A Contribution to the Pathology of Epilepsy.

by

Robert Ingh, M.B. B.Ch. (Edin 1898)

1892 1902
The following research was suggested to the writer by Dr. J. W. Mott, and the work has been carried out in the laboratory of the London County Council. Claybury, the clinical material was obtained from Claybury Asylum.

The history of Epilepsy is that of the human race, its prevalence unfortunately is widespread, the suffering which it brings to the poor patient is inestimable and untold. The treatment of the disease is attended with comparatively little success, that the disease has commanded some interest. The workers in the field have largely limited their investigations to the clinical phenomenon associated with the attack, pathologically to the morphological histology. The chemistry of the disease has until 4 or 5 years ago attracted little attention, probably on account of the difficulties which it entails. The writer hopes that the few points in this investigation will prove of some service.

Summary of Contents.

Historical

Methods.

Clinical Cases. General Considerations

Conclusions.
The Alkalinity

Under normal conditions the reaction of human blood is alkaline. The alkalinity is due to the presence of two salts, e.g., Bicarbonate of Soda, NaHCO₃, and Bicarbonate of Soda, Na₂CO₃. These two salts are called acid salts and are readily dissociated when brought into contact with an indicator such as Alizarin forming a colored salt. Phenolphthalein has been used as an indicator to a neutral reaction obtained due to the fact that it does not possess the property of dissociating these acid salts if for this reason it cannot be used as an indicator. Thus the blood is an alkaline fluid in virtue of these two salts which are bases in combination with very weak acids.

Up to the present time various investigations have been carried out on different methods and to estimate the alkalinity of the blood. The earlier investigators used the titration method. Huntzki titrated with Phosphoric acid; Lassen, 2.

K. J. Fritz, used the titration method. The same objections apply to both these methods. The amount of blood required is too much, the solutions of these organic acids become weaker when exposed to light. Leibnitz used alums...
of Plasky of Paris impregnated with cinchic, a drop of blood was applied to the slab. The blood capillaries were retained on the surface, the plasma soaked in. Reacted with the absorbed cinchic, Schaper used sheets of glazed paper impregnated with cinchic.

These methods were improved upon by Kantio in 1884. As the method has been in extensive use, it may be briefly described.

Blood is mixed with a solution of sulphate of tartaric soda, saturated with phosphorus acid. The neutral point estimated with cinchic paper, the principle of the method consists in the prevention of coagulation by the saline solution, while the alkalinity is neutralized by the etrason with tartanic acid. Thus the solution of tartanic acid is added in graduated amounts to the sulphate of soda solution. Solution will contain 700 sulphate of soda solution 10 acid 10 acid

Solution 2. To sulphate 1-40 on to solution 10 1-60 acid

10 sulphate. Equal quantities of blood and one of these solutions are taken up in a pipette, and thoroughly mixed in a wash glass. The reaction tested with cinchic paper, if the mixture is alkaline, then the next stronger acid solution is taken 1-60 on until the neutral point is obtained.
Brown improved this method by titrating with trichloroacetic acid. Again, the objection is, that too much blood is required, also the presence of the red blood corpuscles necessitates dilution with the saline solution thus increasing the difficulty of accurately estimating the neutral point. In this method the alkalinity of the blood plasma and corpuscles is estimated, and in order to do this efficiently titration must be carried out slowly at the body temperature so that all the corpuscles are broken down.

Kaycraft & Williamson's method consists of a series of glass plates paper, treated with different strengths of sulphuric acid. This gives a series of papers of graduated acidity. A drop of blood is brought in contact with a paper of a certain strength for ten seconds, then dipped in water, the reaction noted. The method is a simple one, but the results are not accurate enough.

Wright's Method, which is used in this investigation and described in full: Wright claims many advantages - the quantity of blood required is small, the red blood corpuscles are completely separated from the serum, the alkalinity can be tested in a few hours.
From a clinical point of view the alkalinity of the serum is the more important because it comes into such close contact with the tissues, it may be taken as an index to the changes taking place in the circulating blood.

