A RECORD OF RHINOSPORIDIAL POLYPI WITH SOME OBSERVATIONS ON THE MODE OF INFECTION

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AFTER the recent publication of 60 cases of rhinosporidiosis by Allen and Dave (1936), this review of my 48 cases collected during the past five years would be of little interest, had it not been for the fact that (1) my cases have been collected from areas of infection which fall in four distinct groups and (2) that a common causal factor of infection is in evidence in all of them.

Ashworth (1923) has concluded that the mode of infection remained undetermined. Allen and Dave (1936) have not been able to discover a common causal source of infection in their 60 cases.

I have tried here to establish, by review and illustrations of case records, that the infection as seen in Poona is 'water-borne'. The cases reviewed are from two districts, Poona and Satara. Two areas of infection have been investigated and the source of infection in the other two is made evident from the review of case records detailed herein.

The first out of the series of my cases in which the rhinosporidium was identified was a polypus removed on 6th February, 1931, from case 1, G. T., a sand-worker.

Group I, Poona.—Source of infection: portion of the river Mula-Mutha between the Holkar bridge and the Jamsetji Bund.

(*Continued from previous page*)

and was evanescent; on some days even the glands in the neck were scarcely noticeably enlarged.

Another clinical feature was the behaviour of the spleen. In the interval between febrile attacks it was usually just palpable; it began to enlarge just before the temperature rose and continued to do so with the utmost precision by half to three-quarters of an inch a day; with the fall of the temperature it again subsided.

The blood picture gave no assistance: the very marked large mononuclear increase is not a common feature of this disease, nor is the low eosinophil count. The diagnosis was, however, confirmed by the histological section of the gland removed at the time of death; in this the picture was typical of the condition.

Our thanks are due to Captain C. L. Pasricha for his advice and the assistance of his department in the bacteriological examinations, and to Professor M. N. De for his report in the sections of the gland and for the four excellent photomicrographs of these sections, over which he took considerable trouble personally.

An occupational disease

During the succeeding two years, *i.e.*, up to February 1933, eight more rhinosporidial tumours were collected. All the men were 'sand-workers' engaged in collecting sand from the river bed. A common causal factor was at once evident. On 26th August, 1932, case 8, A. K., a carpenter, was seen with a rhinosporidial tumour. He was discovered to have been a sand-worker previously. At this time the mode of infection was not unnaturally thought to be in the peculiar type of work in which these men were engaged, that is, that of collecting sand from the river bed. The disease appeared to be an occupational one.

The portion of the river Mula-Mutha used for the collection of sand lies to the north of the city, between Jamsetji Bund two miles from the Sungum, and the village of Dapodi about the same distance from Kirkee. The men work in groups of 4 to 20 in one area, known as a 'plot', for 2 to 8 hours a day, eight months in the year. About 200 men are engaged in the occupation, but not more than a hundred are engaged in one season, the bigger groups being situated between the Bund and the Holkar bridge, a mile and a half from the Sungum up the river.

In order to ascertain the extent of infection amongst the sand-workers commencing on 10th March, 1933, 55 men were examined.

	All cases	Infected
Number examined ..	55	10
Ages, years ..	20 to 40	..
Period engaged, years ..	1 to 14	2 to 7 (except 1)
Hours of work ..	2 to 6	..
Nature of work—		
Carters	10	..
Divers	45	10
Habits—		
Smokers	23	2
Non-smokers ..	16	7
Not noted	16	1

In 14 cases other nasal diseases were present and 10 had chronic catarrh; none of the latter group had rhinosporidial infection.

The men were mostly Bhois or Mahrattas, but there were four Kolis (fishermen) who, though engaged in the work all their lives, were not infected.

None of the members of the families of the workers was infected.

Infection rate in the sand-workers is about 1 : 5.

