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THE POST-POLIO SYNDROME AND RE-REHABILITATION

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There appear to be many causes for the late effects of polio and the Post-Polio Syndrome. Many problems result from aging of the previously damaged muscles and limbs. If a polio survivor becomes ill from medical problems unrelated to their polio history, general debilitation may cause progression of their post-polio weakness and lead to new symptoms. Additionally, occasionally polio survivors develop unexplained new muscle atrophy and weakness. This condition is known as Progressive Post-Polio Muscular Atrophy.

During the past five years, a Post-Polio Research and Training Program has been established at the University of Michigan Hospital in Ann Arbor, Michigan. A Post-Polio Clinic is held weekly to investigate causes for new symptoms among polio survivors and to develop re-rehabilitation programs for them. Using modern rehabilitation methods and techniques, these polio survivors are able to be helped and can usually be restored to their customary levels of functioning. Many of them, however, need to return to or begin using braces, crutches, canes, wheelchairs, and a variety of adaptive equipment in order to compensate for the newly developed weakness and loss of functional abilities. Research continues to be done in order to discover what factors may predispose some polio survivors to progression of their weakness and development of new disabling medical problems. By sharing some of this new information with medical professionals and consumers, it is hoped that rehabilitation outcomes can be improved. The goal of this presentation is to explain what we have learned about the late effects of polio and how to manage their disabling effects.

Acute poliomyelitis is a viral infection which invades the body through the gastrointestinal tract. The central nervous system is the only place where permanent damage to the body results from the infection. Within the central nervous system, polio virus can destroy motor nerve cells located in the spinal cord. Some nerve cells are permanently destroyed, whereas others are only temporarily damaged. After a person has recovered from the acute poliomyelitis infection, the body attempts to repair the damage. Polio survivors usually can regain some strength during the first two years following the polio infection, if proper exercise and therapy are performed. There are three ways in which this recovery occurs. First of all, some nerve cells are only temporarily damaged and as they recover, strength improves. Second, muscle fibers innervated by surviving nerve cells can increase their size and become stronger through traditional strengthening exercises. The third mechanism for improvement is due to sprouting of new nerve twigs from the undamaged nerve supply. These new nerve sprouts grow to reach muscle fibers which have lost their nerve supply. Surviving nerve cells thus are connected to more muscle fibers and

there is an increased number of muscle fibers per nerve cell. This means that surviving nerve cells do two to three times as much work on an individual basis during muscle contraction. The resultant increased metabolic work may predispose these nerve cells to overfatigue and early degeneration later in life.

After 25 or 30 years of high intensity muscle work, many of the new nerve sprouts begin to wear out and degenerate. Motor units begin to shrink back to their original number of muscle fibers per nerve cell. For the polio survivor this means a shrinking of muscle size and decreasing strength. This process has been shown to occur very slowly at an estimated rate of about 1% of muscle strength per year.

Epidemiological studies suggest that as many as 25% of polio survivors will experience loss of strength or other post-polio symptoms. Progressive post-polio muscular atrophy occurs most commonly in polio survivors who have consistently used their residual muscles at high intensity for many years. It is believed to result from chronic overuse damage of the partially re-innervated muscles.

Other factors which contribute to late muscle deterioration in polio survivors include: normal age related loss of motor nerve cells; age related decrease in circulation which can cause slow decrease in the size of muscle fibers; and the effect of environmental toxins which can hasten nerve degeneration. Additionally, as people become older they often become less active and this leads to further disuse atrophy. If a person becomes severely ill from other health problems, such as a heart condition, pneumonia, arthritis or a fracture, they also may become weaker from disuse atrophy. Because polio survivors have decreased muscle and nerve reserve capacity, disuse atrophy can become more significant in terms of degree of weakness-related loss of functional ability. Most new pain problems that are seen in polio survivors result from repetitive strain injuries to the weakened muscle fibers and muscular tissues. When musculoskeletal pain develops, a person normally must rest the part in order to resolve the pain and inflammation. However, rest leads to further weakness and atrophy. Thus a vicious cycle of increasing weakness, increasing pain, and increasing disability can result.

