PARALYTIC POLIOMYELITIS IN GUATEMALA[1]

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INTRODUCTION

Paralytic poliomyelitis has been controlled in various developed areas of the world with the help of either inactivated or live oral vaccines *(1-3)*. However, despite massive vaccination campaigns, the disease continues to pose a serious health problem in tropical countries *(4, 5)*. Such is the situation in Guatemala, where oral polio vaccine (OPV) has been used since 1973. Analysis of the number of paralytic poliomyelitis cases admitted in recent years to the Children's Hospital for Infectious Diseases and Rehabilitation (CHIDIR), the national referral center in Guatemala City, shows that the disease continues to be endemic and that increased numbers of admissions have occurred periodically (Figure 1) *(6)*. Starting in July 1982, the number of patients with signs and symptoms of paralytic poliomyelitis admitted to the CHIDIR increased sharply (Figure 2), prompting the investigation reported here.

PATIENTS STUDIED AND VIROLOGIC METHODS

One hundred and thirty-three children with clinical diagnoses of paralytic poliomyelitis were studied. All were admitted to the CHIDIR between 15 July 1982 and 31 January 1983. Each child's age, sex, place of residence, clinical symptoms, and history of vaccination with oral polio vaccine (OPV) were recorded.

Fecal specimens for poliovirus isolation were obtained on the day of admission by means of a rectal swab. The fecal material was placed in cold Earle's balanced salt solution supplemented with penicillin and streptomycin and was transported to INCAP's[6]

