The Complement-Fixation Test in Chagas' Disease

BY

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(With plate 105—122).

During the months of April, May and June of 1926, we had the opportunity, in the hospital of Lassance, in the North of the State of Minas Geraes, of putting into practise the complement fixation test applied to CHAGAS'disease.

As a starting-point for work we had the previous papers on the subject by GUERREIRO, MACHADO, VILLELA and BICALHO.

We selected 200 suspected cases amongst the many patients who came to the Out-Patient Department of the Hospital. The Wassermann test was made at the same time in all cases.

There follows a synopsis of the technic used, the clinical reports taken with more detail and the results obtained.

TECHNIC USED.

In the reactions made, for syphilis as for CHAGAS'disease, the material used was always the same, with the exception of the antigen.

The hemolytic system used was that most currently employed, i.e. sheep red blood-corpuscles, hemolytic serum of rabbits. (Rabbit anti-sheep system) and complement from normal guineapig serum. The sheep red blood-corpuscles were used suspended in the proportion of 5% in normal saline and not in the volume corresponding to that of the blood, because this would have ensured less uniformness as the number of red blood-corpuscles to the volume of plasma does not give a constant ratio. The red blood-corpuscles were used the day the animal had been bled or on the following days, after preservation in the ice-chest, without the use of any preserving substances, such as formaldehyde and others, as is advised by some writers. When the red blood-corpuscles began to hemolyse by themselves they were discarded. In this way a good degree of efficiency in the working out of all reactions was obtained.
For complement normal guinea-pig serum was selected. Complement obtained on the day of the test or on the day before it was used.

For the Wassermann reaction KOLMER's antigen (1) was used, and was obtained from the Wassermann dept. of the Instituto Oswaldo Cruz. The principal purpose of KOLMER was the preservation of lecithins. The antigen is extracted from human or from ox-heart. As a rule the latter is preferred owing to the ease with which it can be obtained immediately after the animal's death. This is an excellent antigen, with practically non-existent anti-complementary and haemolytic properties, and with excellent fixing property.

For the diagnosis of CHAGAS' disease two antigens were made use of both from a puppy well infected with Trypanosoma cruzi. One was from heart and spleen together, the other from the spleen alone.

The technic of VILLELA and BICALHO was followed in its preparation. The organ or organs of the puppy are taken with aseptic precautions washed summarily in normal saline, weighed and cut in small pieces so as to make triturations easier, which is done immediately afterwards in a mortar. After that to one part in weight of the pulp is added one part of glycerin and two of sterilised distilled water. Carbolic acid must be included in the mixture so that it remain in he proportion of 0.5 %. After leaving it to macerate for two or three days the mixture is filtered and kept in the ice-box, the supernatant fluid being used as antigen. It must be stated that the antigens tried did not show the regularity and constancy of those used by the research-workers quoted. This would lead me to advise the greatest caution in its use and the antigen should only be considered as useful after careful triturations and test with controls taken from patients of other diseases and from normal subjects. One of the reactions carried out with an antigen recently prepared and used for the first time would produce complement-fixation when mixed with any of the sera (about 20). One would have thought that the antigen was inhibitive if a careful titration had not already been made of its inhibitive action.

What seem equally desiderable to avoid is the use of great quantities of antigens as would be necessary in the case of antigens with weak fixing power. In our tests antigen in 1 % dilution in normal saline was used, never in greater quantity than 1 c.c. With greater quantities the reading of results is almost always difficult and uncertain.

In antigens of heart and spleen together we noticed that anti-complementary power rises more rapidly than in that of spleen alone. Anyway, the antigen which lasted longest did not reach one month, contrarily to what VILLELA and BICALHO obtained with an antigen lasting 4 months and giving regular service. This must have been an exceptional case, for our work was carried on during a year with 17 antigens and inhibitive action appeared after from 15 to 30 days and sometimes before.

Antigens prepared with normal organs do not show the slightest fixing action (MACHADO VILLELA and BICALHO).

Alcoholic antigens are unsatisfactory, besides favouring confusion with the Wassermann reaction.

