. The procedure was done on 16 patients with three having both sides done with no complications. Before surgery they had an average of a 25 degree toe-down or equinis position. The mean age was 54 years. The Achilles tendon turns as it attaches from the calf to the heel of the foot. If it is too tight a foot is held with the heel off the floor. Three or four partial cuts in the tendon release the fibers and the body fills in the gap. The result is a foot that is flat on the floor and can be more appropriately braced.

The second most common surgery was lengthening the iliotibial band, a tendon on the outer side of the thigh running from the hip. When tight, it can tilt the pelvis, and, even more commonly, cause valgus or knockknee. When contemplating surgery for knock-knee, the bones need to be relatively healthy because no matter what is done to the tendons or ligaments it will not correct the deformed bone. If the bones are relatively adequate, then releasing the iliotibial band will correct the deformity and hold the leg in a more appropriate position with a brace.

We recommended this for nine people, two declined. Of the seven patients, four had surgery on both legs. The mean age was about 53 years and approximately 40 years after the onset of polio. Before surgery there was an 18 degree average knock-knee deformity, and after surgery a 10 degree alignment. Normal is seven degrees. If the leg is straightened out, the brace can be a lot simpler. Again, there were no complications.

A bent knee or flexion deformity is caused by the hamstring muscles in the back of the thigh overpulling weak or absent quadriceps muscle in the front of the thigh. Releasing the deforming forces, which are the hamstring muscles behind the knee, is the solution. But rather than letting relatively good muscles go unused, surgery can move them to the front and hook them into the quadriceps tendon around the knee cap. A non-helpful muscle is now very useful. This procedure has been done without any complications. After healing in a cast a brace is prescribed. Before surgery the mean muscle strength of the quadriceps was grade one; after surgery, grade three which means the person's leg could be lifted against gravity. This is not enough to go without a brace, but it improves the bracing choices. For example, a knee joint that is light weight, hinges, and is offset protecting against hyperextension could be used.

A very high-arched foot, or cavus foot, is difficult to fit into a shoe. The first decision is whether or not there is a bone deformity. If not, and the foot has some flexibility, the ligament on the bottom of the foot that is holding the arch so high is released. This was done on eight patients, all of whom were women; two had both feet done. The foot is painful because it has got to stretch out after surgery and then the arch will come down. Before surgery average degree of arch was about 21 degrees, and after surgery it was six degrees. Zero degrees or neutral alignment is normal. Three people had scar pain for several months after surgery primarily from the stretching.

When the bones in the foot are deformed resulting in a high arch, releasing the ligament on the bottom of the foot will not be sufficient. One solution is to cut a little wedge in the top of foot or do an osteotomy (cutting bone). Held with a few staples, walking in a cast is recommended immediately after surgery to stimulate healing. We performed this surgery in six patients who had an average high-arch deformity of about 24 degrees and after surgery a two degree. One person had complications of a sore on the bottom of the foot.

Tendon transfers to the heel to improve calf strength are done usually in combination with other procedures. A variety of tendons that run in a calf can be hooked into the heel to improve the pull of the calf. This surgery does not eliminate the need for a brace but it does improve strength and makes the bracing less complex and lighter weight.

We performed miscellaneous procedures on several individuals such as correcting toe deformities which are very painful inside of a shoe; a bad knock-knee with bone deformity which required cutting the bone to realign the leg to be able to brace it; and one hip replacement. Good muscle strength is needed to hold the hip stable and <u>must</u> be considered in recommending total hip surgery for a polio survivor. We also did a total knee replacement.

Overall, of the first 200 patients, we recommended surgery for 79 and 46 had surgery with 58 different procedures done.