Physiology: The alkalinity undergoes a diurnal variation being lowest in the morning, gradually rising in the afternoon becoming low again in the evening. It is increased during digestion, due to the passage ofbicarbonate of soda from the stomach to the blood. It is decreased after severe muscular exercise, probably due to the entrance of the products of muscular metabolism, e.g. lactic acid, into the blood. Apart from these two conditions, the alkalinity is maintained at a constant level, varying within physiological limits. It may be taken as an index to the amount of activity of oxidation within the tissues, between the blood and the various tissues.

Pathology:
Numerous observations are recorded, noting the changes in the alkalinity in disease.
These changes are constant and manifest themselves in a diminution of the alkalinity. Diseases of the blood, Pneumothorax, Penicillium, Debile, Cachexia, chronic Diabetis, and especially in Diabetic Coma, Cholera, Jaundice, Good Rheumatism. In certain mental diseases Dementia Paralytica, Epilepsy.

Charon Prior, working with Landor's method found a diminution in Epilepsy. I come to the conclusion that the Epileptic attacks present nearly constant variations and are in inverse relationship to the variations in the alkalinity of the blood. Later, I confirmed the diminution in the alkalinity.
Wright's Method.

The thumb is cleaned with soap and water sterilised with 1 per cent solution of formalin solution of Carbolie acid is admissible as its interference with the alkalinity of the blood. An incision is then made with a lancet, & a copious supply of blood obtained, it is unnecessary to apply pressure to the thumb. The blood is collected in capillary tubes by means of capillary action, or if necessary by suction at the other end of the tube. B is then sealed up in the blowpipe flame. The tube inverted, then A is sealed.

It may be left suspended for 24 hours, during which the clear plasma will be found at the B end and the corpuscles retained at the A end. The method used by the writer was to suspend the tube for some hours, then Centrifuge.

Preparation of acid solutions and indicators for the Analyses.

A solution of sulphuric acid was accurately standardized by precipitating with Barium Chloride and weighing the Barium Sulphate thus produced. The mother solution used was of the following
value 1 cc = 0.4155 grammes of H₂SO₄
(mean of 6 analyses). Dilutions of various strengths were made from this acid by running the calculated amount for the strength from the burette into a graduated cylinder, adding the requisite amount of distilled water. The dilutions first used were 10: 20: 30: 40: 60. These were supplemented by other dilutions differing in their strength but very little. 10-fold dilution 1000 cc = 4.155 grammes of H₂SO₄

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The indicator used was the skim paper, Special of Grünert No. 6. This was treated according to
Lothig, with an extremely dilute acid solution
in 20,000. Hydrochloric acid - washed with
distilled water. It dried at 100° C.

Titration of Serum against the
Standard acid solutions.

A capillary pipette is inserted into the serum
about 2 cm io allowed to flow into the
tube. The serum is allowed to run up the
pipette for a short distance, about 1 cm
than a mark is made with a blue pencil.
The end of the pipette is now quickly
inserted into a solution of acid of unknown
strength. Say 10 fold dilution, the acid
solution allowed to run in until the lower
end of the serum column runs up to
the blue mark. In this way an equal
quantity of serum and an acid of known
strength is obtained. The contents of the
pipette are blown out on to a clean watch glass
thoroughly mixed with the end of the pipette,
aspirated, blown out again 2-3 or until
mixing is complete. Finally, the mixture is free
more taken into the pipette, a drop or two blown on to a piece of the prepared filter paper, the reaction is noted if the neutral point has not been accurately estimated. Fresh titrations are carried out with acids of greater or less strength until the desired reaction is obtained. Great care was taken to standardize the acids in the first instance. Wright's results are given as dilutions of the chemically normal \( \text{H}_2\text{SO}_4 \) acid, but the acid employed in this investigation was of different strength. Thus,

\[
1000 \text{ cc} = 4.155 \text{ grammes of } \text{H}_2\text{SO}_4
\]

\[
1000 \text{ cc} = 4.9 \quad \ldots \quad (\text{Wright's})
\]

The alkalinity has been returned as the amount of \( \text{H}_2\text{SO}_4 \) in 1000 cc of acid which would exactly neutralize 1000 cc of serum. Thus by the result alkalinity 1.385 grammes of \( \text{H}_2\text{SO}_4 \) is meant, that 1000 cc of a solution containing this amount of \( \text{H}_2\text{SO}_4 \) would exactly neutralize the alkaline proportion of 1000 cc of the Serum.