After titration of the haemolytic serum and of the complement, titration of the antigen is undertaken, in accordance with the table:

Complement of the example given above may vary according to titration.

Red blood-corpuscles which are added after the first action of the water bath are previously sensitised, i.e., are mixed with the haemolytic serum one or two hours before.

Haemolytic serum was used in a double dose.

Reading of results was practiced one or two hours afterwards. The point at which the antigen began to produce inhibition was noted and half the quantity which still did not produce the inhibition of the slightest degree of haemolysis was used. For instance when th's quantity was 0.8 of the centesimal solution of antigen, in the reaction 0.4 would be used.

Sera of patients and controls were used as a rule within four days of venous puncture. In the case of naturally inhibitory sera, none of the substances recommended were used to overcome this obstacle, as for instance Barium sulphate. The reaction is already complicated and obscure enough by itself and it was preferred to use the different reacting substances untampered and in the most natural manner possible.

The quantity of serum used is important. The optimal dose is 0.2 c.c. Greater quantities are almost always inhibitory and give, not infrequently, non-specific reactions.

Human sera are provided with a certain degree of haemolytic properties against sheep's red blood-corpuscles. On this account in the reactions there were always placed controls to witness this particular. This property did not appear marked enough or general enough to be an obstacle. Only in six cases was partial haemolysis obtained in control tubes with human serum and sheep red blood-corpuscles. Previous titration of this property is not of any practical advantage besides being troublesome.

Human serum contains complement almost always in considerable quantity. The process with inactivated serum was used. Inactivation (destruction of complement) was obtained by heating at 56°C. during 20 to 30 minutes. HECHT's test with non-inactivated sera was not put into practice. Only one reaction was made with cerebro spinal fluid. This is not inactivated since it does not contain complement and is used in the dose of 1 c.c. The test
carried out with 0.2, 0.5 and 1 c. c., was only positive with the latter.

After ascertaining the quantities of haemolytic serum, complement and antigen to be used, the reaction was carried out. The methods usually employed were practised according to the preference of several writers. The test gives results with any of the following: a). Fixed quantities of serum and complement and varying quantities of antigen; b). Fixed quantities of antigen and complement and varying quantities of serum; c). Fixed quantities of complement and varying quantities of serum and antigen; d). Fixed quantities of serum and antigen and varying quantities of complement; e). Fixed quantities of the three regents.

Tests with the quantities of the three reagents fixed or with fixed quantities of serum and antigen and varying quantities of complement appeared to be more practical and gave greater ease and precision in the reading of results.

In both these instances, the reaction was guided by the tables below:

### Varying quantities of complement and fixed quantities of serum and antigen.

<table>
<thead>
<tr>
<th>Tubes</th>
<th>Serum 1/10 (titrated)</th>
<th>Antigen 1/10 (titrated)</th>
<th>Complement Normal saline</th>
<th>Hemolytic serum</th>
<th>Red b. corp. 50/0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.5</td>
<td>1.1</td>
<td>1 cc.</td>
</tr>
<tr>
<td>2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.6</td>
<td>1.0</td>
<td>1 cc.</td>
</tr>
<tr>
<td>3</td>
<td>0.2</td>
<td>0.2</td>
<td>0.7</td>
<td>0.9</td>
<td>1 cc.</td>
</tr>
<tr>
<td>4</td>
<td>0.2</td>
<td>0.2</td>
<td>0.8</td>
<td>0.8</td>
<td>1 cc.</td>
</tr>
<tr>
<td>5</td>
<td>0.2</td>
<td>—</td>
<td>1.0</td>
<td>1.8</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>0.2</td>
<td>—</td>
<td>1.0</td>
<td>0.8</td>
<td>1 cc.</td>
</tr>
<tr>
<td>7</td>
<td>—</td>
<td>0.2</td>
<td>0.5</td>
<td>2.3</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>—</td>
<td>0.5</td>
<td>2.5</td>
<td>—</td>
</tr>
</tbody>
</table>

