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OF THE EOSINOPHILES IN THE  
BLOOD; REPORT OF THE FOURTH  
CASE.

BY  
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OF BALTIMORE, MD.

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**THE DIAGNOSIS OF TRICHINOSIS BY MEANS  
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BY THOMAS R. BROWN, M.D.,  
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IN 1897, in reporting the great increase of the eosinophiles in the blood in a case of trichinosis<sup>1</sup> this being the first mention ever made of an association between trichinosis and eosinophilia, I made use of the following words: "The presence of such quantities of eosinophiles in the blood suggests their possible diagnostic value in trichinosis, and perhaps, if it be found on further studies to be characteristic of this disease, may help to clear up the cases which are regarded *intra vitam* as rheumatic in nature and which, years afterward, the autopsy-table shows to have been cases of trichinosis." That the disease is not such a rare one in America as is usually supposed and that it may be definitely diagnosed by the remarkable increase of the eosinophiles in the blood is amply proven by the results obtained since that time.

In 1898 I reported<sup>2</sup> two additional cases wherein, from the eosinophilia alone, the condition of trichinosis was diagnosed, and in all three cases, living, actively motile, non-encapsulated trichinæ were found in small pieces of muscle removed from the patient. The concluding sentences of that article may be of interest in this connection: "From these observations it is fair to conclude:

"1st. That there is a marked increase in the percentage of eosinophilic cells in the blood in trichinosis.

<sup>1</sup> *Johns Hopkins Hospital Bulletin*, pp. 79-81, April, 1897.

<sup>2</sup> *Journal of Experimental Medicine*, vol. iii, No. 3, pp. 315-347.

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"2d. That the increase may be used as a diagnostic sign in this disease.

"3d. That this disease in its sporadic form is more common than has hitherto been supposed, as shown by

Date. 1898.	Leucocytes, per c.mm.	Percentage of Various Forms.			
		Polymor- phonu- clear Neu- trophiles.	Small Mononu- clears.	Large Mononu- clears and Transi- tional Forms.	Eosino- philes.
Aug. 8.	18,100				
Aug. 10.					48
Aug. 13.		43	7.3	1.7	48
Aug. 28.	8200	45	14.5	2	38.5
Sept. 4	7900	49	18.5	2.5	30
Sept. 18.		55.2	19.6	2	23.2
Sept. 25.	9600	61.5	16	2.5	20
Oct. 2.	8750	54	19.5	2.5	24
Nov. 5.		49	40	2.5	8.5
Nov. 13.		64.5	27.	3	5.5
Nov. 20.		61	27	4.5	7.5

RESULT OF BLOOD EXAMINATION IN A CASE OF TRICHINOSIS.  
(J. L., CASE IV.)

the discovery of the three cases above described within a comparatively short period at the Johns Hopkins Hospital.

4th. That a systematic examination of the blood should be undertaken in cases with indefinite intestinal, muscular or articular symptoms in the hope that in some, at least, of the hitherto doubtful cases a diagnosis may be made."

I have now to report another case of this disease, diagnosed entirely by means of the blood examination, the diagnosis being verified by the subsequent removal of a small piece of muscle and the finding of living, actively motile trichinæ therein.

J. L., white, aged thirteen years, was admitted to the Johns Hopkins Hospital, August 4, 1898. He complained of headache and pain in the legs; he had never been sick before. On July 30th he commenced to have headache, which was still present at the time of his admission. On July 31st he had a slight nose-bleed, while during two days, July 30th and 31st, he had had pains in the shins. He had a good appetite, the bowels moved regularly every day, and he had not had chills, nausea, nor vomiting.

The physical examination showed the patient to be a small boy of dull appearance, with eyelids somewhat swollen. His heart and lungs were negative. There was no abdominal tenderness; no rose spots. The spleen was not palpable; tongue thickly coated; considerable gurgling in the right iliac fossa. There was neither swelling nor tenderness in the muscles of the arms or legs; the throat was negative. The temperature range was between 98 and 100.2° F. during the first four days and the case was at first regarded as a mild febricula of doubtful origin, possibly typhoid fever.

On August 10th an examination of a specimen of freshly taken blood was made, and one was at once struck by the large number of eosinophiles present, these cells with their large, highly refractive granulations being unmistakable. A differential count made on dried speci-

mens, stained with the Ehrlich stain, showed that 48 per cent. of all the white blood-cells were eosinophiles, and this *at once* led to a diagnosis of trichinosis being made.

