

## AN OUTBREAK OF POLIOMYELITIS IN ANDHRA PRADESH (SOUTH INDIA)

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### ABSTRACT

*An outbreak of poliomyelitis that occurred in the year 1992 in Telangana region of Andhra Pradesh, South India was investigated to understand the reasons for persistence of poliomyelitis in the general population and for the outbreak in Andhra Pradesh in particular. The study comprised of a detailed investigation of epidemiological and clinical features, serology and vaccination status and a case control study to calculate vaccine efficacy by matched pair analysis. The outbreak occurred after a relative quiescence of 3 years. The age group of the patients ranged from 2 months to 5 years, 26.5% being infants and 70.2% being children between 1 and 5 years. The outbreak was mainly caused by Type 1 poliovirus. Vaccine efficacy was found to be 70%. Antibody response was not high in cases. Seventy six per cent of the children with poliomyelitis were unvaccinated. Ignorance of the mothers and family interference were the main causes for not vaccinating the children. The study indicates the need to increase the vaccination coverage and inclusion of children upto 5 years in the programme. Absence of vaccination is the major risk factor for the outbreak. The persistence of poliomyelitis in older children, low antibody response and sub-optimal vaccine efficacy point out the problem of achieving control with OPV in tropical countries and suggest the need for alternate strategies. Better health education strategies need to be developed.*

**Key words:** Polio outbreak, Oral Polio Vaccine, Vaccine efficacy.

Poliomyelitis has been an endemic disease in India. The three dose schedule of OPV to susceptible children is the national policy for prevention of poliomyelitis and was introduced through EPI in 1978 to cover all susceptible children.

The Universal Immunization Programme (UIP) which had been launched in 1985 shifted the emphasis of immunization of older children to infants. The immunization coverage with the trivalent Oral Polio Vaccine (OPV) is reported to be 98.8% of the target population during the year 1990-91. Nevertheless, poliomyelitis continues to be a crippling disorder of the children in India with 10,412 cases reported in 1990(1). These figures are mostly based on admissions to major hospitals in the country and could be gross under-estimates of the problem because of the inadequate surveillance of the cases in the country.

We are presenting a detailed report of an investigation of a major outbreak of poliomyelitis in Telangana region of Andhra Pradesh, during the year 1992 with a view to understand the reasons for persistence of poliomyelitis in the country.

### Methods

Two hundred and eighty consecutive admissions of clinically diagnosed cases of poliomyelitis to the Institute of Tropical Diseases and hundred and twenty consecutive admissions to Niloufer Hospital,

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Hyderabad during the period of January to December 1992 constituted the study material. Institute of Tropical Diseases (ITD) is a major hospital to which most of the cases of infectious diseases are admitted. Data on the profile of admissions to the same Institute of cases with polio over a period of 20 years (1972-1992) was collected from the well maintained admission registers of the hospital.

The children with polio were thoroughly examined by the pediatricians in the investigating team and the diagnosis was based on the onset of asymmetric flaccid paralysis following a brief gastrointestinal or respiratory illness. Mothers of all these children were interrogated and information on vaccination status, reasons for not vaccinating in case of unvaccinated patients and history of administration of intramuscular injections preceding paralysis were collected. Two ml of blood was obtained from all the patients at the time of admission and repeated at the end of 4-6 weeks in 200 children who came for re-examination at that time. The acute phase sera were collected within the first week of the onset of paralysis. Sera was separated from all the samples and stored at  $-20^{\circ}\text{C}$  till microneutralization assays for type specific polio antibodies were carried out using the method of Schmidt(2). The method briefly consisted of incubation of heat inactivated sera with 100 TCID<sub>50</sub> of each of the three virus strains for 3 hours. Vero cells (African Green Monkey Kidney Cells Culture, Pune, India and maintained in our laboratory) were seeded. The plates were incubated at  $37^{\circ}\text{C}$  in presence of 5% CO<sub>2</sub> for 7 days. The neutralization of the cytopathic effects caused by the virus on the vero cells were read following the standard procedure. Titres 1:4 and above were scored as positive titres.

Siblings of every case of poliomyelitis were investigated as controls, for evidence of poliomyelitis, vaccination and serological status. One hundred and forty seven of them who were matched for age and sex with the cases were used for analysis and calculation of vaccine efficacy. The latter was calculated using the case-control pairs according to the method of matched-pair analysis using the formula

$$\text{VE}\% = (1 - \text{RR}) \times 100 \quad (\text{RR} = \text{relative risk})(3).$$

## Results

### *Epidemiological and Clinical Features*

Data available from the admission registers of ITD from the year 1972 onwards is given in *Fig. 1* as total number of polio cases hospitalized every year and their percentage out of total admissions to the hospital.

