

TWO CASES OF ENTERITIS CAUSED BY ASCARIS LUMBRICOIDES.

CASE VII—1896.

DISEASE—ASCARIS LUMBRICOIDES,

Convict No. 2102. Iyappen. Age—22 years. Health—good. Weight—120 lb. Sentence—20 years.

Hospital—24th June 1896.

Month and date.	Particulars of case and treatment.	Diet.
1896.	<i>Previous history.</i> —No previous history of disease except occasional attacks of colic and griping pain in the belly and has passed round worms in his native place. <i>Condition on admission.</i> —He had a temperature of 101°, and bowels irregular, headache and weakness with high-coloured urine, which is scanty. Complained chiefly of pain round the umbilicus and sickness. He was detained on the 23rd June 1896 and given a dose of santonine, and jalap on the following morning when he was admitted to hospital.	
June 24th ...	The temperature will be seen from the chart. His bowels moved six times when he passed three <i>ascaris lumbricoides</i> . He vomited three times and complains of pain in the abdomen. He is weak and exhausted.	Milk, arrack.
„ 26th ...	Fever continues; absence of vomiting, but the griping still continues; urine free and light coloured.	
„ 27th ...	Same condition and santonine is again prescribed. Bowels moved once.	
„ 29th ...	No more worms passed after the ol. ricini had been given in the morning. Fever is still present, which is due to the presence of more parasites or to intestinal catarrh and toxin poisoning. Bowels moved thrice. Santonine is again prescribed.	
„ 30th ...	Fever continues; bowels moved thrice; he passed one round worm; less pain and headache.	
July 1st ...	Same state and weak. The rise of the temperature to 102° was due to the irritation of the ascaris present in the bowel.	
„ 3rd ...	Still weak and complaining of slight pain in the abdomen. <i>Treatment.</i> —Bismuth, salol, quinine.	Milk diet, arrack.
„ 8th ...	Motions non-bile-stained, these being previously watery.	
„ 13th ...	Convalescing.	
„ 16th ...	Convalescent and cured.	

CASE VIII—1896.

DISEASE—ASCARIS LUMBRICOIDES.

Convict No. 2420. Anandan. Age—18 years. Health—good. Weight—94 lb. Sentence—6 months. Hospital—9th June 1896.

Month and date.	Particulars of date and treatment.	Diet.
1896.	<i>Previous history.</i> —Had a previous attack of fever similar to the present, about a year ago, which lasted several months. No other illness to speak of. <i>Present condition.</i> —On admission he had a temperature of 101°; bowels irregular; urine scanty and high coloured. He complained of prostration, headache and pain in the limbs and colic. He was prescribed santonine on the 9th June 1896, and ol. ricini on the following morning when he had several motions, in which were five round worms.	
June 12th ...	Temperature will be seen in the chart. His bowels moved twice and were watery; urine still high coloured and he still complains of colic.	Spoon.
„ 15th ...	Fever continues; frequent motions and still has pain in the abdomen. He is weak and exhausted.	
„ 16th ...	Slight bronchial catarrh and pain in the abdomen. Santonine is again prescribed and also pul. jalap co. next morning.	
„ 17th ...	No worms are noted, but probably those not visible to naked eye have been got rid of. There is also catarrh of the intestinal tract.	
„ 21st ...	Same condition.	
„ 26th ...	Fever continues.	
„ 28th ...	Fever continues; urine is normal.	
July 1st ...	His condition the same, still fever, watery stools containing dirty agar-jelly-looking mucus. <i>Treatment.</i> —Salol, Bismuth, Dover's powder and quinine. Motions are bile-stained, is weak and exhausted.	Spoon diet, milk, arrack.
„ 3rd ...	Improving.	
„ 8th ...	Improving.	
„ 13th ...	<i>Treatment.</i> —Tonics.	
„ 16th ...	Convalescent and cured.	

II.—MALARIA, ANKYLOSTOMA DUODENALE, ASCARIS LUMBRICOIDES.

RAJAHMUNDRY CENTRAL JAIL.

THE object of this part of the paper is to examine and, if possible, elucidate the causes which have led up to the periodical outbreaks of sickness that have from time to time occurred among the prisoners confined in the Rajahmundry Central Jail. The health of this jail has been for several years unsatisfactory.

