

Salk Vaccine

Polio, also known as poliomyelitis or infantile paralysis, is a contagious disease that spreads from a human to another human very quickly. It is a story of a young brilliant scientist. It is also a story of a wise lawyer and United States president who walked with crutches, forty summers of fear, hundred of laboratories, thousands of small monkeys, and an organization with the strange name of the March of Dimes. (Curson pg 1) Story of polio extends from a newborn child to an older person.

Poliomyelitis is ordinarily a mild, viral infection to the intestinal tract. Most babies are born with a temporary, partial, or complete immunity to many diseases, including poliomyelitis. If a baby is exposed to the virus of polio while it has the temporary immunity, it will develop a stronger, more permanent immunity; its mild discomfort will be unnoticed in the process. If the baby has no contact with this virus, the temporary immunity of the infancy will wear away. Most American babies, carefully guarded from every speck of dirt and dust, have little opportunity to develop a natural immunity to polio or anything else. Under these sheltered conditions great havoc can be caused if the polio virus particles break out of intestines into the bloodstream and are carried to all parts of the body. It is when the virus enters nerve cells in the brain and spinal cord and destroys or damages these cells that the paralytic symptoms of poliomyelitis become evident. (Klein pg 8)

New York City's Department of Health planned to hand out a leaflet in parts of the city where many cases of polio had been reported. The message of the article was printed on the front page of New York Times on the morning of July 4, 1916. It said that infantile paralysis is very prevalent in the city, so keep your children out of the street as much as

possible, and also keep them out of the houses on which the Department of Health has put a sign which tells one in which house the disease is. It also read that it is a disease that babies and young children get, and if your child is sick, then send the child to the doctor or notify the Board of Health. 500,000 copies of the leaflet were printed and handed out because there was an epidemic, or a sudden and rapidly spreading outbreak, of polio in New York City and all across U.S. (Curson pg 1-2)

Most of the sick people were children. But it soon became clear that people of all ages could get the disease mistakenly named “infantile paralysis” since infantile means - of or relating to young children or babies. Yet many of the victims were in their teens or twenties. Seriously ill people were usually quarantined to keep the disease from spreading. They were not allowed to leave the place until they were well again. Communities around New York tried to prevent New Yorkers from entering their towns. Children were kept out of movie theaters, libraries, and also from some churches. (Curson pg 3-4)

No one knew the roots of this disease. There is evidence, obtained from the bones of a mummy, that an Egyptian pharaoh may have had it. (Klein pp. 1) So it is sure that it had been existence for a long time. It seemed that everyone had an idea of how this disease started. Some people blamed pollution. Others suggested that the cause was dirt and sanitation problems. Mosquitoes, flies, and fleas also with chickens and fish were blamed. The Anti-Vaccination League claimed vaccinations such as injections or shots for other disease like smallpox caused the epidemic. (Curson pg 3) Immediately following the 1916 epidemic there was no great movement to start a research program to find a cure or prevention for polio. Although cases continued to occur, there were no more great

epidemics until the late 1920s. When the severity of epidemics increases in the 1930s and 1940s, polio attracted more attention, and the demand for research increased. (Klein pg 10)

Jonas Edward Salk was the person who developed the first successful polio vaccine. Born on October 28, 1914, Jonas was not even two years old when the polio epidemic struck. Thousands of children in that summer developed polio. Four-year old Jonas Salk stared down the street at a child with splints strapped to her legs. In spite of the splints' sturdy support, the little girl needed help to stand. Walking required even more effort. Jonas looked down at his own strong, thin legs. He could run and jump and climb the stairs to his family's apartment easily. What had happened to the other children? Could it happen to Jonas himself? He never forgot anything that confused, or bothered him. (McPherson pg 9)

He was a very self-disciplined boy. He was supposed to get good grades and keep his room neat. He was supposed to be respectful to his parents and to read lots of books. When baby Herman was born, five year old Jonas was also expected to be a model brother. Dutifully he kept quiet while the baby slept, helped his mother with simple chores, and shared his toys as Herman got older.(McPherson) He did everything that was expected of him. In school as well as home, Jonas's training and self-discipline set him apart. Relatives and family friends were as impressed as Jonas's classmates were. "Even as a kid, when Jonas said something, you could put it in the bank," a relative said. (McPherson pg 12-13)