The pattern of incidence during the 1970's shows the typical endemic profile of poliomyelitis with change to alternate years or once in 3 to 4 years of higher incidence during the mid 80's. There was a decline in the polio admissions during 1989-91 and again a rise in 1992. The cases investigated in the present study belonged to the twin cities of Hyderabad and Secunderabad and the neighboring districts mainly belonging to the Telangana region of Andhra Pradesh (*Fig- 2*).

Seasonal distribution of the cases is shown in *Fig. 3*. Cases were seen throughout the year with a peak occurring during the months of July-August-September.

*Table 1* shows that more than a quarter of the cases were infants while more than 50% were children between 1 and 3 years of age, thus, bringing the figure to nearly 88% below the age of 3 years. Cumulative

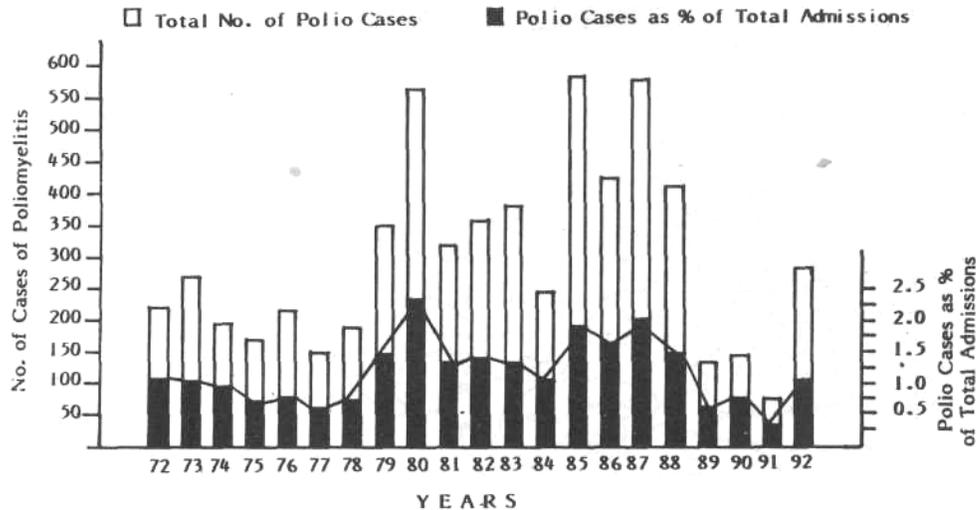


Fig. 1. Cases of poliomyelitis admitted to Institute of Tropical Diseases, Hyderabad (1972-92).

percentage indicated the occurrence of more than 98% of cases in children below 5 years leaving a very small percentage of children above 5 years of age who suffered from acute attack of polio.

Clinical pattern of paralysis showed spinal form of polio with involvement of one, two or more limbs in 82.9% of the cases. Bulbar or bulbospinal form was noticed in 13.5%. Weakness of neck muscles with head drop was the only presenting manifestation in 3.5% of the cases. Three children had lower motor neurone type of facial nerve paralysis, two of them having associated bulbospinal paralysis.

#### ***Paralysis Provoked by Intramuscular Injection***

Onset of paralysis was noticed in 73.5% of the children following administration of intramuscular injection on the same limb.

#### ***Serology***

*Cases:* Predominance of type 1 anti-

bodies was found in 63.5% of the cases while, evidence for types 2 and 3 was observed in 15% and 13.5%, respectively. Among the 200 children in whom repeated antibody titres were determined, 189 children showed 2-4 fold rise in antibody titres over basal values (*Fig. 4*). Eleven children had initially low antibody titres and did not show any rise in convalescent sera.

*Siblings:* Out of 300 siblings examined, data on 147 siblings who were <5 years and thus were age matched with cases was analysed. Protective antibody titres were observed in 86.8, 81.9 and 77.1% of the siblings for type 1, type 2 and type 3, respectively.

#### ***Vaccination Status***

*Cases:* Seventy six per cent of the polio cases had not received OPV. Fifteen per cent received 3 doses of OPV while nine per cent had partial vaccination with one or two doses.



Fig. 2. 'Spot Map' of Andhra Pradesh showing the catchment area.

*Siblings:* Out of the 147 siblings, 23.1% were protected with 3 doses of OPV while 6.1% received only partial immunization and 70.8% did not receive even a single dose of OPV. Among these siblings, 9 had polio prior to the investigation as evidenced by residual paralysis and of these 8 were unprotected. The vaccine efficacy calculated using matched pairs as indicated in Table II is 70%.

Reasons for not vaccinating the child-

ren against polio are described in Table III.

42.9% of the mothers expressed their ignorance about the need for vaccination while one third of the mothers expressed their inability to get the child vaccinated because of interference by family members and/or chronic illness of the child. For 15% of the mothers vaccination was inaccessible while 8% of the mothers were indifferent.

