Differences in Multiplication of Virulent and Vaccine Strains of Poliovirus Type I, II, and III in Laboratory Animals

By

Galina A. Koroleva, V. A. Lashkevich, and Marina K. Voroshilova

The Institute of Poliomyelitis and Virus Encephalitides,
U.S.S.R. Academy of Medical Sciences,
Moscow, U.S.S.R.

With 5 Figures

Accepted December 29, 1976

Summary

Multiplication of virulent and vaccine strains of poliovirus type I, II and III in laboratory animals of different species was studied comparatively. The main criterion of virus reproduction was the production of the photoresistant virus progeny after inoculation of the animals with proflavin-photosensitized virus strains. On the whole, virulent poliovirus strains were characterized by replication in a wide range of hosts (monkeys, cotton rats, white mice, guinea pigs, rabbits, chickens, chick embryos), a low infective dose, production of the photoresistant progeny to a high titre, clinically overt disease in some animal species. The vaccine strains multiplied in a narrower range of hosts, had a high infective dose, a low titre of virus progeny, and caused no clinical symptoms of infection. These differences may serve as a marker for differentiation between virulent and attenuated strains in vivo. Administration of guanidine before inoculation of newborn cotton rats completely prevented or delayed by several days the production of photoresistant virus progeny. This fact confirms the stability of the proflavin-poliovirus complex under conditions ruling out virus replication.

Introduction

The present study is a continuation of investigations of poliovirus infection using photosensitized virus strains (8). In this work we compared replication of virulent and vaccine strains of poliovirus type I, II, and III in laboratory animals of different species. Results are presented indicating: a) a wider range of susceptible animals and a more marked capacity for in vivo reproduction of virulent than of vaccine strains; b) the dependence of the infectious process on the dose of virus; and c) the inhibiting effect of guanidine on the course of in vivo infection.
Materials and Methods

Viruses

Vaccine poliovirus strains of types I, II, and III (LsC 2ab, P 712 Ch 2ab, Leon 12a₁b) were used in the first passage of the original Sabin strains in green monkey kidney cell culture at 34 °C. The group of virulent poliovirus strains included Mahoney, MEF-1 and Saukett.

Cell cultures, virus photosensitization, titration and typing, inoculation of animals and determination of virus content in organ suspensions were performed as described previously (8).

Results

Poliovirus Replication in Animals of Different Species

Monkeys

*Macaca rhesus* monkeys were inoculated into the right thalamus with 0.5 ml each of photosensitized vaccine and virulent poliovirus strains of type I, II, and III with titres of $10^{7.5} - 10^{8.2}$ PFU/ml. The virus content was determined in fragments of tissues of the brain and spinal cord (cortex, subcortex, thalamus, medulla cerebellum, cervical, thoracic and lumbar cord) from which separate 10 per cent suspensions were prepared and titered. Virus titres in one singular segment of the CNS with the highest virus content of all segments tested are presented for each period after inoculation in Figure 1.

Fig. 1. Poliovirus multiplication in the CNS of Rhesus monkeys. The virus titre in a singular segment of the CNS with the highest virus content of all segments tested is given. Titre of photoresistant virus (o——o) and the corresponding titre of total virus (● — ● ●).