By the end of the year 1933, 16 tumours had been collected. Case 15, D. I., a farmer, was noticed to have been infected on the work during the first season's diving. Tumours from case 10, C. N. M., a mason, and case 16, S. I., a *mali*, at Yeravada could not however be traced to this occupation, although there was a probability of the infection coming from the same

source, owing to the use these men made of the area for the purpose of bathing and swimming.

Case 10.—C. N. M., aged 40, a mason, had a rhinosporidial tumour growing from the left olfactory sulcus which was removed on 10th March, 1933. He had never been a sand-worker, but he bathed and often swam in the river between the Bund and the Sungum. The tumour recurred and was removed again on 18th May, 1934.

Case 16.—S. I., aged 30, a mali, rhinosporidial tumour growing from the floor and the left inferior turbinate removed on 6th December, 1933. He was a resident of Belapur and worked as a gardener in a bungalow on the Bund garden road. He was never in the sand-working business, but swam behind his master's bungalow.

Group II, Manchar.—Source of infection: tank to the west of the town.

A polypus removed on 8th January, 1934, from case 17, C. B., aged 25, a merchant, from Manchar was the first indication of the existence of the disease in the neighbourhood of Poona.

He also offered the useful information that some more residents of Manchar were similarly affected, and that all of them, including himself, frequently used an old tank in the town for swimming and bathing.

Manchar is situated on the right bank of the Ghodnadi river, about 12 miles north of Khed and 37 miles north of Poona. It is a market town with a population of about 4,000. To the west of the town, beyond a watercourse, is a reservoir about 25 yards square with two flights of steps leading to the water. The west wall has a niche ($3 \times 2 \times 6$ feet) with carved side posts and sculptured foliage. Within the niche is a much-worn Devnagari inscription difficult to read. A separate well nearby is reserved for obtaining drinking water.

A brook running north to south, which is nearby, is also used for swimming, when full, in the rainy season.

On 26th January, 1934, at this source of infection I collected three specimens and examined 32 bathers in the tank. The tumours removed were from cases 19, 20 and 21. In all, five cases of rhinosporidial infection were observed, one being an eye infection.

All persons examined were students. The duration of infection was between 1 to 2 years.

Infection amongst the bathers was 1 : 8. All were males.

My thanks are due to Dr. M. G. Bhave, medical officer in charge of the charitable dispensary at Manchar, for permitting me to operate at the dispensary and for the help in conducting the investigation.

Case 28.—H. K., aged 23, a merchant, had the rhinosporidial tumour removed on 25th January, 1935. Tumour growing from the floor of the left nostril. Duration of symptoms, one year. Nine months before he had stayed at Manchar for four months. During his stay there he used frequently to swim in the tank.

Case 38.—S. G. K., aged 26, a hawker in bangles. Operation on 7th August, 1935, for a rhinosporidial tumour on the floor of the right nostril. He had stayed at Manchar two years ago for three months and used to swim in the tank then. Symptoms of epistaxis for the past six months only. A very vascular tumour had been removed previously elsewhere.

A water-borne disease

It had now become evident that the disease as it appeared in Poona was no longer limited to the sand-workers. Could there not be some factor common to both Poona and the Manchar cases? The sand and the fish as a source of infection, not found in the tank at Manchar, were ruled out. The silt and the mud perhaps, but the water, the stagnant water, certainly was essentially the same in these two places.

The water in the tank at Manchar was stagnant throughout the year, excepting an occasional overflow in the rainy season. The water in the Mutha river beyond the Sungum was dammed across by the Jamsetji Bund about 2 miles down the river. In spite of the sluices in the Bund, silt and sand accumulated in the bed of the river. There was water stagnation to a great extent.

Some cases illustrating the water-borne nature of the infection in the Poona group, in persons other than the sand-workers :—

Case 33.—D. N., aged 20, a peon, tumour removed from the right side of the septum on 15th May, 1935; used to swim in the river behind the Maharaja of Kolhapur's bungalow.