It is a significant fact that the occurrence of *ankylostoma duodenale* in the Rajahmundry Central Jail was discovered in the year 1887 by Assistant-Surgeon Hadden. This was the year

TWO CASES OF ENTERITIS CAUSED BY ASCARIS LUMBRICOIDES.

CLINICAL CHART OF TEMPERATURE, &c.

No. 2102 Name—Ayyappan.

Age—22 Years.

Disease—Ascaris Lumbricoides.

Result—Cured.

Date	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14						
	M. E.																										
TEMPERATURE, FAHRENHEIT'S SCALE.	103°	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	TEMPERATURE, CENTIGRADE SCALE.
	102°		39°				
	101°			38°			
	100°				37°		
	99°					36°	
	98°						36°
	97°						
96°	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Pulse.	M.	80	76	80	80	80	72	76	72	78	76	72	74	72	72	72	72	72				M. } Pulse. E. }					
	E.	76	80	110	112	76	72	96	112	106	80	78	72	72	72	72	72	72									
Resp.	M.	20	18	20	20	20	18	20	18	20	18	18	18	18	18	18	18	18				M. } Resp. E. }					
	E.	18	20	20	26	18	18	18	18	22	20	20	18	18	18	18	18	18									
Motions.		1	1	1	1	3	2	2	2	2	2	2	2	2	2	2	2	2				Motions.					
Urine, ozs.																						Urine, ozs.					
„ Sp. Gr.																						„ Sp. Gr.					
„ Reaction.																						„ Reaction.					
„ Chlorides																						„ Chlorides.					
„ Albumen.																						„ Albumen.					
Day of Dis.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Day of Dis.					

Urine normal.

TWO CASES OF ENTERITIS CAUSED BY ASCARIS LUMBRICOIDES.

CLINICAL CHART OF TEMPERATURE, &c.

No. 2420 Name—Anandan.

Age—18 Years.

Disease—*Ascaris Lumbricoides*.

Result—Cured

Date	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
TEMPERATURE, FAHRENHEIT'S SCALE.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	M. E.	
	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	103°	
	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	102°	
	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	101°	
	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	100°	
	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°	99°
	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°	98°
	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°	97°
96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	96°	
Pulse.	M.	74	75	74	72	74	74	72	78	74	74	76	96	96	80	74	72	72	72	72	72	M.
	E.	98	102	98	80	85	80	86	80	94	94	84	80	98	96	98	96	94	76	80	76	E.
Resp.	M.	18	18	18	18	17	18	17	18	18	17	18	18	24	20	20	20	18	18	18	18	M.
	E.	20	20	20	20	20	19	20	20	20	24	20	20	20	24	24	24	22	19	19	20	E.
Motions	3	2	2	1	3	....	3	2	1	2	2	1	....	2	1	1	1	1	1	1	1	Motions.
Urine, ozs.																						Urine, ozs.
„ Sp. Gr.																						„ Sp. Gr.
„ Reaction.	Urine healthy throughout.																				„ Reaction.	
„ Chlorides.																						„ Chlorides.
„ Albumen.																						„ Albumen.
Day of Dis.	2	2	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Day of Dis.

in which the District Jail was closed and its prisoners sent to the Central Jail. It was also the year in which beri-beri was supposed to have been introduced into the jail by the Burmese arrivals. In 1887 beri-beri was supposed to be due to, or to have a connection with, ankylostoma and it will be noticed, as at least a curious coincidence, that the discovery of ankylostoma synchronized with the supposed introduction of beri-beri. It is at least certain from an examination of the Hospital Case Books that the cases returned as beri-beri were treated with the treatment usual in ankylostoma, *viz.*, the administration of thymol. After the year 1887, there is no mention in the records of the parasite having been again noticed, till I found it in my first *post-mortem* (March 1897). Since then it has occurred in 75 per cent. of the necropsies. The malarial parasite by wholesale destruction of the red blood cells causes an anæmia, which tends to dropsy and at the same time alters the structure of certain viscera, *e.g.*, the liver, spleen, and kidney. This alteration in the structure leads also to dropsy, a result super-added to that produced by the anæmia. The ankylostoma, a blood-sucking nematode, by itself produces a pernicious anæmia, as well as dropsy and fatty degeneration of the internal organs. In 90 out of 120 cadavera, I have detected this parasite in the bowel, and since it is established that these parasites—that of malaria and the ankylostoma—can even separately cause dropsical symptoms and high mortality, it is but reasonable to conclude that their effects will be far more marked if combined in the same individual. The statement that beri-beri is a disease endemic in the Northern Circars was made so long ago as 1835 by Assistant-Surgeon Malcolmson, I.M.S. His book, though no doubt it answered a useful purpose at the time in bringing the disease to public notice, can no longer, in view of the great progress of medical knowledge and research since 1835, be considered to be possessed of authority. Since then, so far as I am aware, no further enquiry into the question whether beri-beri is really endemic in the Northern Circars, has been made. In the Manual of the Godaveri District, written by Mr. Henry Morris, C.S., in 1878, a statement occurs to the effect that "one of the principal diseases of the district is beri-beri. The Telugu name for this disease is 'Ubbu-Vayuvu' or rheumatism with dropsical swelling. The acute form is attended by intermittent fever, the chronic form is more frequently the sequel of rheumatism and fever." It will be here observed that this description, obviously written by a layman, was penned before Laveran, in 1880, discovered the malarial parasite. The description which Mr. Morris gives of beri-beri corresponds well with what is now known as malarial cachexia, but it does not agree with beri-beri, which is neither a rheumatism nor an intermittent fever with dropsy. It will,