In obtaining the normal alkalinity, control cases have been selected from the staff of Claybury Asylum - Physicians, Clerks, Porters.
and Attendants. Care was taken to avoid
the time during which the alkalinity is said
to vary, e.g. after food. & after severe muscular
geneses. Blood was taken at a stated time 11 AM
on successive days. from each case. The average
obtained was 1.662. & case. 4. 8. 7 showed
the highest 1.806. This was obtained on three occasions;
Of all 20 cases were examined. The reason why
the control cases are not taken from one class is
to show the constancy of the alkalinity. that in spite
of the different conditions of living. such as diet.
habit etc. between the cases. the alkalinity is
maintained at a constant value. within
physiological limits.

Epilepsy. Blood was taken from each patient
at 11 AM on successive days. during the inter-
paroxysmal period. i.e. an interval of 7 days
between seizures. The alkalinity varies. two cases
showed a normal alkalinity. The average
of the 10 cases was. below that of the control
cases.
The blood was obtained from the ear in nearly all the cases, the rest from the thumb. The instruments used in the leucocyte count were the ordinary Thomas' Tess's apparatus; the diluting fluid was the ordinary normal saline solution coloured with Methyl violet. In all the cases 256 squares were counted. The co-efficient of error being 0.2 per cent. Four glass preparations were taken at the same time, one in the incubator for an hour, held over acid vapour for 5 minutes replaced in the incubator for 24 hours, then stained with Delafield's Hæmatoxylzine well diluted for 3 minutes, counterstained with Eosin for 30 seconds, worked in Methylated Spirit, Absolute Alcohol, cleared in Toluol and mounted. In the differential count from 800 to 1,000 leucocytes were counted. Four cover glass preparations were used. The nomenclature adopted in the classification of the leucocytes is taken from Clifford Allbutt's System of Medicine.

1. Finely granular polymorphonuclear contains numbers of fine granules. Nucleus irregular & multiparite. Plagocyte. 75 per cent.
The Coarsely Granular Eosinophil or Eosinophile contains large granules - nucleus horseshoe or reniform. 2 per cent.

Small Hyaline or Lymphocyte: nucleus large protoplasm hyaline no granules. 20 per cent.

Large Hyaline: large amount of protoplasm than the small. 10 per cent.

The total number of leucocytes per cubic millimetre of blood is extremely variable - variations occur in different individuals, at different times - the normal range lies between 6000-10000 - any number below 6000 constitutes a hypo-leucocytaemia, above 10,000 a leucocytaemia. Physiological leucocytos occurs in the new born - in pregnancy and during digestion as all the cases are males & adults, the first two are excluded. In taking the leucocyte count in the interpartum period, due attention was paid to the time. The time chosen was ½ hour before meals. Thus ruling out digestion leucocytaemia.

Historical: Rutherford Keaphale was the first observer noting the changes in the blood in mental diseases, he states that in epilepsy
that the vitality is lowered & the blood is more degenarated in males than in female patients. Of the 100 cases on admission 37 per cent recorded a lowered percentage of red blood corpuscles & 40 per cent showed a higher percentage than normal. - the leucocyte varied within physiological limits. Hambright, who studied the blood in various Psychoses, which included 12 cases of Epilepsy, states that at the time of the attack the total quantity of leucocytes is increased & their increase diminishes with every new attack. The leucocyte is at its highest an hour after the attack. The increase is due to the almost relative & absolute increase of lymphocytes with relative decrease of the older cells. He also states that a few hours after the poisoning the county granular & crystal cells are increased.
J. L. age 16. admitted May 31, 1900; Duration of
Epilepsy: 5 years. Bodily condition: Good.