Case 39.—G. B., aged 17, a potter, bathes in the river above the Sungum and collects mud and earth from the river bed for making bricks. Rhinosporidial tumour removed on 25th September, 1935, from the left side of the septum.

Case 40.—B. J., aged 25, a Bhoi, fisherman. Tumour removed from the spur on the right side of the septum on 1st November, 1935. Once removed three years ago. Bathes and swims near Sungum.

Group III, Satara.—Source of infection: three tanks in the city, Mangalwar, Machi and the municipal tank.

The suspicion aroused regarding the water-borne nature of the infection was brought a step nearer conviction by the appearance of this group of cases. The first to come under notice was case 22, S. R. K., a student, seen on 20th April, 1934, with a rhinosporidial polypus arising from the floor of the left nostril. Case 24, S. D. G., a teacher from Yawatmal in the Central Provinces, followed on 11th May, 1934. The infection was traced to the source at Satara, which place he often visited during holidays. Case 26, B. J., a clerk, had his polypus removed on 17th October, 1934. Suffered from attacks of epistaxis for three years. He gave a history of exposure to infection at Satara seven years previous to the appearance of the symptoms. Case 22 brought his brother, case 27, D. R. K., also infected at Satara, for operation on 23rd November, 1934, thus completing my first five cases from this group. They were all used to bathing and swimming in one or more of the three infected tanks in that city.

Case 25.—N. N., aged 19, rhinosporidial polypus growing from the junction of the septum and olfactory sulcus left side. Operation on 15th June, 1934. Till last year bathed in Phutka tank, now bathes in the municipal tank, Satara.

Case 26.—B. J., aged 25, a clerk. Growth in the right nostril growing from the olfactory sulcus. Presence of the growth noticed for one month. Exposed to infection one year ago. Previously once operated on for epistaxis, three years previously a vascular growth had been removed. He had been exposed to infection seven years before. Now resident of Poona.

Satara is 69 miles by road to the south of Poona, situated on a slope below a range of hills which form a semicircular girdle round a recess, with the fort on the south and the Yawateshwar hills on the west. All drainage goes to the Yenna on the north by means of brooks rising from the hills on three sides. The city has several wells and tanks. Many of the tanks have now dried up. The three tanks to which the infection is traceable are constantly in use for the purpose of bathing and swimming, particularly in the hot weather.

The largest and the oldest is the Mangalwar or Shripat tank to the west of the city. The Phutka *talao* is in Machi *peth* near the foot of the hills and the municipal tank in Bhavani *peth*, though smaller, is very popular. The students in particular use this, because it is near the school and more central. The extent of infection in the swimming population was not investigated, but from the survey of cases the source of infection can be quite definitely traced to these tanks.

Group IV, Oundh and Yelliv.—Source of infection : old wells in the respective places.

In order to complete the record, three cases are included in this group provisionally, case 13 seen on 30th June, 1933, from Khamgaon in Bhimthadi subdivision. The village has not been traced and is included in this group for convenience.

Case 44.—K. A. G., aged 16, a student, rhinosporidial growth removed on 18th March, 1936, from right inferior turbinate. History of swimming in old well in the village of Yelliv and a tank at Oundh. He knows of some more persons with such growths using the well and the tank.

Case 45.—B. S., aged 22, a goldsmith, rhinosporidial growth in nose removed on 12th June, 1936. He visits Oundh every two or three months, and swims in the tank whenever he visits Oundh. He also visits Satara and used the Mangalwar tank a year ago once. He is a resident of Poona but never bathes in the Sungum area.

Summary of the case records

Forty-eight cases examined and treated from 6th February, 1931, to 25th October, 1936.

