ACTINOMYCETOMA PEDIS DUE TO *NOCARDIA CAVIAE* IN INDIA

(Report of three cases)

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Summary

Actinomycetoma pedis due to Nocardia caviae in two male cultivators, a Bengalee and a Bihari, and a Bengalee house wife are described. In all the cases there was swelling of foot with multiple nodules and discharging sinuses showing protuberant openings and area of fibrosis. The discharging sinuses contained white to cream yellow granules, measuring 100-600 μ in size and composed of hyaline cementing matter and Gram positive and non-acid-fast to acid-fast branched filaments, $< 1\ \mu$. Nocardia caviae was isolated from the discharge in all 3 cases. Various properties of the isolates are presented. Bone was involved in 2 cases. The infection followed trauma in all the cases. The local soil was the source of infection.

The infection in the middle ear of guinea pigs caused by Nocardia caviae (N. caviae) was reported by Snijders[1]. Though Erikson[2] treated N. caviae as a distinct species, there was no further isolation and identification of this actinomycete uptill 1962. In that year Gordon and Mihm[3] identified an isolate from a case of mycetoma as N. caviae. This was followed by reports of cases of actinomycetoma caused by N. caviae in Indonesia[4], Tunisia[5] and Japan[6].

Lately, cases of actinomycetoma due to N. caviae have been reported in Mexico[7], India[8,9,10], Europe[11] and U. S. A.[12,13]. Nocardia caviae is known to infect dog[14], dolphin[15], goat[16] and baboon[17].

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This paper presents 3 cases of actinomycetoma pedis caused by N. caviae, and various properties of the isolates.

Report of Cases

The case histories are presented in Table I. Case 1 (Fig. 1) was referred to us from Calcutta Medical College Hospital, Calcutta, and cases 2 (Fig. 2) and 3 from the out patients' clinic of the Department of Dermatology, Calcutta School of Tropical Medicine, Calcutta for investigation. Cases 1 and 3 had contact with cattle, and all the patients had worked barefooted. None of the patients' family members had any disease similar to those of the patients'.

Microbiology

The sinuses and nodules were cleaned with 70 per cent ethanol. The discharge was collected in petri dishes, containing 25 ml of physiological saline to search for macroscopic granules; mounted in 10 per cent potassium hydroxide (KOH), smeared and stained

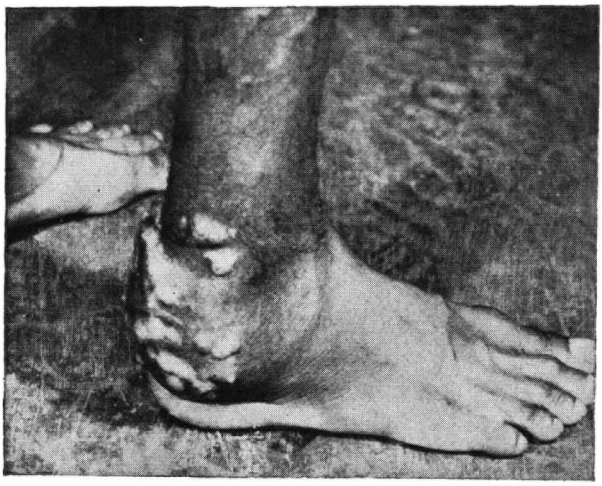

Fig. 1 Actinomycetoma caused by *Nocardia caviae* in a 35-year-old Bihari cultivator, 3 years duration; case 1.

with Gram and Kinyoun acid-fast stains for microscopic examination of granules and filaments. The discharge was also directly inoculated into 4–8 slants each containing Sabouraud's dextrose agar (SDA) and brain heart infusion agar (BHA) and incubated at 30°C and 37°C.

The isolates, obtained in culture, were checked for purity and subjected to a battery of tests to determine their cultural, morphological, biochemical and physiological properties. The methods used for the study were those of Gordon and Mihm[3] and Gordon[18], and Thammayya et al[8]. The colour of pigments of the cultures was determined according to Rayner[19]. The actinomycetes were identified after comparing them with the species of Nocardia according to Gordon and Mihm[3].

