

A human infection caused by monkeypox virus in Basankusu Territory, Democratic Republic of the Congo *

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This paper presents clinical and epidemiological information on a patient with smallpox-like disease, from whom a monkeypox-like virus was isolated. The patient was the first recognized human monkeypox case in medical history.

Monkeypox virus, which is closely related to variola virus, was first identified by Magnus et al. (1959) as the causal agent in two outbreaks of pox infection in cynomolgus monkeys that had recently been received from Singapore at the Statens Serum-institut, Copenhagen, Denmark. During the next 10 years, eight more outbreaks in the USA and the Netherlands were identified among groups of captive monkeys imported from India, Malaysia, and the Philippines (Arita & Henderson, 1968). However, no naturally occurring outbreaks of monkeypox were identified and no human infections were detected.

On 1 September 1970 a 9-month-old child suspected of having smallpox was admitted to Basankusu Hospital, Equatorial Province, Democratic Republic of the Congo. Specimens from the patient were sent to the WHO Smallpox Reference Centre, Moscow, and a virus similar to, if not identical with, monkeypox virus was isolated (Marennikova et al., 1972). Since this was the first recognized case of human infection caused by monkeypox virus, it was decided to undertake special epidemiological investigations in Basankusu Territory. The investigations were carried out by the authors during January 1971, and the results are presented in this report.

* On 27 October 1971 the name of this country was officially changed to the Republic of Zaire.

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THE STUDY AREA

Equatorial Province covers an area of 340 000 km² and has a population of about 2 650 000. There are four districts, which are further subdivided into territories; Basankusu is one of the territories of Equatorial District and covers an area of approximately 20 000 km² and has an estimated population of 62 000. Most of the inhabitants are primitive farmers living in small villages. The entire district consists of dense tropical rain forest. There is a rainy season from February to November, but even during the "dry" months of December and January it usually rains 2-3 times a week. A main road crosses Basankusu Territory from the west to the south-east (Fig. 1) and most of the population lives along this road or its sidetracks. The main road itself is intersected by several impassable rivers without bridges or regular ferry services. Communications with the capital, Kinshasa, are by an irregular air service or by boat. At least 7-8 days are required to reach the area by the overland route from Kinshasa.

A 150-bed government hospital is located at Basankusu Town, and is staffed by a physician and paramedical and technical personnel. A total of 18 government and mission dispensaries are scattered throughout Basankusu Territory. The medical units are mainly engaged in curative medicine but routine vaccination against smallpox is performed by nursing sisters during monthly visits to dispensaries.

The District Medical Officer in charge of the hospital receives reports of infectious diseases from paramedical personnel or from dressers working in dispensaries, as well as from chiefs of villages and

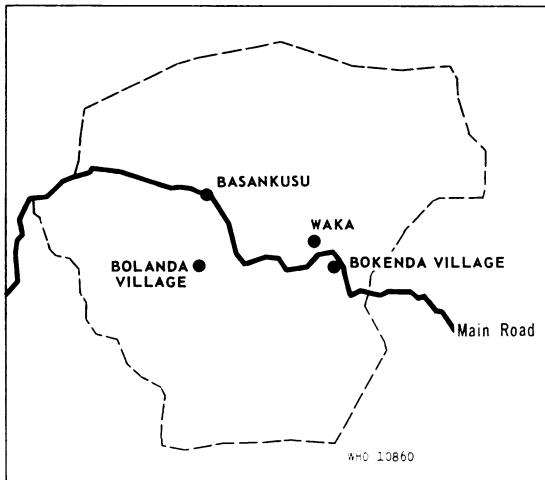


Fig. 1. Basankusu Territory, the study area.

administrative officers of sectors or regions. Patients suffering from infectious diseases, including smallpox, are examined by the physician only if they are admitted to the hospital or if a large outbreak is reported. When smallpox is detected, it is reported by cable to the Provincial Medical Officer at Mbandaka.

PREVIOUS OUTBREAKS OF SMALLPOX

The last known significant outbreak of smallpox occurred in 1968 in the Waka-Bokeka region of Basankusu Territory. Altogether, 70 cases, including 18 deaths, were registered. During a visit to Waka village, we examined several persons who were reported to have suffered from smallpox during the 1968 outbreak. The presence of typical pock marks and a characteristic clinical history confirmed the diagnosis. In 1969, several suspected cases were treated at Basankusu Hospital but none was confirmed.

During 1970, two cases of smallpox were reported. On investigation, the authors found that one of these had been a case of typical chickenpox and had been notified in error, and the other patient was the one from whom monkeypox virus was isolated. Several cases of chickenpox were also investigated by the authors at the time of these studies but all were clinically typical cases and variola virus was not isolated from any of them.

CLINICAL AND EPIDEMIOLOGICAL DATA

The patient (A. I.) was a 9-month-old boy who became ill with fever on 22 August 1970 and 2 days later developed a rash. He was admitted to Basankusu Hospital on 1 September. On examination it was recorded that the lesions were haemorrhagic, although they showed a centrifugal distribution typical of smallpox. Crusts were collected for laboratory examination. The rash lasted about 2 weeks. During the scabbing stage the patient developed otitis and mastoiditis as well as enlarged, painful cervical nodes, which were subsequently incised and drained. The patient recovered and was about to be discharged but on 23 October he developed measles and died 6 days later. The child had never been vaccinated.