TABLE

	I	II	III	IV	TOTAL
Number of the group					..
Name of the group	Poona	Manchar	Satara	Oundh and Yelliv.	
Place of infection	River Mula-Mutha, near Sungum.	Tank west of the city.	Three tanks	Old wells	..
Number in each group	25	8	12	3	48
Site of infection—					
Olfactory sulcus	5	..	2	..	7
Septum	4	4	3	..	11
Floor of nose	1	3	2	1	7
Turbinal bones	3	..	5	1	9
Not mentioned	12	1	..	1	14
Pathological diagnosis	20	8	11	3	42
Clinical diagnosis	5	..	1	..	6
Occupation—					
Sand-workers	18	..	..	..	18
Students	..	5	6	1	12
Others	6	3	5	2	16
Not known	1	..	1	..	2

REMARKS.—The duration of the disease was up to seven years. The symptoms appeared from within a year to several years after exposure to infection. All persons infected were males.

Outstanding signs, symptoms and treatment

Epistaxis, the presence of a strawberry red growth, and nasal obstruction are the three outstanding symptoms. When the tumour is deep in the nose, epistaxis is the first symptom. Obstruction is usually the last. The sand-workers complain of inability to remain under water long enough, even with very small growths. Unlike ordinary nasal polypi these growths never cause a 'frog-nose'. Sessile growths have often a linear attachment of a mucous fold from which they grow into the cavity of the nose. Treatment is surgical. The knife is used after localizing the attachment. Allen has tried neostibosan with variable results. A rapid diagnosis is arrived at by dropping the polypus in Zenker's fluid; hundreds of tiny leaflets stand out from the surface of the polypus in a few minutes, the red colour changing to ash-grey.

Conclusions

In the cases so far recorded from elsewhere no common cause of infection has been noted. From the review of cases recorded here it is clear :—

(*i*) that the rhinosporidial infection in Poona and the neighbourhood is localized to areas divisible into groups,

(*ii*) that the infection in these groups is localized to infected water of the wells, tanks, or an infected section in the course of a river,

APPENDIX I

List of rhinosporidial polypi removed from 6th February, 1931, to 25th September, 1936