### Fixed quantities of the three reacting elements.

<table>
<thead>
<tr>
<th>Tubes</th>
<th>Serum 1/10 (titrated)</th>
<th>Antigen 1/10 (titrated)</th>
<th>Complement Normal saline</th>
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<th>Red b. corp. 50/0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.5</td>
<td>1.1</td>
<td>1 cc.</td>
</tr>
<tr>
<td>2</td>
<td>0.2</td>
<td>—</td>
<td>0.5</td>
<td>2.3</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>0.2</td>
<td>—</td>
<td>0.5</td>
<td>1.3</td>
<td>1 cc.</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
<td>0.2</td>
<td>0.5</td>
<td>2.3</td>
<td>1 cc.</td>
</tr>
<tr>
<td>5</td>
<td>—</td>
<td>—</td>
<td>0.5</td>
<td>2.5</td>
<td>1 cc.</td>
</tr>
</tbody>
</table>

After immersion of tubes in a water-bath for one or two hours results were read.

The two last tubes are general controls which are made once for the reactions of the day.

In the last process the reaction is rarely dubious and the cases of partial hemolysis obtained were few. In the cases the reaction can be considered to be weakly positive.

For the WASSERMANN reaction the same methods were used. KOLMER'S
antigen was used, 0.2 of the dilution at 1:20 of the pure antigen being taken.

All titrations were made or assured before beginning the reactions as was also the testing of the fixing power of the antigen by means of the controls from the former reactions.

GENERAL SUMMARY AND CONCLUSIONS.

It is our purpose in publishing the present paper to make clear the possibility of diagnosing CHAGAS' disease by means of the BORDET and GENGOU complement-fixation reaction, for the following reasons:

1. In 200 cases suspected of being of CHAGAS' disease selected among those attending the hospital at Lassance, the test was practised with 159 positive results, which gives a high total percentage of 79.5%.

2. In the cases of the cardiac form 87.2% of positive result were obtained out of a total of 39 reactions. This is the form which most favours diagnosis whether by this or other means.

3. In the case of subjects affected only with thyroid lesions, mostly of goitre 79.5% positives were obtained in a total of 119 reactions. It would seem to me that this is a great argument in favour of the hypothesis expressed by the discoverer of the disease, in favour of endemic goitre of this and probably of other regions being caused by Trypanosoma cruzi.

4. In the cases of the nervous form 100% positives were obtained in a total of 6 reactions.

5. In those of glandular form 75% positive results were obtained in a total of 8 reactions.

6. In those of undetermined form 25% in 8 reactions.

7. All these patients were submitted at the same time to the WASSERMANN reaction. With serum from the same puncture and under the same conditions except as regards antigen, 17% positive reactions were obtained. In 13% both reactions gave positive results. Most of the patients with a positive Wassermann showed evident syphilitic lesions.

8. The specificity of the reaction was always evident. In 16 sera of normal subjects, in 2 sera of patients with malaria and in 3 patients with ulcers, influenza and rheumatism, used as control, the reactions were in all cases negative, thus confirming the works of GUERRERO, MACHADO, VILLELA and BICALHO.

The antigen which gave the best result was that prepared with the spleen of a puppy well infected with Trypanosoma cruzi, whilst that of spleen and heart proved to be a little inferior.

We hereby extend our thanks to Professor CARLOS CHAGAS for having given us every facility for studying. To Dr. EURICO VILLELA for the guidance given from the outset for our work. To Dr. OCTAVIO MAGALHÃES for the help given us during our stay in the State of Minas Geraes and to Dr. EVANDRO CHAGAS for the interpretation of tracings and the summary of the first three cases.

The case-reports which are given next are those which it was possible to write with more leisure and which are therefore more complete.

They belong, as all the others, to the archives of the Hospital Oswaldo Cruz, clinical service of Dr. EURICO VILLELA, at whose side we have worked.

CASE REPORT

1. E. P. A., 28 years of age, residing in Lassance.

Subjective signs of circulatory trouble. Slight oedemas, enlargement of the liver.
Dullness of first heart sound. Considerable enlargement of the heart. Pulse with more or less 40 pulsations a minute and breaks due to extrasystoles as is evinced by auscultation. Small goitre. No valvular murmurs or evidence of aortitis. Venereal antecedents.