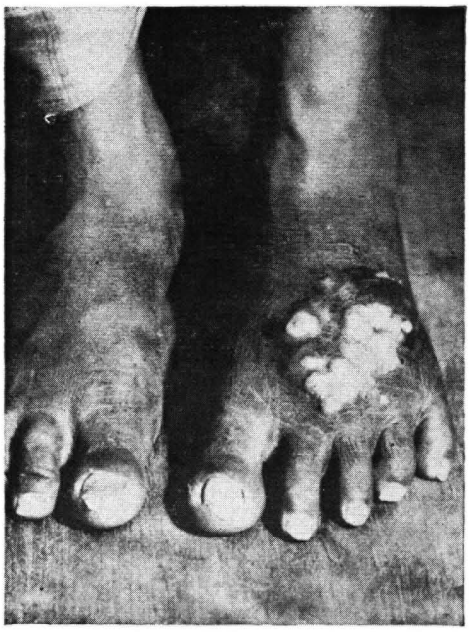

Fig. 2 Actinomycetoma due to *N. caviae* in a 25–years-old Bengalee house wife, 4 months duration, case 2.

Results

The results of macroscopic and microscopic examination of the discharge, granule morphology (Fig. 3) and cultural study are presented in Table I. Nocardia caviae (Fig. 4) was isolated from all 3 cases and in all the inoculations on both SDA and BHA. The cultural and morphological properties of the isolates are presented in Table II and their physiological and biochemical properties in Table III. The isolate ST 342-75, from case 1, showed sectors of saffron (13f) and apricot (7d) coloured growths; and the variants, on separation and subsequent tests, showed identical biochemical and physiological properties.

Discussion

The cases which presented with actinomycetoma showed involvement of whole foot and ankle. The presence of white to cream yellow granules, measuring 100 to 600 and composed of hyaline cementing matter, and presence of Gram positive, non-acid-fast

TABLE I

The Clinical Histories, Radiology and Mycological Examination of Actinomycetoma Pedis Cases

Caused by NOCARDIA CAVIAE

Case	Sex/age(yrs) Occupation Residence	Clinical History				Radiology	Mycology		
		Site	Clinical features	Duration	Previous injury		Direct Microscopy		
							KOH	Gram	Acid-fast
1	M/35 Cultivator Singbhum Bihar	Right foot including heel and ankle (fig 1)	Swelling, multiple, prominent nodules and discharging sinuses with protruded mouth, fibrosis. Sanguinopurulent discharge with minute, white grains. Pain and tenderness. Two inguinal lymph nodes of same side enlarged, discrete, non-tender. No constitutional symptoms.	3 yrs	Thorn prick 8 months before onset	Soft tissue swelling, demineralization of tarsals, exostosis from and dense calcification of talus, no osteolysis.	White irregular, lobulated, vermiform, 100 μ, 150 × 60 μ to 300 × 40 μ granules, composed of hyaline, cheesy cementing material and refractile branched filaments, < 1 μ	+	+

2	F/25 Cook Howrah West Bengal	Dorsum of left foot (fig. 2)	Irregular swelling; multiple painless, nontender, large nodules and discharging sinuses with swollen, protuberant openings; raised and depressed scars. Seropurulent and sanguinopurulent discharge containing white grains. Regional lymph nodes not palpable. No constitutional symptoms.	4 months	Fish bone prick 2 months before onset	No bone changes	Granules white to creamy, lobulated to irregularly elongate, margin entire, 200 μ, 200 × 150 μ to 300 × 200 μ composed mostly of cheesy matter and scattered, hyaline, refractile, short to long branched filaments with and without swollen ends, < 1 μ, (Fig 3).	+	+
3	M/28 Cultivator 24 Parganas West Bengal	Whole of Rt. foot	Whole of the foot markedly swollen with multiple, large nodules and discharging sinuses with raised border of the openings and fibrosis at places. Discharge sanguinopurulent with small, white to cream yellow grains. Throbbing pain and irregular fever during suppuration of nodules. Regional lymph nodes not palpable.	2 yrs	Cut with a stone chip 3 months before onset	Bone destruction wih osteoperiosteitis	Granules white to cream yellow, long, lobulated, lunular to vermicular with entire margin, 150 μ, 400 × 200 μ to 600 × 400μ, composed of cheesy matter and hyaline, refractile branched filaments, < 1 μ,	+	—

TABLE 2

The morphology and cultural properties of Nocardia caviae isolated from 3 cases of actinomycetoma pedis

Property	Isolate number		
	Case 1	Case 2	Case 3
Mycelium	+ (present)	+	+
Permanent mycelium	+	+	+
Rods and cocci	+	+	+
Aerial mycelium	±	+	+
Spores	— (absent)	—	—
Colony margin asteroid	+	+	+
Elevation	+	+	+
Colony pigment	Pale luteus (17f) Salmon (13'f) to Peach-apricot (7d-9'b)	Salmon (11d)	Salmon (9'f) Salmon-flesh (9'f-7'f)
Reverse colony	Ochreous (13'b) to Apricot (9'b)	Light orange (13b)	Ochreous
Diffusible pigment	—	—	—
Easy to emulsify	—	—	—
Suspension course	+	+	+
Melanin pigment	—	—	+
Growth on :			
Sabouraud's dextrose agar	Good	Good	Good
Nutrient agar	Poor	Poor	Poor
Optimum temperature	30°C	37°	30°C

