

Acute polio and its evolution: reminiscences of a 'polio fellow'

Ernest W. Johnson, MD, circa 1970s

Returning from 34 months in the southeast Pacific as a GI to my home in Akron, Ohio, I was entitled to four calendar years of a university education funded by the GI bill. I enrolled at The Ohio State University (OSU) and while rooming with a high school friend who was completing his last year of medical school, was given advice-- after joining him on several clinical rotations--to finish the pre-med requirements and use up the educational entitlement in medical school. I did!

As a fourth-year medical student, I was looking ahead to a residency choice, considering anesthesia, pediatrics, physical medicine and rehabilitation, radiology and psychiatry. It seemed logical to defer the final choice until I had experienced these rotations during my internship at Philadelphia General Hospital. My post-MD hospital year began with obstetrics and gynecology, followed by orthopedics, ENT, endocrinology and, by the time I needed to make a selection, I was still confused, so I flipped a coin and it came up psychiatry. I applied for and was accepted in a program at Indiana Medical School. My choice seemed appropriate until my rotation on psychiatry in December. It was a disaster!

As soon as I reported to the service, I was directed to an isolated, high-security room with a locked door, solid except for a small grill. When the door slammed shut behind me, I was imprisoned with a hypomanic patient who was manacled to the bed. Two hours later, I was able to attract the attention of an orderly and be released. I called Indiana and cancelled the residency, too late to apply for another.

Next day

Answering an ad in the *Journal of the American Medical Association*, I accepted the position as a general practitioner with a surgeon in Findlay, Ohio. My intention was to work a year and then reapply for a residency, with pediatrics as a tentative option. Tentative only until I had made several home calls in the early morning hours for a sick baby. When responses to my request to see the child in the office next day was answered with "NO, we intend to see our regular doctor (read - pediatrician)" that was the end of my intended career in pediatrics

My pivotal encounter with rehabilitation medicine began as I assumed my required service in the emergency room. One of the first patients I saw was a 19-year-old

painter who had fallen from a scaffold and fractured his neck at C-6 (spared complete spinal cord injury.) I quickly referred the patient to OSU, which had just initiated a rehabilitation program.

Seven months later (yes, you could keep a tetraplegic person for that long) I was asked to join the discharge conference. During that visit, I met Dr. Ralph Worden, the founding director of the physical medicine and rehabilitation program at OSU. He remembered me as a fourth-year medical student who had written a review about "fibrositis" for my grade in the clinic rotation. He suggested that I apply for a *National Foundation of Infantile Paralysis* fellowship. These fellowships were instrumental in the growth of the field of rehabilitation medicine.

Many of the original leaders in rehabilitation were "polio fellows." My first year of residency was at the Children's Hospital in Columbus. This year was spent largely with polio patients. At one time, there were more than 75 acute polio patients, mostly children, although young adults were also admitted.

I remember the staff shortage, with many of my weekends spent putting on Kenny hot packs and stretching tight, painful muscles. Kenny packs were hot wool cloth packs which were heated to 140 degrees and then had the water spun out and applied under canvas wraps. Burns were occasionally produced, but usually avoided by careful application. This treatment was extremely effective in relieving the muscular pain that was so typical of acute polio.

The pain pattern was characteristic and coincident with the meningeal symptoms in the central nervous system invasion acutely: usually, neck, back and severe posterior thigh and calf pain. Dr. John Guyton (one of OSU's first residents) and I studied these acute polio patients with electromyography that clearly showed these symptoms were not neurologic but rather muscular in origin.

Much controversy arose about "when and if" to exercise the polio-weakened muscles. Dr. Richard Baer, the second resident at OSU (I was the third.) began progressive resistance exercises within the first month of acute polio and these demonstrated no untoward effects. Dr. Worden, who had trained at the Mayo Clinic, taught us the Sister Kenny approach to managing polio. He had spent two years at the Kenny Institute in Minneapolis. We learned about "Kenny sticks"; these were modified wooden underarm crutches which were shortened. Dr Worden emphasized the need for MINIMAL bracing - none, if one could get along with

sticks. The Kenny approach for pain was to apply hot packs and stretch all of the two-joint muscle groups.

I must acknowledge that the first resident at OSU, Dr. Richard Burk, who caught the polio virus during his fourth year at Creighton Medical School, was treated at the Kenny Institute. Here, he met Dr. Worden and then when Dr. Worden was recruited to OSU, he came along.

We were introduced to the concept of "muscle alienation" -- the notion that if a muscle drops out of a movement for a time, it loses its ability even if function returns. The typical example is the anterior tibial muscle, which can drop out of foot dorsiflexion during the acute phase, and then the patient uses the foot evertors to clear the limb on swing phase.

Dr. Burk had severe residuals and used two knee-ankle-foot orthoses (KAFO) and bilateral underarm crutches.

I want to point out that there are three distinct immunologic types of the polio virus. *Type I* is the most common in most epidemics and was named for the rhesus monkey from which the first isolated strain was obtained (Brunhilde; 1937).

Type II (Lansing) is less frequent with fewer strains, named after the first strain, isolated in an outbreak in Lansing, Michigan in 1938.