Family History: Father, another alive, intemperate.
Maternal aunt insane. Patient the only child.

Mental Condition: Very dull intellect, mind, is unable
to add simple numbers - slow in answering questions.
After fits is very impatient, restless, often has to be
held down.

History of fits: First fit 5 years ago. When at school
fits gradually increased in frequency. Grand mal.
after an attack remains in a state of mental
confusion for some hours. (5-14). Record of fits
from admission to Dec. 21, 1901.


Acidity of Blood during the interval 1.148.
Sept 24, 1901: 5 fits from 8 Fm. 9.30 Fm.

Blood taken 10 M. = 1.0387
" . . 10.30 M. = 1.26
" " . 11 M. = 1.385
" " . 12 M. = 1.385
" " . 1 Am. = 1.43.

At the time he was very confused.

Blood taken 10-30 Am = 1.46.

December 20, 1901: 6 fits from 4 Am. 7.45 Am.

Blood taken 9 Am = 1.18
Blood taken 11 A.M. Alkalinity 1.43
12 A.M. " 1.48
3 P.M. " 1.48

December 25, 1907.
5 A.M. from 10 A.M. - 12 P.M.
Blood taken 12.30 P.M. Alkalinity 0.821
" 1-30 P.M. " 1.12
" 2-30 P.M. " 1.383
" 5-30 P.M. " 1.43

The patient was very confused, would not answer questions, was very irritable when spoken to. His mental confusion lasted for 8 days. During this period his blood was taken at a stated time, 11 A.M. every morning.

Dec. 28. 1.48; Dec. 29. 1.538
Dec. 30. 1.48; Dec. 31. 1.57

January 1. 1.59; Jan. 2. 1.59

On January 3rd, he was bright and cheerful and answered questions readily, expressed a desire to get up. From Dec. 20 to January 5, he was not treated for his epilepsy.

January 5: was put on Potas Bromid. Jan. 20.
Three times a day. This treatment was continued until the 13th of January. During
This treatment he had 3 days fits, but the alkalinity was maintained at 1.538.

January 12, 1902

about 60 seconds after his blood had been taken, he had a slight fit.

Immediately prior to the fit, alkalinity 1.26
0.5 hour after 1.18
1 1.383
2 1.43
1p 1.538.

January 13, 1902

was put on Suprarenal Extract, one capsule three times a day after meals, on the 15th the dose was increased to 6 per day. On the 20th reduced to 3 a day. Continued until the 29th of January. Whilst under this treatment he had 33 day fits and 14 night fits which is a distinct increase. However, the mental confusion was not so great. He recovered from the after effects of the paroxysms much sooner than when under the Bromide treatment.

During the intervals, there were no distinctive changes in the blood, the leucocytes appeared normal. The alkalinity was not affected, the pulse was diminished in frequency by
Shea-C. The blood pressure was increased.

January 30. He was given, Potassium Bromide 15. Soda Bicarb. 6 gr. 15. Aquad ad 3½. 3½ times a day. This treatment was continued for two months. During this time he had 14 day fits, 14 night fits, which is a pronounced decrease. The average number of fits per month being 6 day fits, 10 night fits. The alkalinity was maintained at a fairly constant value, ranging from 1.48 to 1.66.

Leucocytes.

Interparalytic period, 9.500.

Differential Count. Polymorphonuclear. 65 per cent.
Large Hyaline, 67%. Small Hyaline, 25%.
Eosinophile, 3%.

10 minutes after 7.55. Leucocytes 10,000.

Differential Count. Polymorphonuclear. 68%.
Large Hyaline, 87%. Small Hyaline, 23%.
Eosinophile, 4%.

60 minutes after. Leucocytes 81,000.

Differential Count. Polymorphonuclear. 60%.
Large Hyaline, 87%.
Small Hyaline, 29%.
Eosinophile, 5%.
P.C. age 15. Admitted August 7, 1900: Duration of epilepsy 9 years. Family condition good.

