condition although he used to complain frequently of heaviness in the cardiac area and flatulent dyspepsia. A similar but milder attack occurred in 1942; but this time the symptoms of gastric distress were more marked. Treatment was given on similar lines and the condition improved. I however suspected that the gall-bladder was the original cause of the trouble, as it was very tender. The physician-in-charge agreed with me, and on radiological examination it was found to be badly functioning. The electro-cardiogram showed a slight left axis deviation. In this case the most likely primary cause was a pathological gall-bladder and this must have caused some secondary degeneration of the heart muscle.

There seems to be a very close connection between the pathological condition of the gall-bladder and the heart. According to Laird, thrombosis of coronary arteries occurred in 12 per cent of cholecystitis cases, and cholecystectomy cured 78 per cent of 'heart cases' with gall-bladder symptoms. He is of opinion that gall-bladder disease is a definite etiological factor in myocardial lesions; it produces abnormal T wave changes in the electro-cardiogram which disappear after removal of the diseased organ. The incidence of atheroma of the arteries has been found to be high in people with cholecystitis.

Post-cholecystectomy pain is one of the things that causes worry to the patient and also to the surgeon. Usually it remains for about a month or two, although mild in nature. It is usually due to disturbance in the adjustment of the abdominal nervous system caused by the removal of an important organ. In most cases it disappears with a mixture containing a vago-sedative such as belladonna and some alkalis. In some nervous people the pain continues for some months. In two cases small doses of insulin, 10 units daily for about a week, completely cured the patients. One of the causes of persistent pain is supposed to be post-operative adhesions between the duodenum and the raw area left behind on the surface of the liver after removal of the gall-bladder. This can be prevented by covering the raw area with the serous coat dissected off the gall-bladder, but where this is impracticable, the great omentum should be utilized.

EXPLANATION OF PLATE XII

Fig. 1.—Gall-bladder enlarged and having a small papillomatous growth at the fundus.

Fig. 2.—Gall-bladder is atrophied, coat is thickened and changed in colour. The aberrant artery is shown as a branch of the right hepatic artery going along the wall of the gall-bladder and entering the right lobe of the liver: (1) hepatic artery, (2) pylorus, (3) cystic duct, (4) pancreatic duct, (5) pancreas, (6) common bile duct, (7) aberrant branch of hepatic artery, (8) cystic artery, (9) liver.

Fig. 3.—Gall-bladder fibrosed and atrophied. The fundus is slightly buried in the substance of the liver and is firmly adherent to the wall of the duodenum.

Fig. 4.—An enlarged gall-bladder full of adhesions and directly communicating with the common bile duct without the regular cystic duct being present.

Fig. 5.—Skiagram shows two stones, one in the gall-bladder the other in the kidney.

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OCCURRENCE OF FLUOROSIS IN ENDEMIC FORMS IN HYDERABAD STATE*

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ALL animal tissues and plants contain fluorine in very small amounts. It is found in soils, rocks and water.

No convincing evidence has been as yet produced to show that it performs any useful function in animal nutrition, or that it is essential for animal metabolism. During the past 15 years, however, evidence has been accumulated to show that the prolonged ingestion of abnormal quantities produces a chronic toxic state, the earliest visible sign of which is called 'mottled enamel' of the teeth or chronic dental fluorosis. Its most common source is drinking water, and the level above which effects are produced is about one part of a million, equivalent to $\frac{1}{120}$ grain of fluorine to a pint of water. However, it is interesting to note that increased immunity to dental caries is supposed to be associated with an increased intake of fluorine (Wilson, 1941).

The presence of fluorosis in the Madras presidency was investigated first in 1937 by Shortt and others. In 1940, Raghavachari and Venkataramanan recorded the wide distribution of fluorides in the water in the province, and they indicated the districts of Bellary, Kurnool and Guntur as an endemic area. These districts are separated from Raichur, Mahboobnagar and Nalgonda districts of Nizam's Dominion by the river Krishna. This led us to believe that those districts of our Dominion which were adjacent to the Madras presidency might have waters containing fluorine, and that we might find cases of chronic fluorine intoxication. Therefore, while doing nutrition and diet surveys of the districts, we took an opportunity to look for cases of fluorine intoxication and to determine the fluorine content of water used for drinking (*see* Map). In all these districts, well-water contained fluorine ranging from 0.25 part to 4 parts per million, and we came across children

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showing mottled enamel of the teeth. A good many cases of bone involvement and joint affections in elderly people were also seen clinically; unfortunately the diagnosis could not be confirmed by x-ray examination.