Tracing no. 1: Plate 105

Rhythm of pulse regular but slow. Venous tracing with $a, c$, and $a-c=0.40$ of a second.

Adrenalin test negative. There was no regularisation of the sino-nodal synchronism.

The patient was treated in an attack of heart failure, but left still in a state of descompensation.

The discordance between the frequency of the pulse and the state of relative heart-failure, was remarkable and indicated a marked decrease in the period of the centers of motor stimulus. Remarkable also is the disagreement between the state of impairment of the heart's strength and the oedema which was very slight as compared to the general state of the patient (relative heart-failure low difference between maximum and minimum pressures etc.). BORDET and GENGOU reaction positive for CHAGAS' disease on April 17, 1926 and April 20, 1926.

WASSERMANN reaction negative on April 17, 1926 and April 20, 1926.

Diagnosis: CHAGAS' disease: cardiac form; extrasystoles; bigeminism. Mal de engasgo.

2. A. N., 39 years of age resident in Lassance.

The patient complains of the difficulty in swallowing liquids as well as solids (Mal de Engasgo). Sensation of arrhythmia with subjective perception of circulatory disorder, distress and palpitation ("avexame e baticum"). Small goitre. Great enlargement of the heart, the enlargement being of the whole organ. There are no valvular murmurs. Extrasystoles very frequent with attacks of pulsus bigeminus after the smallest effort.

Tracing no. 2: Plate 105

Radial and jugular tracings show that this is a case of bigeminate rhythm with ventricular extrasystoles.

In the normal homotopic cycles there are in the phlebogram $a, c$, and $v$ waves with $a-c=0.20^o$ and after each cycle there is a big wave which we take to be $c, a$. This wave makes itself manifest exactly at the point belonging to $a$ and is not preceded by any other which might be taken for $a'$. The wave which precedes it is $v$, coinciding as it does with the dicrotic notch; radial is not $a'-v$, seeing how small it is. BORDET and GENGOU positive for CHAGAS' disease on April 17, 1926 and April 20, 1926.

WASSERMANN reaction negative on April 17, 1926 and April 20, 1926.

Diagnosis: CHAGAS' disease: cardiac form; extrasystoles; bigeminism. Mal de engasgo.

3. J. A. S. white 58 years of age, resident in Lassance.


Tracing no. 3: Plate 105

Ventricular extrasystoles. The radial tracing shows two extrasystoles with a complete compensatory pause. No venous tracing of the extrasystoles could be obtained.

9. J. D. brown 30 years of age, resident in Lassance (Santa Rita).

Photograph no. 23: Plate 114.

He has suffered from malaria. He has been ill three years. Blood-streaked
vomitus and pain in the stomach. After effort he feels fatigue and congestion in the head. Small goitre with a more considerable enlargement of the lateral lobes of the thyroid.


Tracing no. 14: Plate 110

The electrocardiogram shows complete auriculo-ventricular dissociation with ventricular bradycardia (38 beats a minute) and auricular tachycardia (more than 200 beats a minute). The length of the ventricular complex (R to T) is very much lengthened 60 hundredths of a second. The significance of the inversion of T is obscure.

BORDET and GENGOU reaction positive for CHAGAS' disease on April 20, 1926.

WASSERMANN reaction negative on April 20, 1926.

Diagnosis: CHAGAS' disease: cardiac form. Peptic ulcer?

18. A. A. S., while 52 years of age, resident in Lassance

Photograph no 24: Plate 114

Has suffered from malaria. Complains of tiredness and distress. Right lobe of the thyroid slightly hypertrophied. Pulse 44 beats a minute with the patient recumbent. Rhythm irregular. Maximum tension 11, minimum 6 (Vaquez Laubry tensiosphygmophone). Heart sounds dull.

Tracing no. 15: Plate 110.

The electrocardiogram shows complete auriculo-ventricular dissociation with ventricular arrhythmia and auricular arrhythmia. The ventricular complex is lengthened, showing a disturbance in the conveyance of the stimulus in the left branch of the auriculo-ventricular bundle.

BORDET and GENGOU reaction positive for CHAGAS' disease on April 24, 1926.

