The Effects of Cold on Polio Survivors

Dr. Richard L. Bruno, HD, PhD
Director, International Centre for Polio Education

Polio survivors are extremely sensitive to changes in temperature. At merely cool temperatures, most polio survivors report that their feet have always been cold to the touch, their skin a purplish color. However, as polio survivors have aged, 50% report "intolerance to cold" and that their limbs have become more sensitive to pain as the temperature decreases (Owen, 1985). Cold was reported to cause muscle weakness in 62% of polio survivors, muscle pain in 60% and fatigue in 39% (Bruno & Frick, 1987). When polio survivors were cooled in our laboratory from 86°F to 68°F, motor nerves functioned as if they were at 50°F and polio survivors lost 75% of their hand muscle strength (Bruno, et al., 1985a). Although during the same study polio survivors were found to be *twice* as sensitive to pain as those without polio, no increase in pain sensitivity was seen at lower temperatures (Bruno, et al., 1985b).

The reason polio survivors have such trouble with cold is that the parts of the central nervous system that should control body temperature were damaged by the poliovirus. In the brain the hypothalamus (the "automatic computer" that controls the body's internal environment) was damaged by the poliovirus, including the body's "thermostat" and the brain area that tells your blood vessels to constrict (Bodian, 1949). In the spinal cord, the nerves that carry the message from the brain that tells the capillaries in the skin to contract when it's cold were also killed by the poliovirus (Bodian, 1949).

Thus, polio survivors are unable to stop warm blood from flowing to the surface of the skin as the outside temperature drops. This allows loss of heat from the blood near the surface of the skin and causes the limbs to cool. When the limbs cool, arteries carrying blood to the skin and veins that should carry blood out of the skin narrow, passively, as they get cold, trapping blue venous blood in the capillaries and causing the feet to look blue and to become even colder. The cold skin chills the motor nerves, causing them to conduct more slowly and to be less efficient in making muscles contract. The cold also chills tendons and ligaments (imagine putting a rubber band in the freezer) making movement of weak muscles more difficult. As polio survivors know, it takes hours under an electric blanket or a long, hot bath to warm cold legs and regain strength.

However, when polio survivors take a hot bath, blood vessels do exactly the opposite of what they do in the cold. Polio feet and legs become bright red as arteries and veins relax and blood rushes to the skin. Then, when polio survivors stand to get out of the tub, they can feel dizzy or even faint as blood pools in their legs and causes their blood pressure to drop (see Bruno, 1997). The pooling of blood in the feet also explains why polio survivors' feet swell in the heat, swelling that increases as they get older. And polio survivors' easily losing body heat explains why they have an increase in symptoms, especially cold-induced muscle pain, as the seasons change, especially from summer to winter.

Polio survivors need to dress as if it were 20°F colder than the outside temperature. They need to dress in layers and wear heat-retaining socks or undergarments made of polypropylene (marketed as Gortex or Thinsulate) that should be put on immediately after showering when the skin is warm and dry. Polio survivors need to remind doctors that EMGs or nerve conduction tests must be performed in a room that is at least 75°F to prevent false abnormal readings and that a heated blanket is necessary in the recovery room after polio survivors have surgery (Bruno, 1996).

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