Family history: Father died of acute Bright's disease aged 48 from an ulcer, mother alive well. Six children, 2 boys, 2 girls. Patient is the 5th child. The 6th child is also an epileptic.

Mental condition: Is rational in manner and talk slight impairment of memory: In very intractable after fits.

History of fits: Developed his epilepsy at 9 years of age. His mother states that he had a fall on his head when 6 years of age. Grand mal recovery from mental confusion gradual – 2 minutes before after the right lower eyelid twitches.

Record of fits from admission to Dec 31, 1901:

Day Sitis 4th. Right Sitis 8th.

Alkalinity in the interparoxysmal period 1.538.

Right Siti 8 A.M. Blood 11 A.M. Alkalinity 1.385

2-30 P.M. 1.538

Two Sitis 9-30 P.M. Alkalinity

Blood 10-30 P.M. Alkalinity 1.26

11-30 P.M. 1.355

1 A.M. 1.48

4-30 P.M. 1.59
Blood taken 11 A.M. Alkalinity 1.443

" 12 A.M. " 1.48

" 3 A.M. " 1.48

January 12, 1902.

About 60 seconds after his blood had been taken, he had a slight fit.

Immediately prior to the fit, Alkalinity 1.26

1/2 hour after " 1.18

1 " 1.385

2 " 1.43

4 " 1.538

Leucocytes:

The study of the blood 10 minutes after the fit shows no leucocytes. 9.500.

An hour after, there is a decline. Leucocytes 11.300. Differential count.

Polymorphonuclears. 60 per cent.

Small Hyaline 25 per cent.

Large Hyaline 11 per cent.

Eosinophile 14 per cent.
Case III

J.H., age 18, admitted August 24, 1900: Duration of Epilepsy, 14 years. Bodily condition fair. Stature short. Suffer from constipation.


Mental Condition: A simple retardation in manner and talk, is easily confused. Mental reaction slow. Answers questions slowly. Memory for recent events impaired.

History of fits: Said to be healthy & intelligent up to 1886. When his father died suddenly soon after patient had two epileptic fits. "Grand mal, mental confusion lasts about 12 hours."

Record of fits from admission to Dec 31, 1901.

Day fits: 2 1/5, Night fits: 4 1/5.

Alkalinity in the interparoxysmal period, 1 1/8.

December 2.

8 fits from 10:30 A.M. - 11:00 A.M.


12 P.M. 1:26

1 P.M. 1:388

3 P.M. 1:148

At 4 P.M.: Patient was very restless, irritable, a little confused. At 7:30 P.M., he had 10 very severe fits. I was given an Esmone

Blood taken at 7.45 PM, Alkalinity 1.18

" " 8.30 PM " 1.385

" " 9.30 PM " 1.26

" " 11.30 PM " 1.48

During the month of December, the Potassium Bromide was suspended. He had 94 day fit. 441 night fits.

December 15.

15 fit 11.50 PM to 12.30 AM.

Blood taken at 12.40 AM. 8.31

" " 1 AM " 1.26

" " 10-30 AM 1.538

December 21.

14 fit 8.30 PM to 9 PM.

Blood taken at 9.15 PM, Alkalinity 1.0387

10 PM " 1.385

11 PM " 1.43

12 PM " 1.48

January 13, 1902.

Was put on Suprarenal Extract, one capsule three times a day after meals. On the 17th, the dose was increased to 6 per diem. On the 22nd the dose was reduced to 3 per diem. This treatment was continued until February 1st.
The effects produced were essentially similar to those produced in the case of J. H. The fits increased in frequency, the record for the 18 days read: 11 day fits, 154; night fits, 4.

The marked increase of the nocturnal fits is very striking, two fivefold greater than the average monthly record. The nearest approach to these figures was in June 1911, when patient had 121 night fits.

Blood: no distinct change in the alkalinity, which varied from 1.48 to 1.538. The tendency to appeared normal.

Pulse: Diminished in frequency by 9 beats on an average. The blood pressure was increased:

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The effect upon the mental state was good, and the recovery from the confusion following the fits was quiet.