WASSERMANN reaction positive on April 24, 1926.

Diagnosis: CHAGAS' disease: cardiac form. Syphilis.

Photograph no. 25: Plate 115.

49. R. P. S. brown, 29 years of age, resident in Lassance.


Tracing no. 16: Plate 111.

The electrocardiogram shows a deformation of the ventricular complex (R-S taking 0.12 second) revealing a disturbance in the conveyance of stimuli in the left branch of the auriculo-ventricular bundle. Delay in stimulation of ventricle. P R equals 0.20 second.

BORDET and GENGOU reaction negative for CHAGAS' disease on May 20, 1926.

WASSERMANN reaction positive on May 20, 1926.

Diagnosis: CHAGAS' disease: cardiac form. Syphilis.

52. J. M. S., white, female, 35 years of age, resident in Lassance.


Tracing no. 4: Plate 108.

In the venous tracing there are a, c, and v waves with intervals as seen on
normal tracings. Venous and radial tracings showed very numerous extrasystoles, sometimes overlapping, more than one in the same cycle, at times with a complete compensatory pause, sometimes with an incomplete one.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 20, 1926.

WASSERMAN reaction negative on May 20, 1926.

Diagnosis: CHAGAS' disease: cardiac form (irregular extrasystoles) and glandular form. Chronic malaria.


Photograph no. 26: Plate '116.

About 7 years ago she noticed that the left foot was beginning to get 'swollen'. Afterwards the 'swelling' took the right foot as well and began to propagate up the legs towards the knee. A year afterwards the left arm and hand began to 'swell' also and soon afterwards the right hand and arm also. At times, separated by irregular intervals of 15 days, or one month or two, the skin of the leg becomes red and the patient feels pruritus anorexia, vomiting etc. Menstruation has always been irregular. Evacuations normal. The urine always clear. It was never seen to be milky-white or cloudy. Thyroid slightly enlarged. Skin and mucous membranes discoloured. Heart-sounds slightly dull. No other cardiac symptoms.

Pulse 72 beats a minute, the patient standing. Patellar reflex normal. No disturbances of reflexes or lesions of the eye. Compression with the finger-tips does not alter the swelling on the arms and legs, but leaves only a paleness which soon disappears. She has had malaria. Examination of blood fresh and stained does not show anything of interest. The blood was taken during the day.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 20, 1926.

WASSERMAN reaction negative on May 20, 1926.

Diagnosis: CHAGAS' disease: glandular form.


Tracing no. 5: Plate 106.

The venous tracing has a, c and v waves. The v wave of the ventricular cycle fuses always with the beginning of a, owing to the acceleration of the pace. In the tracing are seen four extrasystoles, all of them ventricular. Besides this there is a total arrhythmia, probably of a respiratory nature; this is not very pronounced anyway.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 25, 1926.

WASSERMAN reaction negative on May 25, 1926.

Diagnosis: CHAGAS' disease: cardiac form (tachycardia, ventricular extrasystoles) and thyroid form.

77. M. G. S. coloured, 40 years of age, female, resident in Lassance. Arrhythmia. Extrasystoles. Goitre the size of a walnut.

Tracing no. 6: Plate 107.

Only the tracing 1 a) and the beginning of tracing 2 a) have venous tracings with the waves a, c and v. The other tracings have the radial and carotid pulses. The a-c interval on the tracing is normal, i. e., is of less than a fifth of a second. In the second cycle of the tracing 1 a), there is a ventricular extrasystoles with complete compensatory pause.
BORDET and GENGOU reaction positive for CHAGAS' disease on May 25, 1926.

WASSERMANN reaction negative on May 25, 1926.

Diagnosis: CHAGAS' disease: Cardiac and thyroid forms.

78. J. L. G. white 39 years of age, resident in Lassance.

Arrhythmia. Big goitre without irregular protrusion. Chief enlargement is of lateral lobes of thyroid.

Tracing no. 7: Plate 107.

Venous tracing not very clear, but with a c and w waves present and normal intervals between them. Extrasystoles without complete compensatory pause. They do not appear, however, from the venous tracings to be total.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 25, 1926.