Jonas was ready for high school when he was only twelve years old. But not just any high school would do for Dora and Daniel's son. They wanted him to go to Townsend Harris High School, a highly selective, three-year magnet school. When Jonas was admitted to the magnet school, his parents were happy but not surprised. Each day after

school, he would work on his homework right away. And between homework, he helped take care of seven year old Herman and his new baby brother, Lee. As a high school student he liked reading philosophy and literature. He liked writing s of Ralph Waldo Emerson, Henry David Thoreau, and Abraham Lincoln's writing of equality and freedom. At almost sixteen years old, he was ready to enter the City College of New York and eager to learn everything. He especially loved biology. At Jonas's admissions interview for New York University's College of Medicine, he explained that he didn't want to practice medicine, instead do a medical research. (McPherson pg 13-15)

As Jonas began his year of study, a major medical story was unfolding. Two research doctors, Maurice Brodie of New York University and John Kolmer of Temple University, had independently developed polio vaccines. Each vaccine had been tested on children about the time that Jonas had started medical school. People hoped the vaccines would end the epidemics. But something went terribly wrong. In spite of both doctor's careful work, several children developed polio after their shots. He felt bad both for the children and doctors for their hard work. Even at the social events he spent much of his time thinking. As a budding scientist, he questioned everything in the laboratory. Jonas was fascinated by the concept of immunization. Jonas thought that if chemically treated, harmless toxoids could cause immunity, why couldn't chemically treated, harmless viruses do the same thing? (McPherson pg 19-22)

Meanwhile, a new professor came to the medical school to teach and do research on bacteria and viruses. He took this chance, went to the professor, and asked if he needed any help. Professor Dr. Thomas Francis, one of the better-known bacteriologists of this time, accepted this energetic helper. Francis cultured influenza virus in cultures of minced chick

embryos. When the virus was extracted it was irradiated with UV light, which hopefully killed the virus but not its ability to induce immunity. The work was inconclusive. Francis soon left New York University and went to the University of Michigan. Salk, after graduation, interned at Mount Sinai Hospital in New York. Francis managed to get an additional grant which enabled Salk to join him at Michigan. Later they joined to work for the Army. By 1942 Francis had developed a killed-virus flu vaccine that incorporated strains of two types of viruses. They tested it during the next epidemic in 1943, and the vaccine proved to be 70% effective. They found it necessary to give booster shots at intervals as the immunity conferred by the killed virus vaccine wore off. (Klein pg 36-40)

The two virologists published many papers together and sometimes Salk even had his name listed first. After a while professional jealousies began to taint the relationship between two men. In 1947 he accepted a position at the University of Pittsburgh Medical School. Salk went to Pittsburgh because he thought that as the only full time faculty member he would have his own way in choosing research projects but it was not the case. He had to ask for all kinds of approvals and permissions to do research. (Klein pg 40-41)

Salk, in 1949, was not among the virologist elite who took part in setting foundation policy. Salk wanted to try Ender's tissue-culture techniques, but his foundation grant did not cover this. He looked to other sources, and the University of Pittsburgh managed to get him \$7500, which was enough to buy some equipment and hire a technician. He begged some starter culture from Enders, taught himself how to grow polio virus in tissue culture, and was soon using culture-grown viruses in typing work. Salk and his staff became rather skilled at tissue culture and developed techniques to grow virus in testicular and kidney

tissues of monkeys. He injected some of his cultivated viruses into monkeys and found that high antibody levels resulted. (Klein pg 66-72)