Table I shows the parts per million of fluoride content of water in different districts, with their geological strata. The water from these wells is in actual daily use. These wells are mostly dug in rocky strata to a depth of 60 to 80 feet.

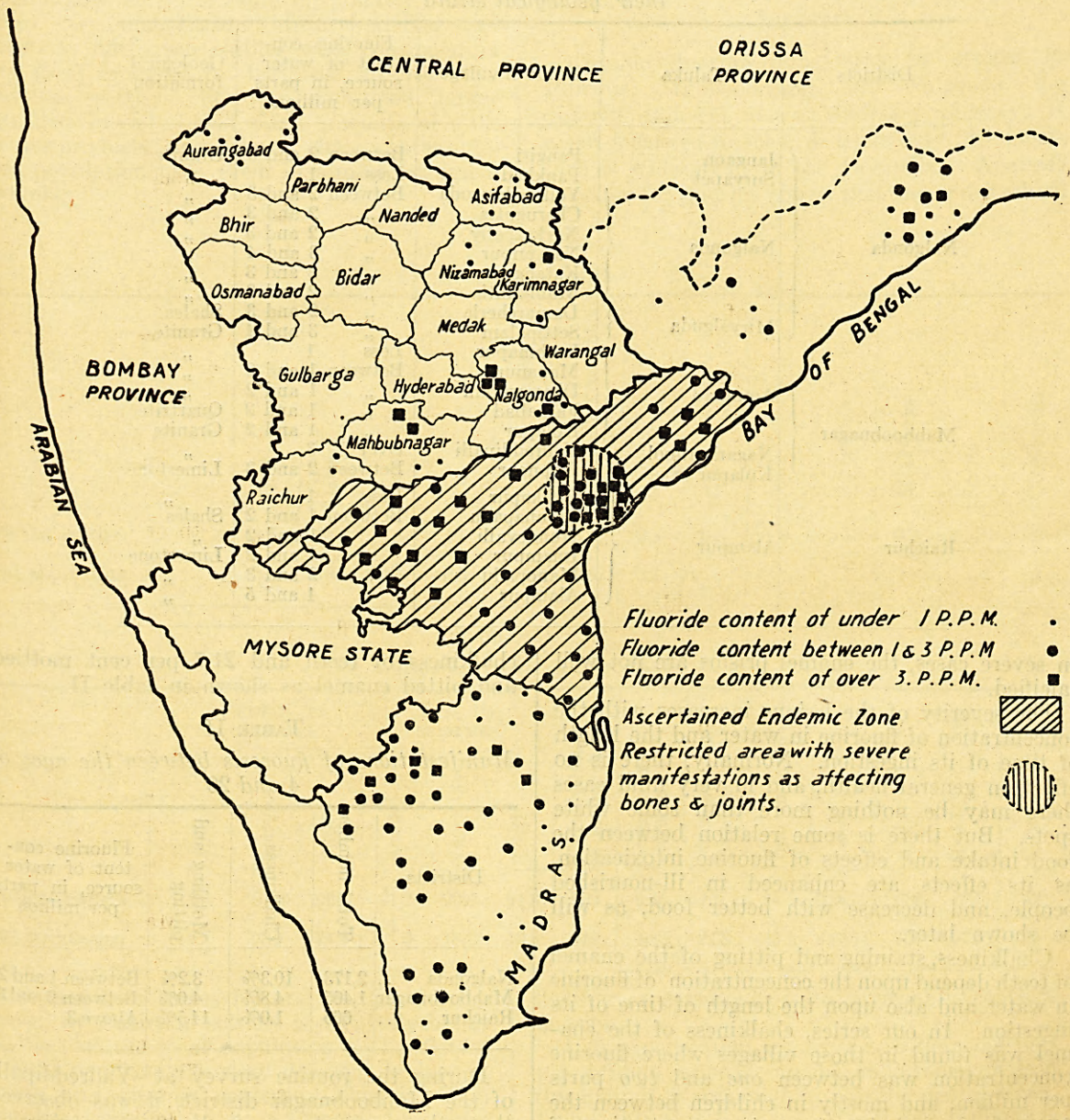
Examination of water from different districts showed that the occurrence of flourine was widespread, and that water flowing over granitoid rocks invariably contained fluorides. These places, with their geological strata, have been shown in the accompanying Map.