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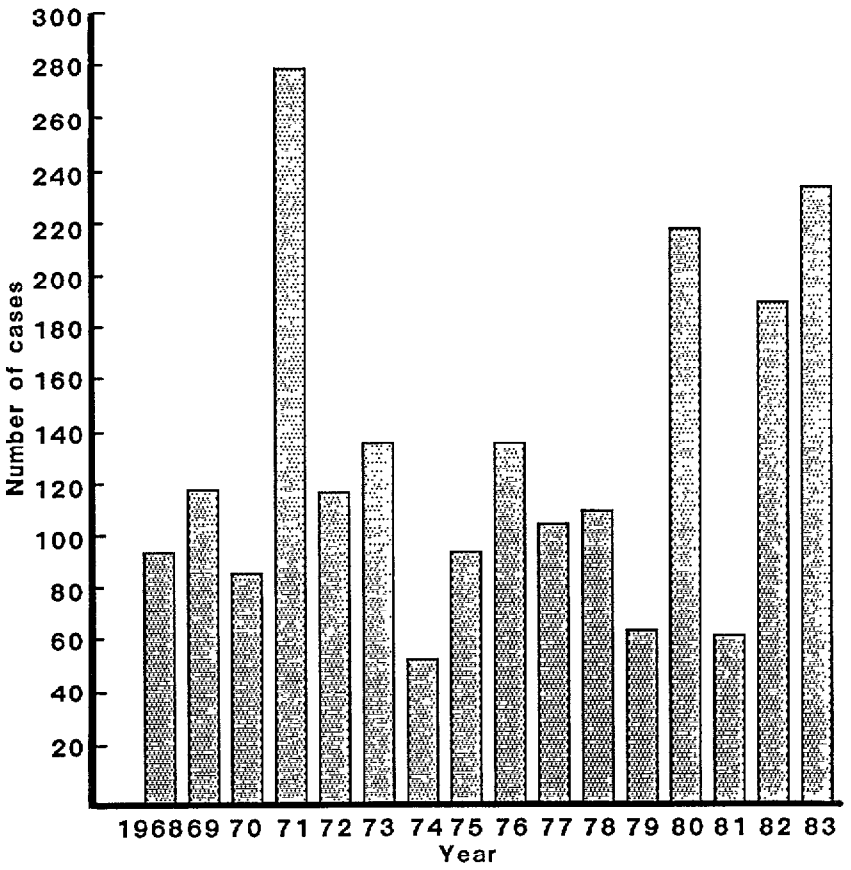
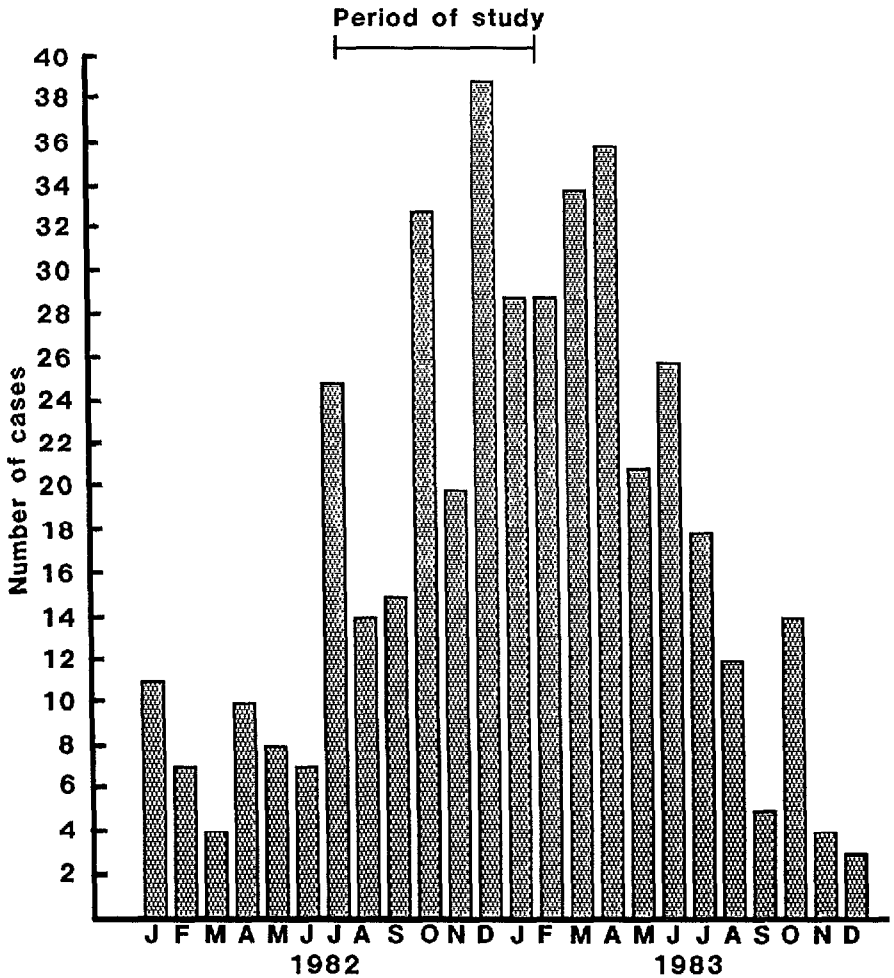
FIGURE 1. The number of children with paralytic poliomyelitis admitted to the Children's Hospital for Infectious Diseases and Rehabilitation (CHIDIR) in Guatemala City from 1968 through 1983, by year.



central laboratories on wet ice. After appropriate centrifugation and further treatment with antibiotics, the specimens were inoculated into monolayers of HEp-2 cells (M.A. Bioproducts, Maryland, USA) and fed with Eagle's minimal essential medium with Earle's salts and fetal bovine serum. The cell cultures were monitored microscopically for a maximum of 14 days to detect the appearance of cytopathic effects. Once cytopathic effects were detected, the isolates were identified as polioviruses by neutralization test (NT), using pooled antisera against the three poliovirus serotypes. Typing was accomplished using monospecific antisera. Sixty-six of the isolates were shipped in dry ice from Guatemala to Holland, where a determination as to whether the isolate was Sabin-like (SL) or non-Sabin-like (NSL) was made by means of enzyme-linked immunosorbent assay (ELISA) *(7)*.

FIGURE 2. The number of children with paralytic poliomyelitis admitted monthly to the CHIDIR in 1982-1983.



RESULTS

Study Patient Characteristics

The age of the patients studied ranged from four months to five years, with 58% being 6–23 months old. Seventy-one were girls and 62 were boys, creating a female:male ratio of 1.15:1.0. Ninety children (68%) had not received any OPV. However, eight (6%) were reported to have received three doses (Table 1). Most of the subjects (45%) lived in Guatemala Department or in the six departments adjacent to it (44%) (Figure 3).