Salk was in better position to know that formalin worked better than radiation and that there were three types and many strains of polio virus. One of the most difficult and crucial problems facing Salk was the choice of strains to be used in the vaccine. To be the “best”, a strain had to meet several qualifications. It had to grow well in the tissue culture, had to be well enough to produce a good harvest of virus. It had to possess sufficient virulence to induce antibody formation. The more virulent the strain, the more likely it was to cause the disease before it could induce immunity to the disease. Salk found strains for Type II and Type III with relative ease. The choice of a Type I virus proved to be particularly difficult. This was unfortunate because Type I polio virus was the most prevalent form of the disease. After months of searching for the ideal Type I strain Salk decided that the most important factor was really the strain’s antigenic properties. Virulence was a desirable characteristic since the more virulent it was, the more antigenic it was. He therefore chose the highly virulent Mahoney strain, isolated from a family in Ohio, for his Type I virus. Through trial and error, he surmised that the best concentration was 250 viruses to 1 formalin at 1 degree Celsius to kill the viruses. (Klein pg 72-74)

By the spring of 1952 Salk and his staff were producing polio virus with factory-like efficiency. Monkeys injected with killed virus stayed alive, with high antibody level, and successfully resisted challenge with live, virulent virus. In order to be injected, the virus had to be in a liquid which Salk chose to be mineral oil. Now it was time for him to try it on humans. (Klein pg 75)

Salk decided that a safe procedure would be to inject his vaccine into children who already had paralytic polio. These children were immune to whatever type of polio virus had caused their paralysis, and an injection of a vaccine made of the same type of virus could not do any further harm. In fact, if the vaccine was good, the level of antibody in the blood would go up. Some forty-five children were involved in the test. The initial step was to take blood samples so that the antibodies could be typed. The injected children did in fact show a significant rise in the antibodies, and none of them showed any sign of illness. (Klein pg 79-80)

Now everyone knew or at least wanted to believe that man in Pittsburgh had a vaccine that would save many children from polio. Thanks to newspaper reports, people began to call it the “Salk Vaccine”. This made Salk uncomfortable because the vaccines were not referred to by the names of men who developed them. He wanted to call it Pittsburgh vaccine or Pittsburgh preparation. But it stayed to be Salk Vaccine. (Klein pg 85)

On April 12, 1955, it was announced in a dramatic national radio and television broadcast that the Salk Vaccine was both safe and effective. (Lauro pg 3) The vaccine was judged to be about 60-70% effective against Type I polio virus, and over 90% effective against Type II and Type III polio viruses. The incomplete effectiveness against Type I was unfortunate since it was the most frequent cause of paralytic polio. Vaccine was about 94% effective in preventing bulbar spinal paralysis, which is a severe form of polio that results in respiratory paralysis and, frequently, death. (Klein pg 109)

Historically, polio has been divided into three fairly distinct stages: 1. acute illness, 2. period of recovery, and 3. stable disability. In the early 1980s, clinicians and researchers

begun to realize that there was a 4th stage characterized by the onset of new symptoms related to the original polio attack. Acute illness - The onset of polio is characterized by a mild fever, headache, sore throat, and vomiting. Period of recovery – recovery begins as soon as an individual's temperature returns to normal and other symptoms subside. This stage can last from weeks to years. Stable disability – it begins when a person reaches a plateau of maximum recovery of strength and stamina. Post – polio syndrome (PPS) – might begin after the 3rd stage has ended. It comes with the onset of new weakness, which is often accompanied by other symptoms, such as fatigue, pain in muscles or joints, and decreased function. Post polio syndrome is a neurologic disorder that produces a cluster of symptoms in individuals who had paralytic polio many years earlier. Because these symptoms tend to occur together, they are called a syndrome. Symptoms of PPS include pain, muscular atrophy, breathing and swallowing difficulties, and cold intolerance. (Halstead, Naierman pg 5-7)

It now appears that as many as one-fourth of these polio survivors are experiencing new health problems which may be related to their illness three or more decades earlier. In recent years, many of these Post Polio patients have been seeking medical help for a variety of complaints that seem to represent new changes in their neurological and functional status. The most common explanation for the causes of such problems after so many years of stability has been aging. (Halstead, Wiechers pg xv)

Although there is no treatment for polio, it can be prevented if the vaccine and the booster shots are given on time. A laboratory diagnosis of poliomyelitis is usually made based on recovery of poliovirus from the stool or pharynx. Neutralizing antibodies to poliovirus can be diagnostic and are generally detected in the blood of infected patients

early in the course of infection. Today, thanks to Dr. Salk, the Salk vaccine has destroyed polio from this world.

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