The patient was the youngest child in the family of L. D., aged 50 years, who has 2 wives and 11 children, 1 daughter-in-law, and 2 grandchildren. All members of the family have lived in Bokenda village for many years. B. M., one of L. D.'s wives and the mother of the patient, left Bokenda village on 18 August with the patient and four other children to visit the maternal grandmother at Bolanda village, 115 km distant. The family reached Bolanda village on 20 August and 2 days later the patient became febrile. The child and his mother had remained continuously in Bokenda until the time of journey. All members of the family denied contact with anyone who had a pox-like rash and the investigators could discover no other cases in the village.

According to A. I.'s father, monkeys are eaten by the family from time to time and are considered a great delicacy. Neither parent, however, could say with certainty whether monkeys had been eaten by the family during the month or so before A. I. developed the disease. Nor was it possible to determine whether A. I. had any direct contact with a killed monkey during the same period before his illness.

VACCINATION STATUS IN BOKENDA AND BOLANDA

The vaccination status of the residents of Bokenda and Bolanda, and in neighbouring villages, is shown in Table 1. All members of A. I.'s family at Bokenda and Bolanda, except the patient himself, had typical vaccination scars and reported having been vaccinated in August 1969 by the mobile vaccination team of the national smallpox eradication programme. Vaccination was performed by jet injector employing freeze-dried vaccine. Virtually all other

Table 1. Summary of a survey for vaccination and smallpox scars in some villages of Basankusu Territory

Village	Age (years)	Total assessed	No. of susceptible persons	No. of persons with :		Percentage of susceptibles
				Vaccination scars	Pock marks	
Bokenda	0-4	54	3	51	—	5.6
	5-15	67	—	66	1	0
	≥ 16	124	1	121	2	0.8
	total	245	4	238	3	1.6
Bolanda	0-4	36	5	31	—	13.9
	5-15	71	2	69	—	2.8
	≥ 16	107	2	105	—	1.9
	total	214	9	205	—	4.2
Likunju	0-4	10	1	9	—	10
	5-15	16	1	15	—	6.4
	≥ 16	33	1	31	1	3.0
	total	59	3	55	1	5.1
Ntomba	0-4	23	4	19	—	17.4
	5-15	42	2	40	—	4.8
	≥ 16	104	1	103	—	0.9
	total	169	7	162	—	4.2
Boodji (school only)	0-4	—	—	—	—	—
	5-15	42	1	39	2	2.4
	≥ 16	5	—	4	1	0
	total	47	1	43	3	2.1
Bolondo	0-4	57	13	44	—	23.9
	5-15	102	5	95	2	4.9
	≥ 16	196	4	189	3	2.1
	total	355	22	328	5	6.2
Waka	0-4	6	—	5	1	0
	5-15	18	—	15	3	0
	≥ 16	19	—	14	5	0
	total	43	—	34	9	0

residents of Bokenda and Bolanda and the neighbouring villages had either a vaccination scar or residual pock marks typical of smallpox. None had been vaccinated after A. I.'s illness.

In the hospital, although A. I. and his mother were housed in a separate ward, it is believed that at least half of the patients had direct contact with A. I. None was vaccinated after A. I.'s admission to the hospital and none developed an illness with skin eruptions. However, the vaccination status of the patients at the hospital during the time of A. I.'s hospitalization could not be determined because of the lapse of time and lack of records.

THE MONKEY POPULATION

Equatorial Province, and particularly Basankusu Territory, has a very large monkey and ape population. The Mongo people who inhabit the area indicated that the following are most frequently seen: *nasoli* (*Cercopithecus ascanius*), *mbeka* (*Cercopithecus mona wolfi* Meyer), *mpunga* (*Cercopithecus neglectus* Schleg.), *liuka* (*Colobus polykomos* Zimm.), *jofe* (*Colobus badius* Kerr), *ngila* (*Cercocebus aterrimus* Oud.), *itofa* (*Cercocebus albinos*), *elenga* (*Allenopithecus nigroviridis* Poc.), and *eja* (chimpanzee).

There had been no recognized epidemic of pox-like disease among the monkeys nor evidence of high mortality. It was noted, however, that predators quickly eat dead monkeys so that even if a number of monkeys had died, this might not have been noticed by the villagers.

To determine whether monkeypox virus infection was prevalent in the area, 25 animals were examined, as shown in the following tabulation.

Type of monkey	Number examined
<i>Cercopithecus ascanius</i>	5
<i>Cercopithecus mona wolfi</i> Meyer	3
<i>Colobus badius</i> Kerr	8
<i>Colobus polykomos</i> Zimm.	6
<i>Cercocebus aterrimus</i> Oud.	2
chimpanzee	1
Total	25

No monkey had a rash of any kind or pox marks that could be considered to have resulted from a pox illness. Sera were obtained from several monkeys and specimens of kidney, liver, and spleen were taken from nine. Samples were frozen in liquid nitrogen and sent to the WHO Smallpox Reference Laboratory in Moscow. Results of these studies are

presented separately (Marennikova et al., 1972). Another group of 40 monkeys was examined by one of us (E. K.) during late December 1970; all appeared normal except that the skin of one monkey showed unusual pigmentation, but the cause of the pigmentation was not clear.