January 30, 1912

He was put on Sodium Bromide, 9 gm 15
Soda Biuret, 9 gm 15. Aqua ad 3/4. 3/4 three times a day.

February 12. The hiccup was
given four times a day for 18 days, from February 24 to the end of March. Three times a day. Under this treatment the number of fits was considerably decreased; during the month of February, the patient did not have a fit.

The alkalinity was maintained at a constant value, e.g., 1.538 to 1.662.

Signsafter:

Interparoxysmal period. 9.100.

Differential Count. Polymorphonuclear. 68 %.
Large Hyaline 7 %, Small Hyaline 22 %.
Eosinophile. 3 %.

Fifty minutes after 8 fits:

Leucocytes. 19,000

Differential Count. Polymorphonuclear. 60 %.
Large Hyaline. 8 %, Small Hyaline 30 %.
Eosinophile. 2 %.
Case IV.


Mental condition: In rational in manner, talk in the intervals. Memory slightly impaired. Slight senseful reactions after fits. Develops delusions of persecution.

History of fits: Developed Epilepsy at 12 years of age, gradually increased in frequency. Month before admission had over 100 fits. Grand mal, mostly nocturnal, recovery from mental confusion rapid.

Record of fits from admission to Dec. 31, 1901:
Day fits 698, Night fits 820.

Alkalinity in the interepileptic period 1.43
3 hours after his blood was taken the patient had a strong fit. 3:00

Blood taken at 3:15 AM. Alkalinity 1.0387

" " 4:30 AM " 1.26

" " 5:30 PM " 1.43

" " 8:30 PM " 1.538.
January 13, 1902:
was put on Suprarenal Extract. One capsule three times a day. On the 17th, the dose was increased to 6 a day. This treatment was carried out for 18 days. The fits increased in frequency, but not to such an extent as in the cases of JH and JL. There were no distinct changes in the blood. The leucocytes were normal, but the alkalinity varied, on two occasions it was 1.43.

Pulse, diminished in frequency by 6 beats, the blood pressure was increased. The effect upon the mental state was very pronounced, the after effects passing off in a short time.

Leucocytes.

Interparoxysmal period. 10,000.

Differential Count: Polymorphonuclear. 60%.
Large Hyaline. 6%. Small Hyaline. 21%.
Eosinophiles. 3%.

4 hours after a fit. Leucocytes 12,000.

Differential Count: Polymorphonuclear. 62%.
Large Hyaline. 14%. Small Hyaline. 30%.
Eosinophiles. 5%.
Case V.

T.G., age 33, admitted October 18, 1893. Duration of epilepsy, unknown. Bodily condition fair.
No family history obtained.

Mental condition: J H. dull, lost of coheredness, after fits is restless, has hallucinations of sight.

History of fits: Grand mal. Spasticic aura.

Mental confusion lasts about 3 hours.

Record of fits from admission to Dec. 31, 1901.
Day fits 30 5 Night fits 4 4 8.

Acetazalic acid. 1.662 1.538

5 fits in quick succession.

Blood taken 15 minutes after. Alkalinity .831

1 hour " 1.36
2 hour " 1.385
4 hour " 1.48
12 hour " 1.662

Alkalinity during aura 1.36.

12 hours after 5 fits. Leucocytes., 11,000

Differential Count: Polyhromobnauclei, 40.70

Large hyaline 7.70. Small hyaline 18.90.