Management of the late effects of polio attempts to control those factors contributing to loss of functional abilities in three ways. First, pain and inflammation of muscles, joints and supportive tissues must be reduced through traditional therapy techniques. This includes the use of anti-inflammatory medications, heat, stretching, and other methods of physical therapy. Second, any activity which is the source of repeated injury and strain must be changed. Frequently an increased amount of weakness in leg muscles demands a return to the use of canes, crutches, braces, or wheelchairs in order to avoid continued strain. It is understandable that polio survivors often do not wish to return to the use of these assistive devices but they may be necessary to reduce the pain resulting from strain and to stop the vicious cycle. Third, polio survivors should exercise on a regular basis. There are three types of exercises that are normally recommended. Flexibility exercises are most important. They must be done to keep the spine flexible and mobile, as well as to prevent tightness of muscles and joints.

Conditioning exercises should be done to promote cardiopulmonary fitness. It can often be challenging to design conditioning exercises for polio survivors because of limited strength in extremities for doing sustained exercise. Swimming is an excellent type of activity for achieving some cardiovascular conditioning without overly straining limb muscles. Carefully designed strengthening exercises can also be utilized. Patients must be careful to not exercise too vigorously and produce new injury and symptoms. Often it is the muscles which were not severely involved with polio that can benefit the most from resuming mild strengthening exercises. If an attempt at strengthening exercises is carried out and new muscle pain and weakness develop, then it is clear that the weakened muscle is susceptible to overuse injury and further exercise of that muscle should be discontinued.

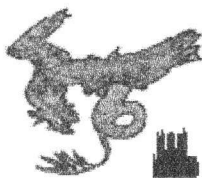
Some of the most common new problems among polio survivors are pain syndromes in the upper limbs. Degenerative arthritis of the shoulder is particularly common among polio survivors who have used crutches and canes for walking over many years. Additionally, arthritis of the wrist and hand, and carpal tunnel syndrome from thickening of the ligaments in the wrist, are very common among cane and crutch

users. In order to help reduce the occurrence of these problems, it is recommended that the lightest possible leg braces be used and that polio survivors avoid becoming overweight. Additionally, wide grips on canes and crutches can lessen strain on wrists and hands. Many of the most severely affected polio survivors, who can only ambulate with great effort using crutches and braces, should be encouraged to use wheelchairs or electric carts when traveling the longer distances that are needed to be active in their communities. Of course, this requires that their communities develop accessible public buildings and promote removal of architectural barriers to people who have mobility limitations.

Another common medical problem among older polio survivors is arthritis in the back and the joints of the lower extremities. Arthritis of the knee is particularly frequent among people who have walked for many years without bracing of the knee and have severe quadriceps muscle weakness. Pain and arthritis of the lower back can develop because of abnormal walking with severe limps and because of scoliosis in the spine. It is important to attempt to correct leg length discrepancies and reduce gait deviations through the use of corrective shoes, canes, crutches and appropriate lower extremity bracing in order to prevent these biomechanically-induced problems.

Psychological stress from the development of new impairments and disabilities is another important and real problem for polio survivors who experience the late effects of polio. Our experience has shown that associations of polio survivors who join together for supporting each other can be very helpful. Polio survivors can learn from each other more quickly than learning from health care professionals. They can share methods for re-adapting their lifestyles and altering their customary ways of doing life activities. They can also effectively work with community and government organizations for improving accommodations and facilities for people with physical disabilities and handicaps. In order to avoid depression and to reduce stress from loss of income and enjoyable leisure time activities, patients must be encouraged to creatively find new adaptations for their physical problems in order to remain productive in their lives and active in leisure time activities.

Our experience with polio survivors in Michigan has been that pain can be eliminated or managed in virtually all cases. Rehabilitation techniques can sometimes restore losses of muscle strength and can usually improve fatigue through more efficient ways of using residual strength and energy. Lifestyle adaptations and the use of new assistive devices can promote continued productive and satisfying activity. New handicaps from the late effects of polio can be prevented through re-rehabilitation.



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