TABLE 3

The physiological and biochemical properties of N.caviae isolated from the 3 cases of actinomycetoma

Property	Isolate number		
	Case 1	Case 2	Case 3
Acid-fastness	+ (positive)	±	— (negative)
Growth on paraffin	++++ (strong)	++++	++++
Hydrolysis of adenine	+ (weak)	—	—
aesculine	+++	+	+
Casein	—	—	—
gelatin	—	+	+
starch	—	—	—
tyrosine	+	—	+
xanthine	+++	+++	+++
urea	+	+++	+++
Nitrate reduction	+++	—	++
Acid from adonitol	—	—	—
arabinose	+	—	+
galactose	—	—	—
glucose	++++	++++	++++
inositol	+++	+++	+
lactose	—	—	—
maltose	—	+	—
mannitol	—	++	++
mannose	++	+	+
rhamnose	—	—	—
sorbitol	—	—	—
sucrose	—	+	—
trehalose	—	+	—
xylose	+	—	—
control	—	—	—

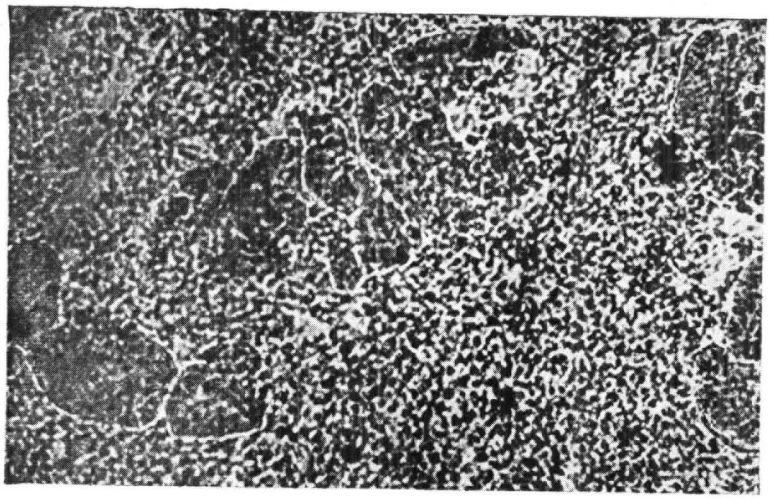

Fig 3

Nocardia caviae, from case 1, on Sabouraud's dextrose agar at 30°C, 21 days old, X 2.

to acid fast branched filaments, $< 1\mu$, is a consistent feature of actinomycetoma due to N. caviae. Based on the morphological, biochemical and physiological properties of the cultures, the isolates were identified as N. caviae (Erikson Gordon and Mihm). The isolate from case 1 exhibited cultural variability, a feature common to actinomycetes[2]. The organisms had affected bones of the feet in 2 cases.

As observed in our previous cases of actinomycetoma due to Nocardia asteroides[21], Nocardia brasiliensis[22] and N. caviae[8], and unlike in eumycetoma cases[23,24,25], the nodules in the present cases were markedly large and prominent and the sinus openings were swollen and protuberant with raised borders.

The infection had followed injury in all 3 cases. This might have facilitated the entry of the organism present in the soil[26,27].

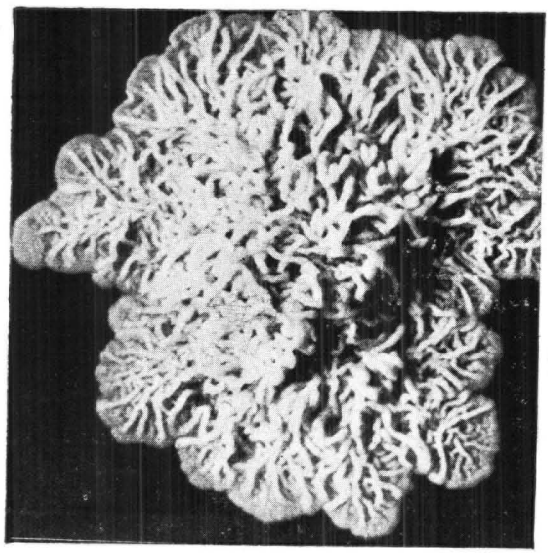

Fig. 4 *Nocardia caviae* granules in discharge, case 2, 10 percent KOH, X 60.

Though the first case of this infection was known as early as in 1924, only lately have there been world wide reports on this infection in man and animals. Thus the disease seems to be cosmopolitan in distribution.

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