I think, be generally admitted that much clearer evidence than that of Malcolmson and Morris is required before the endemic occurrence of beri-beri in the Northern Circars can be held to be proved.

Turning now to the history of the Rajahmundry Jail itself, there were, prior to 1887, two separate jails in Rajahmundry, one the present Central Jail, the other the District Jail. These were situated about $1\frac{1}{2}$ miles apart, the District Jail being located close to the river Godaveri, while the Central Jail stands on a higher level. In 1887 the District Jail was closed and all its prisoners, who were necessarily short-term convicts, were removed to the Central Jail. Now the mortality among short-term prisoners is always appreciably higher than among long-term convicts, and the amalgamation of the District with the Central Jail was, therefore, an event likely to affect the health of the latter unfavourably. If it were found that the mortality of the decade (1887-96) since the amalgamation compared unfavourably with that of the decade (1877-86) before the amalgamation, such a change may be explained by the inclusion during the later decade (1887-96) of short-term prisoners.

TABLE I.

Comparative Statement of Admissions from Malarial Fevers.

Years.	ADMISSIONS FROM INTERMITTENT FEVER IN	
	Rajahmundry Central Jail.	All Central Jails and the Penitentiary.
1880 ...	2,155	2,601
1881 ...	1,315	1,662
1882 ...	1,339	1,564
1883 ...	845	1,148
1884 ...	477	744
1885 ...	384	654
1886 ...	564	831
1887 ...	772	977
1888 ...	809	1,036
1889 ...	377	570
1890 ...	188	565
1891 ...	195	577
1892 ...	123	787
1893 ...	76	635
1894 ...	164	835
1895 ...	235	882
1896 ...	230	708
1897 ...	436	912

As will be seen from the table above, the Central Jail long before 1887 showed an extraordinarily high admission rate for fever, and the confinement in it of short-term prisoners, who notoriously show a higher death-rate than long-term prisoners, would necessarily affect prejudicially the statistics of mortality. In the same year, 1887, occurred the arrival of Burmese prisoners from Rangoon, an arrival to which has been ascribed the importation of beri-beri and the infection of the jail buildings with that disease. But if beri-beri is endemic in the Northern Circars, it is not clear why it should require im-

portation from a foreign source to set up the infection, while if the complaint is not endemic in those districts, the theory of importation and infection must be at once heavily discounted. On either hypothesis it seems much more probable that the real "sanitary event of the year" was not the arrival of the Burmese prisoners, but the amalgamation of the two jails. In the following table the admissions to hospital throughout the two decades are set forth in comparison with the statistics of rainfall.

TABLE II.

Comparative Statement of Admissions to Hospital.