TABLE 1. The study children's age, sex, and vaccination history, and the types of Sabin-like and non-Sabin-like polioviruses isolated from them.

Age (in months)	Sex		Cumulative total (%)	Vaccination history (No. of doses)				Polioviruses isolated						
								Type 1			Type 2		Type 3	
	M	F		0	1	2	3	SL[a]	NSL[b]	ND[c]	SL	NSL	SL	NSL
0–5	2	2	(3)	3	1	—	—	—	1	—	—	—	—	—
6–11	9	16	(22)	19	4	1	1	—	9	9	2	—	—	—
12–17	15	15	(44)	18	10	1	1	—	13	9	2	—	—	1
18–23	8	14	(61)	17	3	1	1	—	12	5	1	—	—	—
24–29	11	6	(74)	8	6	2	1	—	8	3	2	—	—	—
30–35	5	6	(82)	7	2	—	2	—	5	2	1	—	—	—
36–41	6	5	(90)	9	2	—	—	—	3	6	—	—	—	—
42–47	0	0	(90)	—	—	—	—	—	—	—	—	—	—	—
≥48	6	7	(100)	9	1	1	2	—	4	5	1	—	—	—
Total	62	71	133	90	29	6	8	—	55	39	9	—	—	1
(%)	(47)	(53)		(68)	(22)	(4)	(6)							

[a] SL: Sabin-like.
[b] NSL: Non-Sabin-like.
[c] ND: Not determined.

Poliovirus Isolation

One hundred and four children (78%) were found to be excreting viruses at the time of admission to the CHIDIR; only two of the isolates obtained were not polioviruses. Ninety-two (90%) of the excreters shed only poliovirus type 1; seven excreters (7%) shed only poliovirus type 2; one shed only poliovirus type 3; and two shed both type 1 and type 2.

Intratypic Differentiation

Sixty-six viral strains were subjected to serodifferentiation into Sabin-like and non-Sabin-like strains. Fifty-five of the 56 type 1 isolates and the lone type 3 isolate were classified as non-Sabin-like. The remaining type 1 isolate could not be classified as either Sabin-like or non-Sabin-like. All nine type 2 isolates were Sabin-like.