WASSERMANN reaction negative on May 25, 1926.

Diagnosis: CHAGAS' disease: cardiac and thyroid forms.

81. C. C. F., coloured, female, 60 years old, resident in Lassance.

The patient had a strong attack of urticaria lately. She feels a great deal of giddiness. Pain in the right hypochondrium and constipation. Enlargement of the three lobes of the thyroid, each of which is the size of a lemon. Arrhythmia. Extrasystoles. In the area of the mitral orifice there is a musical, systolic murmur, which is fine and not constant. Maximum pressure 13.5, minimum 7 (Vaquez-Laubry).

Tracing no. 8: Plate 107.

Interpolated extrasystoles. Of the jugular no tracing was obtained fit for being analysed. The radial tracing shows a good many extrasystoles all of them occurring advancedly i the diastole, with an incomplete compensatory pause and mostly interpolated.

BORDET and GENGOU reaction for CHAGAS' disease positive on May 25, 1926.

WASSERMANN reaction negative on May 25, 1926.

Diagnosis: CHAGAS' disease, cardiac and thyroid forms.

82. F. P. coloured, 26 years of age, cardiac and thyroid forms.

After running the patient felt a pain on the left side and lost his senses for some time. Apex beat in the 7th. intercostal space, 12.5 cm. away from the middle of the sternum. It is an extremely strong impact but slow. No valvular murmurs. Slight enlargement of the thyroid gland. The patient feels a good deal of dizziness and palpitations. Maximum pressure 14.5, minimum 6 (Vaquez-Laubry).

Tracing no. 9: Plate 108.

The venous tracing shows the a, c and w waves. They do not maintain the normal interval between them: the a and c are at times separated by a bigger or smaller interval and at times appear in inverted order.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 25, 1926.

WASSERMANN reaction negative on May 25, 1926.

Diagnosis: CHAGAS' disease: Cardiac form: Bradycardia through total bradyarrhythmia. with auriculo-ventricular dissociation.

96. I. L. brown, 40 years of age, resident in Varzea da Palma, near Lassance.

Photograph no. 27: Plate 115.

Tracing no. 17: Plate 111.

The electrocardiogram (Lead III) shows the auricular ventricular complex: P inverted and lengthened. Ventricular complex R, S, T with R S lengthened (0.12 second), indicating a disturbance of the conveyance of the stimulus in the left branch of the auriculo-ventricular bundle. Ventricular extrasystoles of the left ventricle with a complete compensatory pause.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 28, 1926.

WASSERMANN reaction positive on May 28, 1926.

Diagnosis: CHAGAS' disease: cardiac form. Syphilis.

105. P. N. A. coloured, 60 years of age resident at Varzea da Palma (near Lassance).

Photograph no. 28: Plate 117.

Right and middle lobes of thyroid gland enlarged to about the size of a lemon. Arrhythmia with frequent extrasystoles. Pulse: 50 beats a minute. At times there are attacks of tachycardia, however, and at others the pulse is less than 50. Maximum pressure 12.5, minimum 7 (Vaquez-Laubry). Abdominal wall tense and prominent. Liver enlarged.

Tracing no. 18: Plate 112.

The electrocardiogram shows the auriculo-ventricular intersystolic interval to equal 0.20 (lengthened). Homotopic ventricular complexes deformed. Multifocal extrasystoles.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 30, 1926.

WASSERMANN reaction negative on May 30, 1926.

Diagnosis: CHAGAS' disease, cardiac form.

107. I. S. M., while 48 years of age, resident in Lassance.


Tracing no. 10: Plate 108

No venous tracing was obtained. In the radial tracing an extrasystole without a compensatory pause and well advanced in the diastole is seen.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 30, 1926.

WASSERMANN reaction negative on May 30, 1926.

Diagnosis: CHAGAS' disease: cardiac form.

109. J. C. S. brown, 49 years of age, resident in Lassance.

Photograph no. 29: Plate 117.

Head-ache. At times dizziness. Incipient, Mal de engasgo. Goitre the size of an orange with chief enlargement of the right lobe of the thyroid gland. Frequent extrasystoles. Maximum pressure 12, minimum 7.5 (Vaquez-Laubry). Pulse: 84 beats second, with the patient standing.