More than 90% of the mothers interviewed were illiterate who did not know

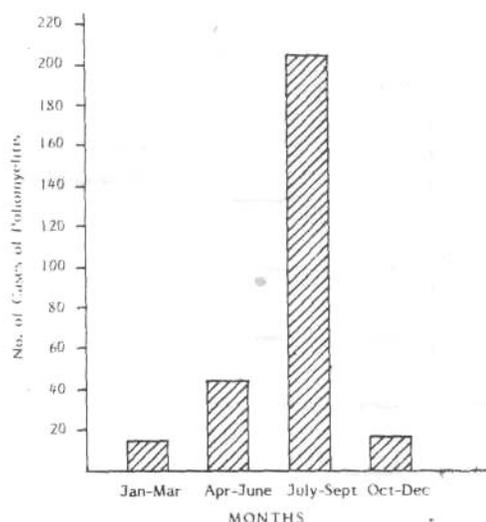


Fig. 3. Seasonal distribution of cases of poliomyelitis.

TABLE I—Age Distribution of Poliomyelitis Cases

Age groups	No.	Percentage	Cumulative
≤ 6	8	2.0	2.0
7-12	106	26.5	28.5
13-24	171	42.7	71.2
25-36	66	16.5	87.7
37-60	44	11.0	98.7
>60	5	1.3	100.0

reading or writing and lived in urban slums or villages in the nearby districts.

#### Discussion

The present outbreak resembles any of the classical outbreaks of poliomyelitis reported from other centres in the country with respect to its seasonal pattern and clinical picture(4,5).

The admissions of polio cases to the Institute of Tropical Diseases indicate the

typical endemic pattern of the disease from the prevaccination period of early 70's to the period of early 80's after the EPI was launched. The change of pattern from this endemic phase to periodic large outbreaks is typical of the transition from the prevaccine endemic pattern to the epidemic pattern of the disease following inadequate immunization and is similar to the changing pattern of poliomyelitis described from developing countries(6). Subsequent to the introduction of national immunization programmes the decline in the incidence from 1989 to 1991 coincides with increase in coverage of polio immunization under the UIP in the State.

In the UIP, the focus is on vaccination of the infants. As a result, perhaps, large number of the unvaccinated susceptible children have accumulated in the older age group over a period for 3 years from 1989-91, and explain the resurgence of polio in 1992. This perhaps could have been averted if the coverage of the susceptible older children was also sustained. The age distribution of the children with poliomyelitis in the present outbreak renders support to this and is further strengthened by our<sup>1</sup> earlier observations on the immune status of unvaccinated children to polio(7) wherein we observed 29% of children between 1-3 years to be sero negative to all 3 types of polio viruses and is also in line with reports from other parts of India(8-10).

One of the objectives of using OPV is to achieve herd immunity. However, the data clearly show that this objective has not been achieved even by covering more than 98% of infants with 3 doses of OPV. Though the UIP has been focussing attention on infants and the coverage is about 98.9% of the target population, the present study indicates that more than 25% of children

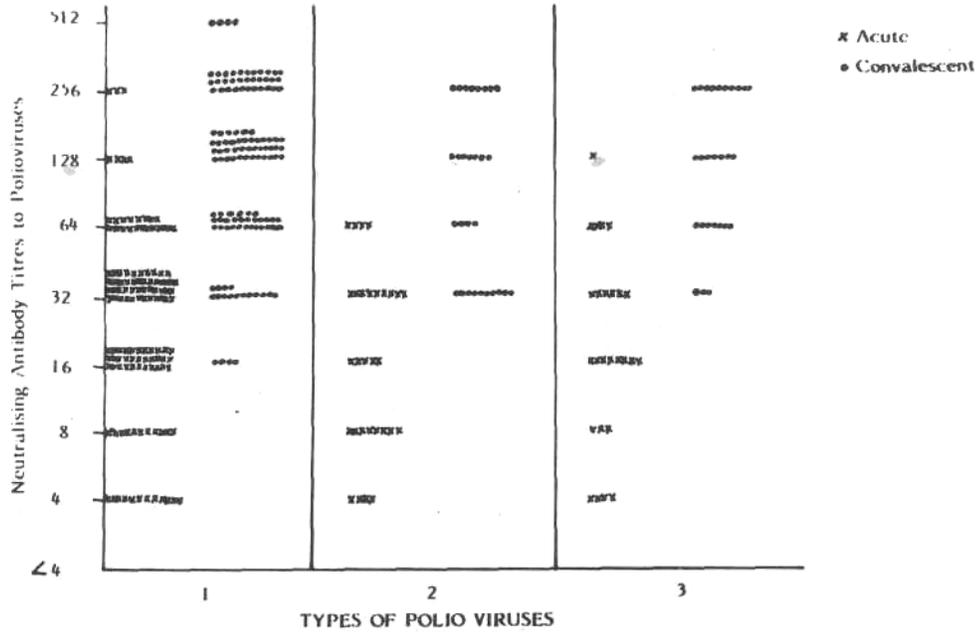


Fig. 4. Antibody titres of acute and convalescent sera of polio cases.

with polio are under 1 year. This observation is similar to the observation made by Sulekha *et al.* from Kerala with a similar immunization coverage(4). These data raise important questions about the adequacy of immunization coverage, efficacy of vaccine and whether there is a need for changing the vaccination strategy.