Before giving the results of the survey, it will be of interest to define the various appearances of the teeth in chronic fluorine poisoning.

In chronic fluorine intoxication, the teeth and bones suffer most. Mottled enamel is one of the first signs, the outer surface of the front teeth being most affected. Opaque, paper-white patches or horizontal or curved bands begin to appear. Sometimes the whole of the surface of the tooth becomes chalky-white in appearance. The tooth may remain chalky-white, or, later on brown, yellowish, or black marking may appear.

The process is very slow in appearing and in progressing. This sign appears during the period of calcification of the enamel of teeth, in those who reside in an area where the fluorine

Map showing fluoride content of water in the different parts of Hyderabad and South India.



content of water is well over the threshold level, that is, above one part per million. As the condition progresses, pits appear.

Histologically, it is said that there is a lack of cement substance between the enamel rods. In severe cases, the enamel prisms are not well calcified.

The severity of the lesions increases with the concentration of fluorine in water and the length of time of its ingestion. Normally, there is no effect on general health, and in very mild cases there may be nothing more than some white spots. But there is some relation between the food intake and effects of fluorine intoxication, as its effects are enhanced in ill-nourished people, and decrease with better food, as will be shown later.

Chalkiness, staining and pitting of the enamel of teeth depend upon the concentration of fluorine in water and also upon the length of time of its ingestion. In our series, chalkiness of the enamel was found in those villages where fluorine concentration was between *one* and *two* parts per million, and mostly in children between the ages of *six* and *fourteen*. A concentration of *two* parts per million and over induces first deeply-stained and later on pitted enamel, mostly seen between the ages of *sixteen* and *twenty*. But it was surprising to find that these various changes in teeth were seen in persons up to the age of *thirty;* after this age these tooth manifestations were not seen, even though they were inhabitants of the place for more than forty years. Does this mean that this sign disappears as age advances? This point needs further investigation.

The total number of children and adults examined between the ages of *four* and *twenty,* was 4,243. Out of these, 16 per cent showed chalkiness of teeth and 21.7 per cent mottled and pitted enamel as shown in table II.

TABLE I

Fluoride content (in parts per million) of water in different districts, with their geological strata

Districts	Taluka	Name of village	Fluorine content of water source, in parts per million	Geological formation
Nalgonda	Jangaon	Pangiri	Between 2 and 3	Granite
	Suryapet	Pankhad	Less 1	"
	Nalgonda	Yellareddyguda	Between 2 and 3	"
		Cherugutta	" 2 and 3	"
		Narkatpally	" 2 and 3	"
		Naryanpur	" 3 and 4	"
		Katangur	" 2 and 3	"
		Munikuntla	" 2 and 3	"
	Miryalguda	Damarcherla	" 2 and 3	Shales
		Settipalam	" 3 and 4	Granite
Mahboobnagar	Amrabad	Lachmapur	Less 1	"
		Mananur	Between 1 and 2	"
		Dharawaram	" 1 and 2	"
		Farhabad	" 1 and 2	Quartzite
		Kolapur	" 1 and 2	Granite
	Nagarkurnool	Yadreddipalli	Over 3	"
	Kolapur (S)	Kopnoor	Between 2 and 3	Limestone
Raichur	Alampur	Bukkapur	Less 1	"
		Chinnapadu	Between 1 and 2	Shales
		Hundevalli	" 1 and 2	"
		Imampur	" 1 and 2	Limestone
		Manopadu	" 2 and 3	"
		Alampur	" 4 and 5	"

TABLE II

Manifestations of fluorosis between the ages of 4 and 20

Districts	Total number	Chalkiness	Mottling and pitting	Fluorine content of water source, in parts per million
Nalgonda ..	2,173	10.3%	3.2%	Between 1 and 2
Mahboobnagar	1,405	4.8%	4.0%	Between 2 and 3
Raichur ..	665	1.0%	14.5%	Above 3

During the routine survey at Yadreddipalli of the Mahboobnagar district, it was observed that the percentage of fluorine intoxication amongst the local population was higher, though fluorine concentration in water was only 1.5 parts per million, whereas the Christian settlers of the same village showed a lower incidence of fluorine intoxication though the water they consumed had a fluorine concentration above 2.5 parts per million. These Christian settlers had been staying in the village for more than two decades.