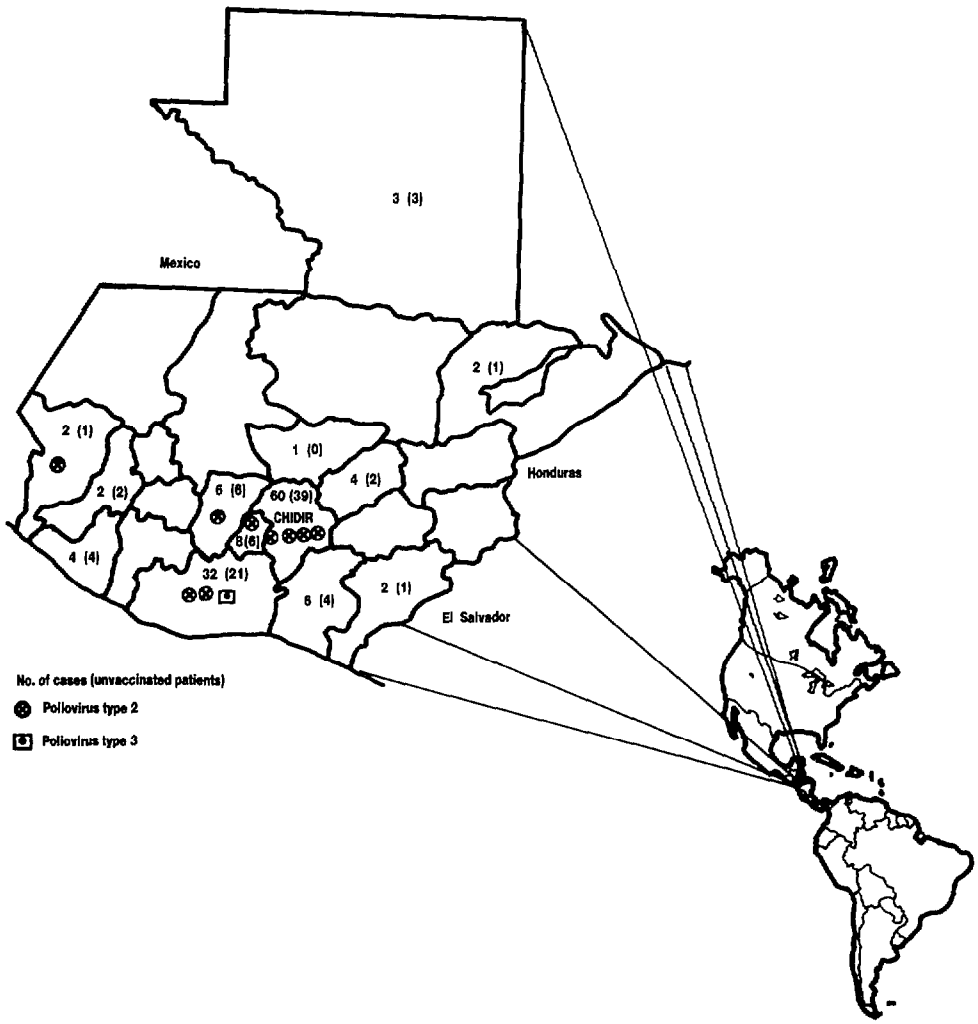
Clinical Manifestations

The basic types of paralysis observed among the 62 children from whom only one type of poliovirus was isolated are shown in Table 2. Twenty-one children (34%) exhibited paralysis of one leg, 22 (35%) had paraplegia, one (2%) had biplegia, one had hemiplegia, six (10%) had triplegia, and 11 (18%) had quadriplegia. The child with biplegia, a three-year-old boy, was affected in the right arm and left leg. The child with hemiplegia (left hemiplegia) was 28 months old. Two of the children from whom non-Sabin-like poliovirus type 1 was isolated died.

Discussion

These and subsequent data reaffirm that poliomyelitis has continued to be a public health problem in Guatemala. Indeed, there were 58, 65, and 80 clinical cases of poliomyelitis ad-

FIGURE 3. Geographic distribution of the study children, showing the number of these children in each department, the number unvaccinated against poliomyelitis (in parentheses), the number found infected with Sabin-like type 2 polioviruses, and the single child found infected with type 3 poliovirus.



mitted to the CHIDIR in Guatemala in 1984, 1985 and 1986, respectively *(8)*. The first 39 cases reported in 1986 constituted 13% of those in the Americas outside Brazil and 4% of those reported in the entire Western Hemisphere for 1986. *(9)*.

Most of the 1982 patients (61%) were less than two years old, a proportion similar to that observed in a 1982 epidemic on Taiwan *(10)*. Ninety (68%) of the 133 Guatemalan children had not received any OPV. These observations confirm the need for vaccination

TABLE 2. Types of paralysis observed among the 62 children from whom one type of poliovirus was isolated and classified as a Sabin-like or non-Sabin-like strain, by the type of virus isolated and the child's vaccination history.

Type of paralysis observed	Polioviruses isolated and OPV doses received													
	Doses OPV received by children with type 1 (non-Sabin-like) virus				Doses OPV received by children with type 2 (Sabin-like) virus				Doses OPV received by children with type 3 (non-Sabin-like) virus				Total	
	0	1	2	3	0	1	2	3	0	1	2	3	No.	(%)
Monoplegic	11	7	—	2	—	1	—	—	—	—	—	—	21	(34)
Paraplegic	13	4	1	1	3	—	—	—	—	—	—	—	22	(35)
Biplegic	—	1	—	—	—	—	—	—	—	—	—	—	1	(2)
Hemiplegic	—	—	—	—	—	1	—	—	—	—	—	—	1	(2)
Triplegic	3	1	—	—	1	—	—	—	1	—	—	—	6	(10)
Quadriplegic	9	—	—	1	1	—	—	—	—	—	—	—	11	(18)
Total	36	13	1	4	5	2	0	0	1	0	0	0	62	

during the first six months of life. At the same time, the noteworthy numbers of vaccinated children from whom polioviruses were isolated suggests a failure by the Sabin OPV used to provide lasting immunity.