Years.	ADMISSIONS PER MILLE FROM INTERMITTENT FEVER.		Total admissions per mille from all causes.	Rajahmundry Central Jail daily average strength.	Total rainfall.	Deaths per mille excluding those from epidemics.
	Rajahmundry.					
	District Jail.	Central Jail.				
1877	41.9	404.1	1066.9	1036.62	...	23.2
1878	87.5	290.9	862.8	1192.60	...	21.8
1879	142.2	669.9	1573.5	967.73	43.6	58.9
1880	153.2	2263.5	2997.0	956.47	28.4	85.5
1881	129.8	1372.8	1839.0	957.88	38.30	25.1
1882	226.7	1494.7	1893.6	895.78	45.0	19.98
1883	215.36	1132.23	1716.5	746.31	36.29	19.94
1884	92.76	754.35	1327.7	632.78	43.25	17.06
1885	59.24	668.53	1192.7	575.39	41.17	19.10
1886	47.42	1020.03	1303.1	555.59	69.61	12.60
1887	...	1409.7	1857.9	546.92	35.40	74.97
1888	...	1532.9	2111.6	527.10	39.46	20.87
1889	...	723.9	1478.6	520.75	62.65	19.20
1890	...	354.5	1272.8	530.33	53.43	26.23
1891	...	360.6	1155.4	543.52	29.50	64.39
1892	...	218.4	1054.7	645.66	64.50	68.15
1893	...	129.2	401.9	627.01	59.15	19.14
1894	...	208.9	625.5	794.63	38.85	18.88
1895	...	322.7	843.4	762.40	51.33	24.92
1896	...	175.4	811.2	849.39	20.28	47.09
1897	...	*463.76	2045.12	1015.59	50.97	...

* Does not include other malarial affections.

Two facts will at once attract attention in the above table, *viz.*:—first, the consistently high admission-rate for intermittent fever in the Central Jail throughout the whole period of 21 years; second, the occurrence in 1880, the year following the great famine of 1877-79, of an outbreak of sickness surpassing even that of 1897. Referring to the second point first, it is not likely to be merely a coincidence that the great increase in the number of admissions to hospital occurred in connection with two famine periods. If the extraordinary sickness of 1897 is attributable to the presence in the jail of the infection of beri-beri introduced by Burmese convicts in 1887, how is the still more extraordinary outbreak of sickness in 1880, eight years before the introduction of beri-beri, to be accounted for? If, on the other hand, the sickness of 1880 was due to causes other than beri-beri, the hypothesis that it was this disease which was at work in 1897 can at least derive no support from any historical reasoning. But

when we turn to the other main point brought out by the figures of Table II, we at once find a feature which is present throughout the period of 21 years, and which alone is sufficient to account for both outbreaks, *viz.*, the continued presence of malarial fever. It will be seen that in 1880, this cause accounted for 2,263.5 admissions per mille out of a total admission-rate of 2,997 per mille, while in no less than seven years within the period taken the admission-rate from this cause exceeded 1000 per mille. That such prevalence of malarial fever is abnormal and excessive will be further proved by Table No. I, whence it will be seen that out of 17,688 admissions for malarial fever in all the Central Jails of the Presidency (including the Penitentiary) between 1880 and 1897, no less than 10,684 or over *sixty per cent.* are accounted for by the Rajahmundry Central Jail. Malaria is the predisposing cause to pneumonia, dysentery, phthisis, &c. This is well illustrated by the fact that in 293 necropsies (1887-96), tubercle of the lung was found in 61 cases and ulceration of the bowel in 116. It is probable that these would have been even more numerous, were it not that the records give no information regarding the condition of these viscera in many of the *post-mortems.*

It is thus found that the history of the Rajahmundry Jail shows a persistently high admission-rate due to malarial fevers, coupled with periodical enhancements of the same disease following periods of famine and scarcity. As the sickness of 1897-98 likewise coincided with and followed a period of famine, the inference that it was due to the same causes as had produced similar results under similar conditions before is a very strong one. It may thus be unhesitatingly claimed that the investigation of the history of the Rajahmundry Jail is favourable rather to the view that its unhealthiness has been due to malaria than to any other cause. The microscopic evidence in favour of malaria is as follows. The blood of 800 convicts, between the years 1898 and April 1901, who were admitted to hospital for fever, harboured the malarial parasite in over 50 per cent. The relative proportions were 65 per cent of the benign tertian, 30 per cent of the malignant, and 5 per cent. of the quartan *Hæmamoeba.*

The experimental inoculation of myself and seven others are recorded in the Scientific Memoirs by Medical Officers of the Army of India, Part XII, 1901.