There are no controlled studies in India to assess vaccine efficacy. Indirect information obtained from the clinical cases of polio occurring in protected children have led to conflicting reports(11,12). The results of the present case control study, however, clearly indicate suboptimal vaccine efficacy (70%) in the study area and might possibly be occurring in other parts of the country as well.

The reasons for vaccine failures could be several. Difficulties experienced in the maintenance of cold chain and interfering factors from the host due to heavy intestinal flora with other entero viruses could be two important factors and are generally similar throughout the country. The conditions

TABLE II - Vaccine Efficacy

Cases	Controls	
	Vaccinated	Unvaccinated
Vaccinated	j = (14)	p = (6)
Unvaccinated	j = (2)	q = (103)
RR (Relative Risk)	= P/k	
VE% - (1-RR) x 100	= 70%	

TABLE III—Unvaccinated Children—Reasons for not Vaccinating

Reasons	Percentage of mothers interviewed
Unaware of immunization programme	42.9
Reasons like family members interference, repeated infection of child	33.3
Inaccessibility	15.2
Mother indifferent	8.6

hardly changed in the past one and a half decades.

Routine vaccination at birth is a good alternate strategy to overcome the interference caused by gut flora(13-14). Maintenance of cold chain to improve vaccine potency in the interior parts of a vast tropical country is a difficult task to achieve. Improvement in coverage of all susceptibles to 100% is equally difficult and might even unmask more number of vaccine failures.

This opens up the option for using inactivated polio vaccine (IPV) which is now shown to raise not only adequate systemic immunity but also local gut immunity(15-17). IPV is not recommended for control of poliomyelitis in India, for several reasons, but mainly because of its high cost. However, the benefits of achieving control over polio with IPV will certainly outweigh the loss of human resources due to crippling of thousands of children every year.

The serology of the cases confirmed the diagnosis of polio by 2-4 fold rise in antibody titres from acute to convalescent sera in 189 cases analysed. Majority of the cases in the present outbreak showed evidence of infection by type 1 polio virus while 15% and 13.5% of cases were due to type 2 and 3 viruses, respectively. In a small percentage of cases the antibody titres were initial-

ly low and did not show rise in the convalescent sera. Thus, though acute poliomyelitis is often a clinical diagnosis, it is essential to confirm the diagnosis either serologically or by evaluating the residual paralysis as per the definition of diagnosis of polio(18). A small percentage of acute cases could thus be caused by non-polio virus in whom the prognosis of the disease could be different. Though acute management of such cases is similar, immunological confirmation of the diagnosis constitutes and strengthens surveillance system which is essential for control of any infectious disease.

The absolute antibody titres in the immunologically confirmed cases in this study are in the range of 1:4 to 1:256 in the acute sera and 1:16 to 1:512 in convalescent sera. These levels are low compared to the titres reported from acute poliomyelitis cases in the West(19) and represent poor antibody response to gastrointestinal infection with poliovirus perhaps due to similar reasons accounting for a poor response with OPV in tropical countries. This observation could be of public health significance and raises doubts about the long term protection against gut infection even in individuals who had natural infection.

The results of the interview with mothers reveal that the major risk factor for

polio is lack of vaccination in more than three fourths of the cases which exposed the children to the absolute risk of developing the disease. The reasons for not vaccinating the children are interesting. Nearly, half of the mothers confessed their ignorance about the immunization programme while majority of the remaining half complained of interference by other family members or frequent illness of the child as causes for not vaccinating.

In India, television is used to impart health education and the importance of immunization against polio is impressively telecast at the primetime of the national television programmes. However, it is clear from the data that this message is not picked up by the masses who are in need of this information. This calls for working out alternate strategies for educating the illiterate masses by a more personalized approach. The health workers in the community should develop rapport with the mother and impart health education and also encourage interpersonal communications.

Several workers have earlier indicated the dangers of provocative paralysis by intramuscular injections (5,20-23). The present data also highlight this problem suggesting the need to educate medical practitioners and clinicians to restrain administering intramuscular injections to children for short and undiagnosed illnesses.

This investigation on the acute polio outbreak in the Telangana region of Andhra Pradesh, South India gives an opportunity to understand the reasons for not achieving control of polio and emphasizes the need to revise the National Policy of polio prevention and evolve newer strategies to impart health education.

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