Serial number	Identification, religion and age	Date of operation	Pathological report	Situation	Group	Occupation	Duration, years	REMARKS
				1931				
1	G. T. (H.), ..	6th Feb.	Positive	..	I	S. W.	..	..
2	N. K. (H.), 35	25th Nov.	,,	..	I	Farmer	..	Former S. W.
				1932				
3	S. I. (M.), ..	10th June	Clinical	..	I	S. W.	..	..
4	M. Y. (H.), ..	17th ,,	Positive	..	I	,,	..	..
5	B. K. (H.), ..	15th July	,,	Both nostrils	I	,,	..	Rec. 22-8-32.
6	S. V. (H.), 20	5th Aug.	,,	,,	I	,,	..	..
7	N. Y. (H.), 30	19th ,,	Clinical	..	I	,,	..	..
8	A. K. (M.), 40	26th ,,	Positive	Right nostril	I	Carpenter	..	Once a S. W.
				1933				
9	H. Y. (H.), 25	8th Feb.	Positive	Lt. septum, rt. floor.	I	S. W.	..	..
10	C. N. M. (M.), 40	10th Mar.	,,	Lt. olf. sulcus	I	Mason	2	..
11	M. A. (H.), 27	24th ,,	,,	Rt. nostril	I	S. W.	..	Rec. 18-5-34.
12	B. K. (H.), 16	16th June	,,	Both nostrils	I	,,	..	..
13	K. R. (H.), 32	30th ,,	,,	Rt. floor	IV	Farmer	2	..
14	D. H. (H.), 25	12th July	,,	Both nostrils, olf. sulcus.	I	S. W.	1	..
15	D. I. (H.), 20	30th Nov.	,,	Lt. olf. sulcus	I	Farmer	9/12	Once S. W., now Dahiwadi.
16	S. I. (H.), 30	6th Dec.	,,	Lt. inf. turb. and floor.	I	Mali	5/12	..
				1934				
17	C. B. (M.), 25	8th Jan.	Positive	..	II	Merchant	..	..
18	N. K. (H.), 30	10th ,,	Clinical	Olf. sulc.	I	S. W.	..	..
19	B. M. (M.), 14	26th ,,	Positive	Rt. floor	II	Student	1	Epistaxis.
20	B. M. A. (M.), 12	26th ,,	,,	Junct. rt. sept. and floor.	II	,,	..	Growing backwards.
21	B. K. (H.), 17	26th ,,	,,	Junct. lt. sept. and floor.	II	,,	2	Epistaxis.
22	S. R. K. (H.), 21	20th April	,,	Lt. floor	III	,,	..	Brother of no. 27.
23	B. P. (H.), 25	27th ,,	,,	..	I	S. W.	..	..
24	S. D. G. (H.), 38	11th May	,,	Rt. inf. turb.	III	Teacher	3	..
25	N. N. (H.), 19	15th June	,,	Junct. sept. and olf. sulc.	III	Student	2/12	Both tanks.
26	B. J. (H.), 25	17th Oct.	,,	Rt. olf. sulc.	III	Clerk	1/12	Epistaxis, expose. 10 yrs.
27	D. R. K. (H.), 18	23rd Nov.	,,	Lt. floor	III	Student	..	..
				1935				
28	H. K. (H.), 23	25th Jan.	Positive	Lt. floor	II	Merchant	..	..
29	P. D. M. (H.), 25	22nd Feb.	,,	Lt. med. turb.	III	Student	2	Epistaxis, 1½ yrs.
30	B. K. J. (H.), 26	1st Mar.	,,	Rt. olf. sulc.	III	,,	..	..
31	V. R. (H.), 18	10th April	,,	Lt. sept. ant. end	II	,,	1/12	..
32	H. M. H. (H.), 15	1st May	,,	Rt. septum	II	,,	..	Once pulled in childhood.
33	D. N. (H.), 20	15th ,,	,,	,,	I	Peon	1	..
34	N. K. R. (H.), 40	19th June	,,	Lt. nostril	I	S. W.	7	..
35	A. R. G. (H.), 24	21st ,,	,,	Lt. inf. turb.	III	..	..	..
36	A. G. (H.), 16	19th July	,,	Lt. olf. sulc.	I	S. W.	..	Removed 3 yrs. ago, rec.
37	S. G. D. (H.), 44	26th ,,	,,	Spur on sept. lt.	III	Pr. service	3	Epistaxis.
38	S. G. K. (H.), 26	7th Aug.	,,	Floor	II	Hawker	..	Choking, epistaxis.
39	G. B. (H.), 17	25th Sept	,,	Septum lt.	I	Potter	7/12	..
40	B. J. (H.), 25	1st Nov.	,,	Spur sept. rt.	I	Fisherman	4	..
				1936				
41	B. R. (H.), 25	24th Jan.	Positive	Ant. end lt. inf. turb.	III	Merchant	..	Six times removed.
42	K. V. R. (H.), 25	31st ,,	,,	Ethm. region under mid turb.	III	Med. student.	..	Spider-like.
43	D. N. (H.), 20	6th Mar.	,,	Rt. sept. eroding	I	Pr. service	3	Rec. swims.
44	K. A. G. (H.), 16	18th ,,	,,	Rt. inf. turb.	IV	Student	5/12	..
45	B. S. (H.), 22	12th June	,,	..	IV	Goldsmith	..	..
46	I. S. (M.), 18	4th July	Clinical	..	I	S. W.	..	..
47	B. J. K. (H.), 20	22nd ,,	,,	..	I	..	..	..
48	S. V. (H.), 22	25th Oct.	,,	Rt. septum.	III	Pr. service	4	..

S. W. = Sand-worker. Rec. = Recurrence.

(*iii*) that the infection is transmitted in the process of bathing, swimming or diving, and

(*iv*) that the part played by the fish or other aquatic hosts, if any, is not certain, but the sand and the silt probably help the process of transmission.