I may be pardoned the transgression of introducing these remarks on malaria, but they have a most important bearing on the subject of akylostoma duodenale amongst the prisoners. The effect of applying leeches to a chronic malarial, would be to abstract blood from the circulation which he could ill afford; hence those internal leeches, the ankylostomata, undesirable guests in the intestine of any one, are specially dangerous to those suffering from anæmia. Even

if, as some have held, the presence of ankylostoma in the bowel were only an undesirable condition that is in this country more or less normal, yet that presence would become prejudicial when the patient is already in the abnormal condition produced by malaria.

III.—ANKYLOSTOMA.

A systematic search for the ova of entozoa amongst the convicts and new arrivals in the Central Prison, Rajahmundry, was commenced in February 1900, and continued till November of the same year. Those examined came from the Northern Circars, which include Ganjam, Godavari, Vizagapatam and Kistna districts. Prisoners also came from Kurnool and the hilly tracts of the East Coast. Altogether over 1,500 new arrivals had their motions examined, and, in addition to these, 300 convicts who had been confined for six months and upwards in the jail. This laborious task was performed by me personally, and, as a rule, three slides were carefully scrutinized.

Ankylostoma.—Of the 1,509 new arrivals, 883 or 58·87 per cent. harboured this blood-sucking nematode, that is to say, that more than half the population of this part of India are affected by this parasite.

Of this large gang of prisoners, 60 per cent. arrived in good health, and 40 per cent. in bad and indifferent, the numbers being as follows:—

Prisoners in good health	= 894
" " indifferent health	= 406
" " bad	= 209

From the accompanying tables, it will be observed that over 53 per cent. of persons in the Northern Circars harbour this nematode, and still remain in good health. It would be expected that the better hygienic surroundings of the prison and the strict supervision as to the cleanliness in the preparation of the food would have produced a material reduction in the numbers affected. Not so, the percentage remains the same, viz., 58 per cent. as demonstrated in the analysis attached of 200 convicts who have served six months and upwards in the prison. The examination brought this fact to light, namely, that the ova are far more numerous in those who are in bad and in indifferent health. This numerical superiority indicates that the parasites are more numerous and are an important factor in the decline in health of the individual harbouring this parasite. This point is testified by the analysis of 105 *post-mortems*, which I performed during my tenure of office as Medical Superintendent, in that the percentage of parasites present has risen from 58 per cent. to nearly 75 per cent. The bowel of those affected shewed the presence of small congested areas from one to several centimetres in diameter and the mucus was thickly streaked with blood.

Total number examined.	Ova of ankylostomoides.	Ova of ascaris lumbricoides.	Ova of trichocephalus dispar.	Ova of tape-worm.
Number 1,509 ...	883	633	131	3
Percentage ...	58·87	42·2	8·7	·20

Health of the convicts harbouring Ankylostoma Duodenale.

	Good.	Indifferent.	Bad.
Numbers affected ...	475	229	179
Percentage ...	53·8%	25·8%	20·4%

Double infection with A. Duodenale and A. Lumbricoides.

Total examined.	Double infection.	Health good.	Health indifferent.	Health bad.
Numbers, 1,509	364	167	101	96
Percentage ...	24·5	45·7	27·7	26·6

Ages of persons harbouring Ankylostoma.

Number of persons whose age was recorded.	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60
	841	55	261	247	144	134
Percentage.	6·54	31·03	29·38	17·12	15·93

Analysis of 105 post-mortems carried out in Rajahmundry Central Jail.

Cause of death.	Number of deaths.	Ankylostoma duodenale.	Hæmorrhagic spots.	Erosions.
Dysentery ...	29	25	18	8
Diarrhœa ...	12	11	7	...
Ague ...	14	2	9	2
Pneumonia ...	17	14	10	...
Tubercle of lungs ...	8	7	5	...
Valvular disease of heart ...	5	4	3	1
Disease of liver ...	3	2	2	...
" of kidney ...	13	11	9	1
General diseases ...	4	2	2	...
TOTAL	105	78	65	12
Percentage	...	74·3	51·9	11·4

Analysis of 200 convicts who have served 6 months and upwards.

	Ankylostoma.	Ascaris lumbricoides.	Trichocephalus dispar.
Number of cases in which ova was present ...	116	37	10
Percentage ...	58·0	18·5	5

Nearly 52 per cent. of the *post-mortems* disclosed these congested spots, while in 11·2 per cent. small erosions and ulcers about 1—3 mm. in diameter were present.