Acute-phase sera from the eight children with a history of receiving three OPV doses were tested for the presence of antipolio neutralizing antibodies, and none of them was found to be positive. Although these children may simply represent the proportion of all children known not to seroconvert after appropriate vaccination *(11)*, it is also possible that the vaccines administered had lost their potency due to improper handling. Appropriate quality control of the vaccines involved and subsequent assessment of the vaccinees' seroconversion would help to determine the factors responsible for this failure to induce protection.

Most of the polioviruses isolated were type 1; only one out of the 104 strains was type 3. This finding agrees with the prevalence of type 1 cases reported from other parts of the world around the 1982 period *(2, 10, 12, 13)*. Interestingly enough, all of the type 1 and type 3 isolates that could be classified by ELISA as Sabin-like or non-Sabin-like were found to be non-Sabin-like (wild-type) viruses. Control of wild-type virus transmission would therefore result in a dramatic decrease in poliomyelitis morbidity.

On the other hand, all nine type 2 isolates were found to be Sabin-like strains. Six of the children from whom these strains were isolated had never received OPV; the remaining three were given OPV at five, 12, and 14 months before their symptoms began. Furthermore, no recent contact with vaccine recipients was reported for any of the children.

In the epidemiologic sense, therefore, these cases could not be classed as vaccine-derived. However, it is noteworthy that seven of the nine type 2 Sabin-like strains were isolated during the first week of the study from patients

living in five different departments of Guatemala, four of which are situated very close to one another (Figure 3). There thus seems no reason to exclude the possibility that the genetically unstable type 2 vaccine strain could have reverted to a virulent form after multiple cycles of natural transmission, and could have caused a small epidemic in undervaccinated children. The other two Sabin-like type 2 strains were isolated during the late phase of the study and were found in combination with type 1. Since serologic determinations were not made with acute and convalescent sera, it is impossible to determine which of the two types of virus was responsible for the disease in these two patients. Nevertheless, it is apparent that the 1982–1983 epidemic was associated with type 1 non-Sabin-like poliovirus.

A high degree of fecal contamination and low levels of hygiene are associated with the poor sewage disposal and potable water distribution systems prevalent in Guatemala, and all of this plays an important role in the high incidence of poliomyelitis. Nevertheless, appropriate measures to control the transmission of wild-type polioviruses would cause a drastic drop in the number of paralytic poliomyelitis cases occurring among Guatemalan children. Such activities should include quality control of the vaccines (starting when they are received by the health authorities) as well as continued surveillance of cases and of the viruses associated with the disease.

Summary

Clinical and virologic studies were done on 133 children between four months and five years old with paralytic poliomyelitis in Guatemala. All of these children were admitted to the Children's Hospital for Infectious Diseases and Rehabilitation (CHIDIR) in Guatemala City between 15 July 1982 and 31 January 1983.

One hundred and four children (78%) were shown to be excreting viruses in their feces at the time of admission; all but two of the isolates were polioviruses. Ninety-two (90%) of the excreters shed type 1 poliovirus only, seven shed type 2 only, one shed type 3 only, and two shed both types 1 and 2. Sixty-six viral isolates were tested to determine whether they were Sabin-like or non-Sabin-like strains. Fifty-five of 56 type 1 isolates and the only type 3 isolate were found to be non-Sabin-like. The remaining type 1 isolate could not be classified. All nine of the type 2 isolates were Sabin-like.

Ninety of the 133 afflicted children (68%) had no history of receiving oral poliovirus vaccine, 29 (22%) apparently received one dose, six (4%) had reportedly received two doses, and eight (6%) were said to have received three doses. Eighty-nine per cent of these children lived in the department of Guatemala or in one of four adjacent departments.

Of the 62 children from whom only one type of poliovirus was isolated and identified as Sabin-like or non-Sabin-like, 21 had monoplegia, 22 had paraplegia, one had biplegia, one had hemiplegia, six had triplegia, and 11 had quadriplegia.

The observations presented here have helped to confirm the urgent need for effective measures designed to control the transmission of wild-type poliovirus in Guatemala.

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