Ashworth (1923) refers to direct transmission of discharged spores as an obvious method by which the infection could be spread from man to man. It is here suggested that the spread takes place through the medium of water, possibly stagnant water.

Spores in the trophic stage with a stout chitinoid envelope have been known to exist in the epidermal layer, probably having thrust their way through from the subjacent connective tissue. It is possible to imagine that such spores floating in the infected water similarly find their way into the epidermal layer from without.

The fact that the carters engaged on the sand work are not infected suggests that mere bathing in infected water is not enough. Swimming, which ensures frequent and more prolonged contact with the spores, and diving, which presses the spores against the nasal mucosa by virtue of the force of the dive and the increased water pressure, are necessary for a successful graft or anchoring of the spores. It may even be possible that this force drives the spores through the mucosa from without in the same way as the increased lymph pressure in the connective tissue has been suggested to thrust them from within. The spores are non-motile, and some such external force would seem necessary.

Whether the spores in infected water remain in the trophic stage or whether a flagellate stage exists is not known, nor is it yet certain whether the sporangium is parasitic in any of the aquatic species.

The occurrence of infection in persons exposed to infection varies within a wide range. A few contract the infection within the first year, but the majority appear to resist infection over a period of some years.

Catarrhal and suppurative conditions of the nasal cavity would seem (from group I) to resist infection, possibly on account of the phagocytic action of the inflammatory cells present in the tissues under the mucosa, in such affections of the nose.

R. E. Wright in 1922 suggested the possibility of the transmission of the organism through water, but his cases did not reveal any such common cause. In the cases recorded and grouped as above, a common cause for such a mode of transmission is made evident for the first time.

All the examples of rhinosporidium from man studied so far appear to be referable to one species, the systematic position of which, according to Prof. Ashworth, is referable to the

(*Continued at foot of next column*)

THE BISULPHITE-BINDING POWER OF THE BLOOD IN CASES OF EPIDEMIC DROPSY, ANÆMIA AND MALARIA AND ITS POSSIBLE BEARING ON A VITAMIN-B DEFICIENCY

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PETERS and SINCLAIR (1933) have shown that in pigeons suffering from vitamin-B_1 deficiency the brain, when incubated with lactic acid, produced pyruvic acid in appreciable amount whereas when the brain of normal control birds is substituted this is not produced. Peters and Thompson (1934) further showed that pyruvic acid is probably a normal intermediary in the course of carbohydrate metabolism. In vitamin-B_1 deficiency the metabolism of carbohydrate appears to be held up at the pyruvic acid stage; this leads to an accumulation of this substance. The exact precursor of pyruvic acid and its normal fate, oxidation or re-synthesis, is at present obscure. The fact however of its appearance in the tissue in this condition is all that need concern us in this preliminary report.

This discovery led to an estimation of pyruvic acid in the blood of pigeons suffering from vitamin-B_1 deficiency. Thompson and Johnson (1935) found the blood pyruvate to be increased from a normal value of 3.46 mg. to 11.31 mg. per cent in affected animals. The method they employed, namely, the bisulphite-binding power (henceforth B.B.P.) is not however specific for pyruvic acid, but Johnson (1936) later isolated pyruvic acid as the 2.4 dinitrophenylhydrazone. Platt and Lu (1936)

(*Continued from previous column*)

fungus group of the Phycomycetes, suborder Chytridineæ, and provisionally near the Olpidiaceæ.

It is as yet undetermined whether the organism found in Poona and the neighbourhood, with such strong affinity for water, may not belong to an allied but a separate sub-group of its own.

Compiled from my notes on the cases seen and treated at the Sassoon Hospitals, Poona, and published with the permission of and thanks to the Civil Surgeon, Lieut.-Col. R. H. Candy, I.M.S., Poona.

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