Tracing no. 11: Plate 108.

Venous tracing with a-c and v waves and the a-v interval equalling a fifth of a second and therefore normal. Ventricular extrasystoles twice in the tracing.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 30, 1926.

WASSERMANN reaction negative on June 30, 1926.

Diagnosis: CHAGAS' disease: cardiac form. Mal de engasgo.

110. L. V. L., white, 47 years of age, resident in Lassance.

Photograph no. 30: Plate 118.

Large goitre, with enlargement of the three lobes of the thyroid, the big-

BORDET and GENGOU reaction positive for CHAGAS’disease on May 30, 1926.

WASSERMANN reaction negative on May 30, 1926.

Diagnosis: CHAGAS’disease: thyroid gland cardiac forms.

112. J. M. brown, 36 years of age, resident in Lassance.

Photograph no 31: Plate 118.

He has often suffered from malaria. The present disease began about a year ago. During his work he felt suddenly giddy and fell. This has occurred again. The patient feels his heart pound. Prompt tiredness. The patient is of a robust build. Slight enlargement of the three lobes of the thyroid. Pulse: 56 beats a minute. Almost permanently bigeminate. Maximum 12 minimum 8 (Vaquez-Laubry).

Tracing no. 19: Plate 112.

Electrocardiogram: The tracing shows a bigeminate rhythm with multifocal ventricular extrasystoles of both ventricles. The ventricular complex is aberrant, indicating a disturbance of the conveyance of the stimulus in the auriculo ventricular bundle in both ventricles. The auricular rhythm is not modified and the intersystolic auriculo-ventricular interval is normal and of 16 hundredths of a second.

This patient suffered from convulsive fainting fits (according to information from his wife) and which we attribute to attacks of ventricular extrasystolic tachycardia, with short periods of ventricular fibrillation. As a matter of fact the electrocardiogram shows in some tracings series of three and more extrasystoles overlapping, making up so to say salves of heterotopic ventricular contractions.

BORDET and GENGOU reaction positive for CHAGAS’disease on May 31, 1926.

WASSERMANN reaction negative on May 31, 1926.

Diagnosis: CHAGAS’disease: cardiac form.

118. A. G. C., white, 50 years of age, resident in Lassance.

The patient complains of severe head-ache dizziness and chronic diarrhoea. Frequent extrasystoles. Maximum pressure 14, minimum 8 (Vaquez-Laubry). Pulse: 86 beats a minute, the patient standing. First heart sound doubled. Slight enlargement of the thyroid gland and only of the right lobe.

Tracing no. 12: Plate 109.

Ventricular extrasystoles. Venous tracings were not obtained sufficiently good for analysis. In 5 a there is an extrasystole which appears to be ventricular on account of its complete compensatory pause.

BORDET and GENGOU reaction positive for CHAGAS’disease on May 31, 1926.

WASSERMANN reaction negative on May 31, 1926.

Diagnosis: CHAGAS’disease: cardiac and thyroid forms.

125. G. A. coloured female, 4 years of age, resident in Lassance.

Photograph no. 32: Plate 119.

She is unable to walk. She stands with great difficulty and is at present unable to do so without being held up. Legs and feet show a slight atrophy of the muscles. Slight enlargement of the
thyroid gland. Normal mental development.

BORDET and GENGOU reaction positive for CHAGAS' disease on May 31, 1926.

WASSERMANN reaction negative on May 31, 1926.

Diagnosis: CHAGAS' disease nervous form.

131. I. A., white, 30 years of age and resident in Lassance.

Photograph no. 33: Plate 119.

Large and protruding goitre with enlargement of the three lobes. Skin and mucous membranes very pale. Tiredness, dizziness and vertigo. Tachycardia. Pulse: 102 beats a minute, the patient standing.

BORDET and GENGOU reaction positive for CHAGAS' disease on June 2, 1926.

WASSERMANN reaction negative on June 2, 1926.

Diagnosis: CHAGAS' disease: thyroid form.

