

## THE PATTERN OF URBAN SMALLPOX - CALCUTTA

by

Dr J. K. Sarkar\*

Epidemiologists investigating smallpox outbreaks in villages often find that the infection has been carried from the neighbouring towns. The experience of the investigators of urban smallpox is often just the opposite; the bulk of evidence indicates that the larger towns form an important reservoir for continuing transmission. Various factors prevailing in towns and villages affect the patterns of smallpox there.

The World Health Organization<sup>1</sup> emphatically states that smallpox surveillance represents the single most important component of the eradication effort. The planning of surveillance must be preceded by a thorough knowledge of the pattern of transmission of the disease in urban areas.

Calcutta is the largest city in the world where smallpox is endemic, and has experienced epidemic outbreaks annually at least until recently. The city, with a population of about four million, is the capital of the State of West Bengal (population about 40 million). Shown in Table 1 are the reported cases of smallpox in Calcutta and in West Bengal State between 1948 and 1960. The yearly fluctuation in incidence in Calcutta and West Bengal is not parallel.

---

\* Professor and Head of the Department of Virology, School of Tropical Medicine, Calcutta

TABLE 1  
SMALLPOX CASES AND DEATHS, 1948-1960

Year	Calcutta			West Bengal (Including Calcutta)		
	Cases	Deaths	Case Fatality Ratio (%)	Cases	Deaths	Case Fatality Ratio (%)
1948	6 228	4 895	79	14 492	7 909	55
1949	982	578	59	2 737	1 244	45
1950	8 087	5 826	72	22 789	12 268	54
1951	8 416	6 637	79	51 626	2 688	5
1952	280	183	65	9 243	3 574	39
1953	234	164	70	1 088	513	47
1954	219	184	84	2 300	850	37
1955	54	45	83	1 126	502	45
1956	366	293	80	2 786	1 185	43
1957	3 054	2 056	67	18 612	10 095	54
1958	346	262	76	28 069	11 435	41
1959	12	6	50	5 941	2 145	36
1960	53	43	81	1 306	459	35

With the vaccination history of the cases unknown, it is difficult to explain why the case fatality ratio is higher in the city than in the whole of the state, despite our belief that the percentage vaccinated was higher in the city than in the rural areas. Regarding mortality, a very old record proved to be of interest. Dr S. K. Chuckerbutty, a pioneer in the field of medicine in India, ran a smallpox hospital in Calcutta during the sixties of the last century. He had stated that the average mortality rate of Indian females was 41.8% and, of Indian males, was 58.5%, which are approximately the same rates we observe today, although the standard of vaccine and the vaccination programme have since improved tremendously. The reason for these similar observations may be that smallpox occurs mostly in the unvaccinated, and therefore the above two improvements have very little influence on mortality rates.

To discuss the epidemiology of an infectious disease in the City of Calcutta, one must also include the satellite towns and industrial areas around the city (metropolitan Calcutta) because many city residents work in those areas and vice

versa. The smallpox figures for metropolitan Calcutta, covering 560 square miles and having a population of 8.7 million and those for the city are compared in Table 2.

TABLE 2  
SMALLPOX CASES AND DEATHS\*

Year	Metropolitan Calcutta			Calcutta City		
	Cases	Deaths	Case Fatality Ratio (%)	Cases	Deaths	Case Fatality Ratio (%)
1964	350	150	43	52	27	52
1965	750	400	53	105	35	33
1966	1 080	550	51	160	60	38
1967	350	100	29	130	40	31
1968	175	75	43	30	23	77
1969	620	175	28	268	165	62

\* Data obtained from Calcutta Metropolitan Immunization Organization

The case incidence and mortality in the city run more or less parallel to those in the metropolitan Calcutta area. This is expected as the areas are more or less continuous.

Studies have been conducted on the epidemiological and virological characteristics of cases in Calcutta during the months of lowest incidence, June through November, as determined by the number of admissions in the only infectious disease hospital in the area. This period of the year was selected because a smaller number of cases permitted a more detailed study. The study, conducted during 1967 and 1968, revealed the following facts:

Incidence and geographical distribution of cases

There were 38 cases in 1967 and 35 cases in 1968, randomly distributed throughout the six months under study. More than three fourths of the cases occurred in six of the 40 postal zones in Calcutta. Almost all patients were in low socio-economic groups. Cases were invariably concentrated in congested "bustees" or slum areas, where each room is occupied by several members of a family and where sanitary conditions are unsatisfactory. Twelve of the 73 patients were, in fact, beggars or foot-path dwellers.