Socially and economically, the Christian settlers staying in the village were better off; this led us to believe that there would be a corresponding disparity in the state of their nutrition, and we carried out detailed surveys of these two groups.

Diet surveys of both the groups were carried out for seven consecutive days; and it was observed that cereals consumed by both the communities were the same in quantity. Vegetables were almost absent from both the diet schedules, but green chillies were consumed in very good amounts by both the groups. The Christian settlers however consumed larger quantities of pulses and small amounts of milk and its products, and oil and ghee, whereas the local population used them in almost negligible amounts.

TABLE III

Diet in ounces

	Home-pounded rice	Jawar	Italian millet	Pulses	Leafy vegetables	Non-leafy vegetables	Oil	Ghee	Milk	Buttermilk	Meat, eggs	Fruits	Condiments
Christian settlers ..	6.7	14.3	4.5	1.5	0.08	0.01	0.3	0.8	1.0	3.1	0.7	..	2
Local population ..	3.1	18.5	5.5	0.5	0.08	0.02	0.2	..	..	1.7	..	..	2

TABLE IV

The analysis of the above diets

	Protein in grammes			Fats in grammes			Carbohydrates in grammes	Calcium in grammes	Phosphorus in grammes	Iron in grammes	Calories	Vitamins		
	Animal	Vegetable	Total	Animal	Vegetable	Total						A (I.U.)	B (I.U.)	C (mgm.)
Christian settlers ..	9.1	81.2	96.3	21.2	20.4	41.6	592	0.45	1.9	45.4	3,067	1,035	601	62
Local population ..	0.7	73.7	74.4	1.0	18.8	19.8	542	0.32	2.08	43.1	2,635	705	272	53

It is seen from tables III and IV that the diet received by Christian settlers is decidedly better than that of the local population. The diet of the local population is very deficient in its fat, calcium and vitamin contents. Vitamin C in both diets appears to be adequate, but since investigations were carried out during winter, its adequacy was maintained by green chillies alone, as the amount of leafy and non-leafy vegetables taken is almost negligible. During other seasons, dry chillies take the place of green ones, and this would necessarily lower the vitamin C intake.

The fluorine content of water consumed by the Christian settlers was between 2 and 3 parts per million, and the incidence of fluorine intoxication 10 per cent, whereas the fluorine content of water consumed by the local population was 1.5 parts per million, and yet the incidence of fluorine intoxication was 17 per cent. These facts suggest a relation between better food and lower incidence of chronic fluorine intoxication.

Summary

Chronic fluorine intoxication is present in Raichur, Mahboobnagar and Nalgonda, the districts adjacent to the Madras presidency. It is not localized to these districts only. Its incidence is widespread in the Dominion. Analysis of water for fluorine shows that the water which flows over granitoid strata invariably contains fluorine.

A fluorine content of water less than one part per million appears to be innocuous; within this limit, it is supposed to prevent dental decay. Above this threshold, *i.e.* 1 part per million, it produces various manifestations of chronic fluorine intoxication, which chiefly affect the enamel of teeth and bones. The severity of the lesions increases with the concentration of fluorine in water and the length of time of ingestion.

The incidence and severity of the disease have some definite relation to the economic and nutritional status of the communities.