134. M. A. F., coloured, female, 23 years of age, resident in Lassance.

Photograph no. 34: Plate 120.

Large goitre, the enlargement being most considerable in the case of the left lobe of the thyroid gland which is the size of an orange. The middle lobe is very much smaller. No disturbances of the heart.

BORDET and GENGOU reaction positive for CHAGAS' disease on June 2, 1926.

WASSERMANN reaction negative on June 2, 1926.

Diagnosis: CHAGAS' disease: thyroid form.

136. A. P. C., coloured, female, 48 years of age, resident in Lassance.


Tracing 2 a is the more interesting and shows the different characteristics most clearly. The venous tracing shows the $a$ c and $v$ waves with normal intervals between, them. There are numerous ventricular extrasystoles which at the beginning of the tracing intercalate between each regular cycle. They are ventricular extrasystoles with a complete compensatory pause.

BORDET and GENGOU reaction positive for CHAGAS' disease on June 2, 1926.

WASSERMANN reaction positive on June 2, 1926.

Diagnosis: CHAGAS' disease: cardiac and thyroid forms Syphilis.

149. G. M. C. brown 53 years of age, resident in Lassance.

The patient complains of a great deal of dizziness, teredness and palpitations venereal antecedents. Thyroid gland slightly enlarged, infrequent extrasystoles. Pulse: 78 beats a minute with the patient standing. Maximum pressure 13, minimum 8 (Vaquez-Laubry).

Tracing no. 20: Plate 113.

The electrocardiogram shows the auricular and ventricular completely normal in the whole tracing. After the last cycle there is a ventricular extrasystole with complete compensatory pause. Extrasystole of the right ventricle.

Photograph no. 35: Plate 120.

164. J. R., brown, 27 years of age, resident in Lassance.

He is very conscious of the heart's action. Goitre with enlargement of the three lobes of the thyroid gland. Pulse: 100 beats a minute, with the patient sitting. Infrequent extrasystoles. Heart en-
larged. Maximum pressure 13 minimum 10 (Vaquez-Laubry).

Tracing no. 21: Plate 112.

The electrocardiogram shows multifocal ventricular extrasystoles. P. R. equals 0.16 second. The ventricular complex following the two extrasystoles of the tracing has no auricular counterpart P (intermittence of sinus).

BORDET and GENGOU reaction positive for CHAGAS’disease on June 7, 1926.

WASSERMANN reaction negative on June 7, 1926.

Diagnosis: CHAGAS’disease: cardiac and thyroid forms.

165. M. R. brown 16 years of age resident in Lassance brother of the preceding case.

Photograph no. 36: Plate 121.

The patient complains of head ache, tiredness and dizziness. Skin and mucous membranes pale. Slight enlargement of the thyroid gland. Pulse: 130 beats a minute, the patient standing. Soft systolic murmur to be heard all over the area of the heart.

Tracing no. 22: Plate 113.

The electrocardiogram shows the ventricular complex R T with R lengthened (0.08 second). Intersystolic interval P R lengthened (0.20 second) indicating a delay in the stimulus from the ventricular node.

BORDET and GENGOU reaction positive for CHAGAS’disease on June 7, 1926.

WASSERMANN reaction negative on June 7, 1926.

Diagnosis: CHAGAS’disease: cardiac and thyroid forms.

169. F. R. coloured, female, 60 years of age, resident in Lassance.

Photograph no. 37: Plate 121.


BORDET and GENGOU reaction positive for CHAGAS’disease on June 7, 1926.

WASSERMANN reaction negative on June 7, 1926.

Diagnosis: CHAGAS’disease cardiac and thyroid forms.

Photograph no. 38: Plate 122.

190. J. R. white 36 years of age resident in Lassance.

Enormous goitre with a greater enlargement of the right lobe of the thyroid gland. Pulse: normal: 88 beats a second the patient sitting. No other lesions. Robust man of good general appearance.

BORDET and GENGOU reaction positive for CHAGAS’disease on June 9, 1926.

WASSERMANN reaction negative on June 9, 1926.

Diagnosis: CHAGAS’disease. Thyroid form.
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