Vaccination status

Fifty-six of these 73 patients (77%) had never been vaccinated, and of the unvaccinated, 17 (30%) died (Table 3). Nine patients had had only primary vaccination in childhood and two of these (25 and 30 years of age) died. Eight patients were reported to have been vaccinated and revaccinated at some time in the past; none died.

TABLE 3

AGE AND VACCINATION STATUS OF SMALLPOX CASES AND DEATHS

Age (years)	No. of Cases	Previously Vaccinated		Unvaccinated	
		Cases	Deaths	Cases	Deaths
0 - 4	12	1	0	11	8
5 - 14	20	1	0	19	3
15 - 24	11	3	0	8	3
25 - 44	25	9	2	16	3
45 +	5	3	0	2	0
Total	73	17	2 (12%)	56	17 (30%)

Severity of cases and virulence of causative viruses

TABLE 4

SEVERITY OF CASES BY AGE AND VACCINATION STATUS

Age	Vaccinated			Unvaccinated		
	Confluent	Discrete	Total	Confluent	Discrete	Total
0 - 4	1	0	1	9	2	11
5 - 14	0	1	1	12	7	19
15 - 24	1	2	3	3	5	8
25 - 44	3	6	9	8	8	16
45 +	0	3	3	2	0	2
Total	5	12	17	34	22	56

Over half of the cases (53.4%) were confluent, the remainder were discrete; there were no haemorrhagic cases. Discrete cases occurred most frequently among the vaccinated. The case fatality ratio is similar to that observed in each of the preceding five years during the off-season period, but lower than that during the smallpox season.

Twenty strains of virus from confluent cases and eight from discrete cases were tested for virulence in the laboratory according to methods employed by Sarkar and Mitra<sup>2</sup>. The percentage of virulent strains was less than that found previously with strains isolated from cases during the smallpox season. This is consistent with the finding of a lower case fatality ratio, the absence of haemorrhagic cases, and a lower proportion of confluent cases during the off-season months.

#### Origin and spread of cases

From 3 cases in 1967 and 2 in 1968, the case histories suggested that the infection might have been introduced into the city. The wide geographic dispersment of some of the cases is not surprising considering the potential of beggars and "bustee" dwellers (who are employed as manual workers in different parts of the city) to spread the infection widely. This raises the possibility that one may occasionally become infected by casual contact with a case, especially if the latter is in a highly infective stage at the moment of contact. Furthermore, although the chain of transmission is usually identified in the majority of instances, occasionally one is tempted to consider the possibility, although remote, of transmission by persons with inapparent infection or by a symptomless temporary carrier.

One outbreak was of particular interest. On investigating the source of the first case of the outbreak it was found that he had moved from a village, Shibanja in Howrah district, about 30 miles from Calcutta. Cases had been occurring there since the preceding May when the first case of smallpox came to the village from the port areas of Calcutta. Thus it seems that the infection was introduced into the village from Calcutta in May 1968 (i.e. smallpox season), maintained there by person-to-person transmission until September 1968, and re-introduced into another part of the city to initiate a small outbreak during the off-season months.

#### Conclusion

Smallpox as an endemic disease in Calcutta is not widespread and is limited to certain "high risk" groups - street dwellers, beggars, and slum dwellers, the majority of whom avoid vaccination. Most of the patients are males. All age groups are involved; children under 15 are not a particular problem, probably because most of those born in Calcutta are vaccinated. Many unvaccinated adults coming to the city from outside contribute largely to the susceptible groups. These groups being highly focal in distribution and the total number of patients being rather small, effective surveillance seems to be a rather easy job, and eradication of endemic smallpox from the city is a practical proposition. It may be mentioned here that in 1970 to date only six smallpox cases have been admitted to the Infectious Diseases Hospital from the city, the lowest number ever recorded. Of the 6 cases, one, in fact, contracted the disease while in the hospital after previous admission to the smallpox ward as a case under suspicion.

References:

1. Henderson, D. A.: Smallpox surveillance in the strategy of global eradication. WHO CD/WP/69.41, 1969
2. Sarkar, J. K., Roy, S., Manji, P.: Epidemiological and virological studies on the off-season smallpox cases in Calcutta. Ind. J. Med. Res. 58: 829-839, 1970
3. Sarkar, J. K., Mitra, A. C.: Virulence of variola virus isolated from cases of varying severity. Ind. J. Med. Res. 55: 13-20, 1967