These figures, as well as the experience gained in the jail after three and-a-half years, go to show that the effects of the ankylostoma are for the most part secondary and not primary. They seldom occur in such numbers as to cause true ankylostomiasis. I feel convinced that many cases of ankylostomiasis are not the result of the ankylostoma primarily, but of such disorders as malaria, dysentery, &c. The presence of ankylostomata in malarial or other cachexias is of great importance. They bleed the patient who can ill afford to lose the blood, and set up local congestions and erosions of the bowel which cause a catarrh and thus retard the proper assimilation of the food and recovery of the patient. It is this secondary effect of ankylostoma that I look upon as most injurious.

It has been stated that pigmentation of the tongue occurs amongst those harbouring ankylostoma duodenale. I find that pigmentation occurs in about equal numbers amongst those affected and those free of the nematode as exemplified in the accompanying table.

List of convicts affected with Ankylostoma treated by Thymol and occasional purgatives.

Number of convict.	Period treated by Thymol.	Dose of Thymol daily.	REMARKS.
994	Days. 10	Grains. 20	Ova as numerous at the end of treatment as at the beginning.
970	17	20	
9635	27	20	
767	24	20	
1305	15	30	
9708	30	20	
629	30	20	
774	30	20	
743	30	20	
9708	30	30	Second period of treatment.
9711	30	30	
774	30	30	Second period of treatment.
743	30	30	Ditto ditto.

Pigmentation of the tongue.

Prisoners affected with Ankylostoma.		Prisoners free from Ankylostoma.	
Number examined.	Number with pigmented tongue.	Number examined.	Number with pigmented tongue.
392	87 22·2%	356	89 25·4%

In regard to thymol observers state that it is the most useful drug we have for this organism. There is sufficient evidence to prove that it rids

the bowel of a large number of them if they are fairly numerous: but I doubt if it will entirely evacuate all. I have notes of thirteen cases who have been consuming large doses of thymol for varying periods from 10 to 60 days, and in whose motions the ova of ankylostoma duodenale were still present at the end of the treatment.

For the diagnosis of ankylostomiasis, therefore, it is necessary to exclude all other blood-destroying diseases rather than depend on the mere presence of this parasite in the bowel.

Ascaris Lumbricoides.—This parasite has been fully dealt with in my paper on Cannanore Central Prison. In Rajahmundry Jail 42·2 per cent. of the new arrivals were found to harbour this nematode, and 24·5 per cent. were found to suffer from the ascaris as well as ankylostoma. The effect of prison life as regards hygiene and clean food is most marked, since the percentage amongst 200 convicts (Table attached) who have served six months and upwards of their term, falls from 42·2 to 18·5 in respect of ascaris lumbricoides, whereas the ankylostomata figures remained stationary for both, namely, 58 per cent.

Trichocephalus dispar appeared in 131 out of the 1,509 examined, *i.e.*, about 9 per cent.

The conclusion thus arrived at is that the ill-health of this jail has been due to the combined prevalence of malarial fevers, ankylostoma and ascarides with their sequelæ pneumonia, dysentery, phthisis, &c., which is well illustrated by the fact, previously alluded to, that in 293 necropsies (1887-96) tubercle of the lung was found in 61 cases and ulceration of the bowel in 116. I do not mean to convey the impression that beri-beri does not exist in the Northern Circars. My time has been spent wholly in Rajahmundry, and I have no experience of other parts of the area known as the Circars. Still prisoners come from all parts of that area to the jail, and the population I have had to deal with is fairly representative. It is left for some enthusiast to find how far the new organisms of Donovan and Leishman affect the health of the population on the East Coast.

To sum up the conclusions suggested in the foregoing paper, the view which attributes the ill-health of the Rajahmundry Central Jail to beri-beri is contradicted by the following facts:—

- I. There is no evidence that beri-beri is endemic in the Northern Circars except Dr. Malcolmson's statements, and his book written in 1835 is now obsolete and unreliable.
- II. Deaths have been returned as beri-beri which are proved by the lesions found at *post-mortem* to have been due to other diseases.
- III. The beri-beri heart is conspicuous by its absence, and there has been no undue hypertrophic influence on the cardiac muscle.

IV. The "Numbness and Burning" sensations of the feet, if taken to denote peripheral neuritis, have been found in diseases in which it is not known to occur, and are therefore an unreliable proof of nerve degeneration amongst the prisoners.