Monkeys in the territory are continually hunted as a source of food and money. Meat from the monkeys is usually eaten in the form of a stew and is also smoked and sold in local markets. Since the monkeys are so much hunted by the local inhabitants, they usually keep some distance from the villages. At the time the authors were visiting one village a hunter brought in some monkeys that he had killed, and children immediately gathered round the monkeys and began to play with them. Thus, if any of the animals had been suffering from an illness caused by a poxvirus, the virus could easily have been transmitted to the children as well as to adults who prepared the animals for eating.

Contact between monkeys and patients suffering from smallpox is also possible. The local inhabitants informed the investigators that those who are very sick are sometimes isolated in remote areas of the forest. Food is left some distance from the patient and its delivery announced by drum beats. If a smallpox patient died, curious monkeys would investigate the isolation camp and come into physical contact with the corpse.

From all of the many persons interviewed, only two reports of a pox-like disease in monkeys were obtained. A missionary who has lived for more than 30 years in the Congo reported that during the outbreak of smallpox in the Waka-Bokeka region in 1968, a monkey (*Cercopithecus mona wolfi* Meyer) was killed in the forest within 10 km of Bokenda village. He stated that the whole body of this particular monkey, especially the head, was covered with a rash, which both in character and distribution resembled smallpox in man. He also stated that this was the only occasion on which he had seen a monkey with an eruption of this type. A sanitary technician said that he also had seen a monkey with rash. This animal was killed in 1969 near Bokenda village where the patient A. I. lived.

DISCUSSION

Regrettably, only limited clinical information regarding A. I.'s illness could be obtained. It is significant, however, that the eruption was sufficiently similar to that of smallpox to cause the physician at the hospital to take specimens for laboratory

diagnosis. Such specimens are being submitted with increasing frequency from medical services throughout the Congo in conjunction with the developing surveillance programme of the national smallpox eradication campaign. During 1970, 40 specimens were submitted from the Congo from which viruses of the variola-vaccinia-monkeypox group were recovered by the WHO Smallpox Reference Laboratory. All isolates except that obtained from A. I. were classical variola strains (Marennikova et al., 1972).

As with the other cases that have been reported subsequently (Foster & Lourie, 1971), no specific contact either with a monkey known to be infected or with a human case could be identified although, as in the other cases, the patient lived in dense tropical rain forest where monkeys are frequently eaten. No further transmission of the infection was evident, either in the village or in the hospital. However, because of the very high level of vaccination immunity in this population, it is entirely possible that the patient was not in effective contact with susceptible persons.

The two reports, both made in 1968, of monkeys with a smallpox-like illness are of some interest since that was the year when a smallpox outbreak

occurred in the area. It has been shown experimentally that monkeys can be infected with variola virus and that some species at least will have an associated rash (Noble & Rich, 1969). Mack & Noble (1970) demonstrated that this may also occur occasionally under natural circumstances when monkeys are in close association with man. However, it is questionable whether these observations have relevance to the illness that A. I. experienced 2 years later. Present evidence indicates that although monkeys can be infected with variola virus, continuing transmission of infection is not sustained. Moreover, the monkeypox virus is distinctly different from the variola virus and the possibility of one becoming transformed into the other has not so far been demonstrated experimentally (Marennikova et al., 1967; Dumbell, personal communication) nor does this seem likely from what is known at present about the behaviour of this group of viruses.

The significance of the observations described here and of the occurrence of other illnesses caused by monkeypox virus in widely scattered areas of Africa during 1970 is not clear at present. Further observations both in the field and in the laboratory are required.

RÉSUMÉ

INFECTION HUMAINE CAUSÉE PAR LE VIRUS DU MONKEYPOX DANS LE TERRITOIRE DE BASANKUSU (RÉPUBLIQUE DÉMOCRATIQUE DU CONGO)

Un jeune enfant âgé de 9 mois, habitant dans le Territoire de Basankusu (République du Zaïre), a présenté en août 1970 une maladie éruptive ressemblant à la variole. L'examen au laboratoire de prélèvements de croûtes a permis d'isoler un virus similaire, sinon identique, au virus du monkeypox.

L'enquête menée à cette occasion a montré que l'enfant n'avait eu, pendant le mois précédant sa maladie, aucun contact avec une personne présentant une éruption. Le

jeune malade n'avait pas été vacciné contre la variole, mais ses proches parents étaient porteurs de cicatrices de vaccination et la très grande majorité des habitants des villages où il avait séjourné avaient été également immunisés ou présentaient des traces d'une atteinte variolique antérieure. On n'a observé aucune transmission de la maladie à l'entourage du malade. Un contact éventuel entre le jeune patient et les singes, nombreux dans la région, n'a pas été démontré.

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