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LEPTOSPIROSIS WITHOUT JAUNDICE

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THE cases of leptospirosis reported by the writer in previous communications (Lahiri, 1941, 1943) as well as those detected subsequently with the aid of laboratory studies all developed jaundice as an important symptom. Since the disease has been described in textbooks under different names, *i.e.* spirochætal jaundice or infective jaundice (Weil's disease), it is considered that the disease should always be associated with jaundice. It is now an established fact that many cases do not produce icterus at all. According to Schüffner (1934), in more than half of the cases studied in the Netherlands, this symptom was absent. Fletcher (1927) also did not note jaundice in some of his cases of leptospirosis in the Federated Malay States. Taylor and Goyle (1931) in their comprehensive investigation in the Andamans recorded that out of 64 cases observed in 22 there was a total absence of jaundice. In 16 of these cases, however, the diagnosis was confirmed by the demonstration of leptospiræ in blood or urine, and in the remaining 6 the diagnosis was based on clinical grounds alone. Thus, it appears that the clinical manifestation of jaundice in the diagnosis of this infection is perhaps not more important than the appearance of a rash in a case of enteric fever. The non-icteric form of the disease no doubt presents considerable difficulty in diagnosis without laboratory investigations. In the literature, cases without icterus so far have not been recorded in this country. It is obvious, therefore, that unless clinicians are on the lookout for the presence of this form of the disease, such cases will continue to pass unsuspected or will be incorrectly diagnosed. In view of the above fact an account of the following case seems worth reporting.

The patient, a well-built male, was admitted to the hospital for fever, headache and agonizing pains all over the body. He was seen on the eighth day of illness. The history suggested acute onset with rigors, and on examination the pain was noticed over the loins, and the tenderness over the calf muscles appeared to be so marked that with slight pressure the patient cried out with pain. The temperature recorded was 99.2°F. The conjunctivæ were intensely congested. Prostration to a moderate degree was present. Examination of the urine showed the presence of a trace of albumin without casts, and there was a total absence of bile salts and pigments. W.B.C. count 10,600 per c.mm. No malaria parasite was seen.

Although in the writer's experience blood culture was not found to be of any value on the 8th day of illness yet it was done as Das Gupta and Chopra (1937) recorded a case which gave positive blood culture as late as the ninth day of illness. Two tubes of Vervoort's medium were inoculated with 0.1 and 0.2 c.cm. of blood respectively and 2 c.cm. of citrated blood was inoculated intraperitoneally into a young guinea-pig weighing 180 grammes approximately. The tubes failed to show any evidence of growth and the animal also remained well and alive during the observation period of 6 weeks. No leptospiræ could be detected in the peritoneal fluid of this animal. A part of the serum from the same sample of blood used for culture and animal inoculation was put up against a classical strain isolated locally and it reacted to a titre of 1 : 1,280. No further sample of blood or urine could be collected, as the patient left the hospital. The temperature came down to normal on the very day the patient was examined. However, the patient was later seen in his house and the case appeared to be a mild one. Thus the recovery was uneventful.

In this connection Walch-Sorgdrager (1939) pointed out in her monograph that of the cases observed in the Nertherlands, those without jaundice had a more favourable issue than those with jaundice. Only one fatal anicteric case was reported, but even in this, the death was due to a complication.

With a view to shedding further light on the incidence of such forms of infection, samples of sera were examined for the presence of agglutinins against leptospira which were forwarded to this Institute for routine serological tests. These specimens were received from physicians and hospitals from all parts of the city. Only those sera were selected which gave a negative Widal reaction against the enteric group of organisms and in which the clot culture also proved negative. Each serum was put up against three classical strains, two of which were isolated locally, and, for each serum, dilutions ranging from 1 : 10 to 1 : 160 were employed against each antigen. Higher dilutions to detect the end titre were used where necessary. In all, 150 samples of sera were examined, of which only one showed a titre of 1 : 640. This sample of serum was not bile-tinged. The titre obtained is considered as indicating an active infection, and it has been shown that an antileptospiral titre of 1 : 100 is definitely suggestive of infection, since samples of sera from cases in which the disease could be excluded failed to react even in a dilution of 1 : 20 against the classical strains. Further tests were made on 75 samples of sera collected at random from the blood specimens submitted to this Institute for Wassermann reaction (Lahiri, 1942) and agglutinins could not be demonstrated in any except one which gave a doubtful reaction in a titre of 1 : 10 only.

Summary and conclusions

Two cases of leptospirosis without icterus are recorded, the diagnosis being based on serological tests. In one of the cases detected, the serum had been sent for a Widal test, leptospirosis apparently not having been suspected in the absence of jaundice.