Type III (Leon) was isolated from a youngster who died in the Los Angeles epidemic in 1939.

When I completed my residency, I accepted the position as assistant medical Director of the 14th Polio Respiratory and Rehabilitation Center at Columbus Children's Hospital, and as Chief of the Physical Medicine and Rehabilitation department. For the next five years, I was totally into managing polio patients with a variety of polio severity and in differing stages of the disease. I was the physician called whenever the ER doctor found weakness. My experience was extraordinary. I saw children with all sorts of neuromuscular conditions *e.g.*, Guillain-Barre, infantile botulism, leukemic infiltration of joints, spinal cord tumors, myopathies and many others which presented as polio. My evaluations included a history and examination for weakness and tightness. The weakness in polio was usually asymmetric and the tightness was always present in 2-joint muscles.

Polio or Not?

I spent my last month of the residency at the Mayo Clinic with Dr. Edward Lambert, the acknowledged "father" of electromyography in this country. I copied all of his instrumentation and brought it back to the Columbus Children's Hospital. Immersed in EMG's all day, I became aware of fasciculations and cramps in both of my lower limbs and had to be reassured by Dr. Lambert that I could have had a minor polio infection while caring for all the acute cases. My wife reminded me that I was sick the entire year at Children's Hospital and might have missed the acute, prodromal episode.

My next step was to study the acute illness of polio and record the initial electromyographic findings in addition to those findings later in the disease. There was controversy about whether the motor conduction velocity was reduced in polio. Dr. John Guyton and I dispelled this notion with the study previously mentioned. The issue of how to treat--activity vs. bed rest--was addressed with the "Kenny" approach. Stretching after hot packs, re-education of weakened muscle groups and minimal bracing were the managements of choice.

Many of our ventilator patients were taught "glossopharyngeal breathing," sometimes called "frog" breathing. This was an adaptation by polio patients who were removed from mechanical ventilation too soon and needed to survive. This was recognized and reported by a physiatrist, Dr. Clarence Dail (Loma Linda School of Medicine) in 1951. I went to California to learn how to teach it, and when I returned, I held two-hour classes every week for all of the ventilator-assisted patients. We awarded a certificate to all who succeeded in learning--about one third of the patients. Much of our effort was dedicated to get these severely involved polio persons back to their homes, obviously a major effort requiring the attention of the "rehab team."

Fast Forward!

Now - some observations about managing post-polio symptoms. It is 20 years later and I'm seeing many of the patients I saw originally. Their symptoms include progressive weakness, pain, and fatigue, among many others. Every Monday morning, I greet three or four post-polio persons with questions. One that is frequently asked is, "what exercise should or can, I do?"

Although my memory cortex is thinning, I still recall the impairments and even their names, sometimes. Occasionally, a parent will accompany the former patient to help me remember. One of our residents, Susan Hubbell, and a faculty member, David Wiechers, took my (1979) challenge to study this "post-polio weakness" with single fiber electromyography, a relatively new technique. With this new technology, we learned that the motor unit in "chronic polio" is constantly undergoing reorganization and that many motor units are super-sized and overworking. We can record some motor units which are 30 - 40 millivolts in size (average, normally, is 2 - 3 mV). Of course, when these motor units "wear out" as some do when we age, the loss is 20 -30 times more severe than it would be in a "non-polio" person.

Other causes of weakness associated with post- polio include wear and tear on joints, contractures, pain, fatigue, etc. Pain is a frequent reason for a visit to me. If localized, it could be nerve entrapment (e.g. carpal tunnel syndrome, radiculopathy), arthritis, musculotendinitis disorders or others. If generalized and associated with fatigue, I believe this is most likely "fibromyalgia" or as we use to call it, "fibrositis." This is a common complaint in individuals who had a spinal fusion, and the physician often orders an imaging study instead of examining the soft tissue, usually the offender. A British investigator suggested this muscular pain is a post-viral symptom which he noted as similar to that he had encountered in the post-flu epidemic in 1970s London.

Irrespective of the etiology, the practical treatment is the same as we use in fibromyalgia, namely, stretching, mild weight training and aerobic exercise. The latter can be swimming, walking, bicycling, a program which should be scheduled at least three times a week. A sub- group of more severe weakness, termed "post-polio progressive muscular atrophy" was proposed as a separate category, but I am convinced that this is simply a more severe progression of hyper-metabolic motor unit failure and not a different process. The ultimate outcome would be related to the condition of the muscle when it began.

I should note that the "normal" muscles after acute polio can become weaker also. Dr. David Bodian, a researcher at Johns Hopkins Hospital who isolated the polio virus, noted that all of the nerve cells in the rhesus monkey were invaded in the acute polio phase and it was likely that a similar phenomenon occurred in humans.

Incidentally, cholinesterase inhibitors are NOT helpful in the weakness in spite of the findings of neuromuscular junction failure on single fiber EMG.

The general rule is to NOT exercise a weak muscle in polio. However, aerobic exercise is a must in all individuals with a chronic condition. Swimming, bicycling, walking and just "keeping active" is the guideline. My advice is to "be a patient patient" and let Mother Nature do her thing.