

# **Polio**

## **I. Introduction**

Polio was a real problem in the middle of the last century. In 1952, one of the worst outbreaks in our history, 3,145 people died (out of 58,000 people with the disease).

- Note that the fatality rate is not all that high. Let's dig into this some more.
- 21,269 people (out of that 58,000) were left with some kind of disability.
- Over the years, these numbers added up. In 1977 there were an estimated 254,000 people in the U.S. that had been paralyzed by polio.
- We suspect that polio was a problem even in ancient Egypt (based on Egyptian wall paintings/reliefs).
- Once upon a time, iron lungs were a common sight. Even now there are still people that have some kind of physical disability due to polio.
- Polio was fundamental in establishing:
  - rehabilitation therapy &
  - disability rights
- World wide, the WHO estimates there are between 10 and 20 million polio survivors.

One reason to discuss this disease is that we have been really close to eradicating it for years now. It would be only the second human disease to be eradicated (after smallpox).

## **II. Causes**

- an enterovirus, in this case a regular RNA virus.
- occurs in three different strains. Type 1 is most closely associated with paralysis.
  - vaccination or infection (and recovery) provide immunity, but only against the strain that one was infected/vaccinated with.
- humans are pretty much the only host.

## **III. Spread & infection**

- The virus is found in feces, and can spread (to the mouth) from there, particularly in areas where sanitation is poor.

- Wash your hands after using the bathroom!!
- But it's also found in saliva, and can be transmitted that way.
- It enters the body through cells in the back of the throat or in the intestine.
- Once it's in the body, it usually enters lymphoid tissue where it multiplies and grows (also causes antibodies to form).
- Polio is most infectious from between 7-10 days before and after symptoms first appear.
- But can be infectious as long as viruses are present in feces or saliva.

#### **IV. Symptoms**

Symptoms usually develop between 3 and 5 days after being exposed. Often people are asymptomatic, but:

- Often they're fairly mild:
  - fever
  - malaise
  - headache
  - sore throat
  - vomiting
- Sometimes they get much worse:
  - meningitis
  - muscle pains & spasms
  - numbness/tingling
  - hypersensitivity
  - weakness/paralysis
  - respiratory failure (infrequent)

In about 1% of infected people, the polio virus affects the nervous system.

- Can affect the spinal cord (“Spinal polio”) which can cause paralysis and in advanced cases paralysis of the breathing muscles.
- Can affect the brainstem (“Bulbar polio”) which can interfere with facial muscles, hearing, seeing, lungs, even heart beat. Lack of control over muscles used to breathe can lead to death.
- Can affect both (“Bulbospinal polio”) a combination of the above.
  - particularly this last form often requires an Iron Lung (or other breathing assistance).

In less serious cases (non-paralytic) people can recover in about a week to 10 days.

In more serious cases, it depends.

If nerve cells are completely destroyed, damage can be permanent.

If nerve cells are only damaged, they may recover in 4 - 6 weeks.

About half of patients with spinal polio recover completely,  $\frac{1}{4}$  recover with mild disability, and the rest are left with permanent disabilities.

Generally, if any paralysis remains after a year, it's likely to be permanent.

Sometimes remaining nerves can sprout new branches to innervate muscle fibers that don't have any more nerves running to them.

One nerve cell may wind up doing the job of many in this way, but it does seem to work.

## V. Treatment

There is no cure. Treatment includes:

- pain medication, physical therapy, surgery, corrective shoes & braces, exercise antibiotics (prevent muscle infections).
- rehabilitation
- in extreme cases, may need ventilators
- other treatments including electrotherapy and massage are sometimes used, particularly for muscle atrophy.
- antiviral medications are being investigated (though hopefully they'll soon be irrelevant)

## VI. Prevention

- Vaccine! There are two types:
    - oral, developed by Sabin in the late 50's. Very effective against all strains, but it in rare cases (1/750,000) the attenuated virus actually causes the disease.
    - injection, developed by Jonas Salk in 1952. Uses inactivated virus, and never causes polio. It's now used in all industrialized countries.
- (the oral vaccine is quite a bit cheaper).
- Of course, you can also avoid infected people, wash your hands, etc. But polio is one of the most contagious diseases known.

## **VII. The good news -eradication:**

Polio has been virtually eradicated in most parts of the world. It now occurs only in 7 countries, and 98% of cases are found in India, Pakistan & Nigeria.

A campaign to eradicate polio started in 1988. Since then the number of new cases have dropped from 350,000 per year to less than 2,000.

- There is some resistance to vaccinations in some areas, particularly in Nigeria where some of this is thought to be a Western campaign to reduce fertility and infect people with AIDS. It's been hard to convince people otherwise.

- This boycott actually caused the virus to spread to neighboring countries that had been declared polio free.

- This happened again in 2007 in Pakistan, and in July a student from Pakistan brought the first polio case in 20 years to Australia.

Hopefully we'll finally be able to immunize these last holdouts and make Polio history.