V. The total absence of paralysis.

VI. The sanitary incident of the year 1887 is explained by the discovery of ankylostoma duodenale, beri-beri being at that time supposed to be due to ankylostoma or to have a connection with it.

VII. The malarial parasite, ankylostoma duodenale and ascaris lumbricoides, each capable of causing excessive sickness, and mortality have been found in this jail to be associated together in many individuals and are thus doubly fatal in their effects.

INTESTINAL ANIMAL PARASITES IN BIHAR AND ORISSA.

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THE following details of the prevalence of intestinal parasites were collected mostly by the microscopic examination of the stools of prisoners in the Chupra and Puri Jails. This examination was carried out as follows :

A little of the stool was picked off with a thin piece of stick and placed on a microscopic slide, and a small quantity of water added, the amount of each used being such as experience showed to produce a regularly disposed film of fecal granules, thin enough, after the superposition of a cover-glass, to insure that the details of the ova were not obscured by other material, but at the same time so concentrated that the largest amount of fæces, compatible with this consideration, was passed under observation. The examinations were mostly carried on as a routine measure on prisoners soon after admission, but some cases were also investigated to ascertain, if possible, the cause of loss of weight. The lenses used were mostly a Zeiss A with No. 4 ocular, and three slides were examined in all but the first few cases.

The results arrived at were these :—

Intestinal Parasites.	Chupra Jail, 153 prisoners examined.		Puri Jail, 44 prisoners examined.	
	Actual numbers	Percentage.	Actual numbers	Percentage.
<i>Uncinaria duodenalis</i> ...	109	71.24%	32	72.72%
<i>Ascaris lumbricoides</i> ...	91	59.47%	19	43.18%
<i>Trichocephalus dispar</i> ...	15	9.8%	6	13.64%
<i>Oxyuris vermicularis</i> ...	5	...	5	...
<i>Tænia solium</i> ...	4	2.61%	0	...
<i>Rhabdomena larvæ</i> ...	2	1.3%	7	15.91%
<i>Tænia nana</i> ...	1	0.7%	0	...
<i>Tænia flavo-punctata</i> ...	1	0.7%	1	2.27%

In the Chupra cases there were 79 instances of infection by two species of parasite, in six cases by three, and in one case by as many as five, these being ascaris, uncinaria, trichocephalus, oxyuris, and rhabdomena, and 88.24% of the prisoners harboured parasites. This estimate is too low, for the cases in which no ova were found occurred largely at the beginning of the investigation, and the inability to find them was evidently largely the result of inexperience.

In Puri 93.18% of the prisoners were found affected, probably a correct estimate; 25 harboured two species of worms, two harboured three species, and one four species.

Uncinaria duodenalis.—The colourless uncinaria ova were found in about 72% of cases both at Chupra and Puri. The amount of segmentation which they showed varied in the most marked way, and was on the average considerably greater in Puri than in Chupra; but the size of the ova bears no relationship to the amount of segmentation; indeed, the largest ova measured were those with four segments. The earliest stage of segmentation recognised was that in which the ovum had just begun to divide for the first time. The first line of fission takes place transversely at a point situated about one-quarter of the length of the long axis from one pole, so that the ovum consists of two segments, one large and one small (Fig. 1). A similar fission takes place at the corresponding point near the opposite pole of the ovum so that three segments are formed. The equatorial cell then divides in the long axis of the ovum, and the appearance may be either that depicted in Fig. 2, A or B. In the latter the ovum looks exactly like that containing three cells only, but it may be distinguished by rolling over the ovum, an effect produced by moving the cover-slip, and as this motion brings another aspect of the ovum to view, the four cells composing it can be distinctly seen.

The next step in segmentation is a transverse division of one of the equatorial cells, so that the polar cells tend to be pushed out of the long axis of the ovum (Fig. 3). The next line of cleavage appears to be in cell marked "a" in this figure and to be in the long axis of the ovum in a plane parallel to the paper as the ovum is depicted in the diagram.

An unusual form of segmentation is one in which, after the stage of four segments is reached, there is a fission of them all in the long axis of the ovum, so that eight segments are formed, in two layers of four each, each layer being similar to the other. The further details of fission are difficult to follow, but finally the ovum may be passed in the fæces as a morula consisting of many small cells (Fig. 6). No larvæ either within or without the shell were ever found.

It is a remarkable fact that, as noted above, and, speaking generally, the amount of segment-