Further questioning of the patient elicited the fact that about one week previous to his admission to the hospital he had had pain in the calf-muscles of both legs, never very great, while there had never been any pain in the other muscles of the body. The legs had never been swollen, but the eyelids had become slightly puffy four days before his entrance. He had not had abdominal pain or diarrhea. On being questioned as to whether he had recently partaken of hog-meat of any kind he remembered having eaten of raw sausage on July 10th, and of cooked ham on July 23d.

On August 11th a small piece of muscle was removed from the left gastrocnemius muscle under cocain anesthesia; this was hardened in formalin, and subsequent microscopic examination showed the same changes as described in full in the preceding three cases (*loc.cit.* p. 328, *et seq.*); the presence of young, non-encapsulated trichinæ in some of the muscle-fibers, about them a fresh, active myositis with many eosinophiles among the cells present, and various degenerate changes in the muscle-fibers themselves, marked swelling and proliferation of the nuclei, longitudinal and transverse splitting of the fibers, etc. The patient's temperature varied between 96.2° and 99.5° F. from the fourth to the twelfth day of his stay, after the twelfth day being practically normal. The urine was negative throughout and the blood did not give the Widal reaction.

The patient was discharged from the hospital on August 22d, feeling perfectly well. During his stay in the hospital his blood showed a leucocytosis of 18,100, while upon each of the two occasions on which a differential count of the leucocytes was made, it was found that 48 per cent. were eosinophiles. As in the other cases re-

ported, the nucleus of the eosinophiles was polymorphous, *i.e.*, identical in form with the nucleus of the neutrophiles.

As I thought it would be of considerable interest to determine how long the condition of eosinophilia lasted after the disappearance of all other symptoms of the disease, the patient was persuaded to return on various occasions within the next three months to have his blood examined. Although the number of leucocytes per cubic millimeter diminished rapidly and was practically normal after the last part of August, nevertheless, the decrease in the percentage of eosinophiles was very gradual, and even on November 20th, the date of the last count, more than three months after the complete disappearance of all other symptoms, a slight eosinophilic increase was still present, the normal percentage of eosinophiles being from 1 to 3 per cent. Elsewhere<sup>1</sup> I have shown in the third case reported by me that the blood was normal both as regards number of leucocytes per cubic millimeter and percentage of the various forms five months after the complete cessation of all other symptoms.

Where the eosinophiles come from, in trichinosis, is still undecided, but a study of the blood and muscle in the four cases leads one to the conclusion that they are probably derived from the polymorphonuclear neutrophiles, those cells normally constituting from 65 to 80 per cent. of all the white cells of the blood, and that this transition takes place in the affected muscles. This is supported by the inverse relationship which exists between the eosinophiles and the neutrophiles in the four cases, by the identical character of the nuclei of both forms, *i.e.*, they are both polymorphous and that what are apparently transitional forms between the two were found in the affected portions of the muscle. Thus the addition of this case makes four cases in all in which this association between trichinosis and a very high grade of eosino-

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<sup>1</sup> *Boston Med. and Surg. Journ.*, September 1, 1898.

philia was present; in the first case, the eosinophiles reached 68.2 per cent. of all the white blood-cells; in the second 42.8 per cent., in the third 49 per cent., and in the fourth 48 per cent., while the total number of leucocytes per cubic millimeter reached 35,000 in the first case, 13,000 in the second, 17,000 in the third, and 18,000 in the fourth.

Just as this article is being brought to a conclusion I learn that a fifth case has just been diagnosed by an eosinophilia in the neighborhood of 50 per cent., with the subsequent verification of this diagnosis by the removal of a small bit of muscle and the finding of the actively motile parasites therein.

Of the four cases I have reported, in only one, the first, was there anything in the clinical history to make one even suspect that the case was one of trichinosis, and it was only by means of the remarkable eosinophilia present, so easily made out by merely glancing at a fresh specimen of the blood under the microscope, that the diagnosis was made. In fact, the second and fourth cases were regarded as probable cases of typhoid and the third as estivo-autumnal malaria before the blood examination was made.

Of course in a few other conditions an eosinophilia is noted in the blood, notably in bronchial asthma during the paroxysm and in splenomyelogenous leucemia, but the eosinophilia in these conditions is of not so high a grade and moreover, the diagnosis is easily reached by means of other signs and symptoms. But in trichinosis, except in the most marked cases or in the epidemic form, a diagnosis is impossible without a blood examination, and in conclusion I would like once more to suggest the great advisability of making the examination in febrile cases of doubtful origin and in cases with indefinite intestinal or muscular symptoms. This examination will require but a few moments and by the demonstration of a

marked eosinophilia it may clear up a case now and then which otherwise would go down to posterity as another of that great class of cases, the undiagnosed.





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