Eosinophile 5.7.
J.S. age 46. Admitted September 10, 1898.
Duration of epilepsy 3 years. Bodily condition fair.
Family History: Father, mother, dead. Paternal
uncle insane. Patient the only child.
Mental condition: Is demented, has very little
idea of time or place. After fits is very restless.
Variable. Develops religious delusions.
History of fits: Had his first fit 3 years ago.
Following a drinking bout. Grand mal. Mental
confusion lasts about 3 hours.
Record of fits from admission to Dec 31, 1907.
Day fits 81. Night fits 114.
Urinary specific gravity 1.662. 1.538.
Two Strong Fits.
Blood taken 30 minutes after. Alkalinity 1.0387
u 1/2 hour " 1.12
u 1 hour " 1.06
u 2 hours " 1.43.
" 5 hours " 1.538
60 minutes after. Kureyto 18,000.
Differential Count. Polyhedral 58.70.
Large Hyaline 8.70. Small Hyaline, 33.70.
Eosinophile 2.70.
Case VII

J. T. B., age 40, admitted May 26, 1895.

Duration of Epilepsy: 10 years. Bodily condition good.

Family History: Father died of Pneumonia - an alcoholic. Mother alive and healthy. Brothers alive well.

Mental Condition: VERY rambling and incoherent.

In late: memory much impaired especially for recent events. References electrical delusions.

History of fits: Had two fits 11 when 30 years of age, at the time patient was travelling with a circus. No history of alcohol. Grand mal.

Mental confusion lasted about 3 hours.

Record of fits from admission to Dec. 31, 1901.

Day fits: S32, Night fits: 32.

Interparoxysmal alkalinity: 1.538

Slight fit 10-40 A.M.

Blood taken at 11-50 A.M.: Alkalinity 1.18

11-45 A.M. " 1.26

Slight fit 12-10 P.M.

Blood taken at 12-30 P.M. " 1.0387

1-30 P.M. " 1.26

3-30 P.M. " 1.43

5-30 P.M. " 1.538

50 minutes after the second fit. Hemoglobin 19000.

Differential Count, Polymorphs. 57%. Large Hyaline 97%.

Smaller Hyaline, 30%. Eosinophile, 3%.
Case VIII

Child, age 19, admitted August 8, 1900. Duration of Epilepsy, 3 years. Bodily condition good.

Family History: Father died of Heart disease: Intemperate.
Mother alive and healthy. Maternal uncle died of tuberculosis. Parent the only child.

Mental Condition: A very unstable, restless, irritable, subject to introspection. Suffered from pugnacious, intractable, suicidal.

History of fits: Had his first fit when 16 years old.

Then had a fit every week for 6 weeks. Then ceased having them for 8 weeks. Gradually increased in frequency and severity. Grand mal, recovery from the mental confusion.

Record of fits from admission to Dec. 21, 1901

Day fits 94. Night fits 236.

Interventricular acuteness: 1.538.

Fit 11.30 a.m.

Blood taken at 11.40 a.m. 1.12

" 12.30 a.m. 1.385

" 1.30 a.m. 1.48

" 3.30 p.m. 1.538

60 minutes after two fits. Nerve cells, 17,000.

Differential Count: Polymorphonucleus 60%.
Large Hyaline 29%. Small Hyaline 10%.
Eosinophile 1%.

Duration of Epilepsy: 15 years. Bodily condition good.

Family History: Father healthy, mother alive and healthy.
Both in temperate. 2 brothers alive and healthy. Patient
the 3rd child, one sister simple minded.

Mental Condition: after fits is very impulsive, religious, emotional, slight mental impairment

History of fits: developed his Epilepsy at 10 years
of age, gradually increased in frequency. Grand
mal, hypnoidal aura. Recovery from mental confusion
gradual about 3 hours.

Interparoxysmal alkalinity 1.538.

40 seconds before a fit 1.26
1/2 hour after fit 1.18
1 hour 1.385
2 hours 1.43
6 hours 1.538.

80 minutes after the fit

Recency No. 12.400

Differential Count. Polymorphonuclear: 68%.
Large Hyaline: 23%. Small Hyaline 6%.
Eosinophiles: 3%.
Case X

E. O., age 31, admitted October 24th, 1896.

Duration of Epilepsy 5 years. Bodily condition good. No family history obtained.

Mental condition: cast dull. Stupid, feeble-minded.

Memory very defective; has no idea of time, after fits is available. Develops persecutory delusions.

History of fits: Grand mal, mental confusion last about 3 hours.

Record of fits from admission to Dec. 31, 1901.

Day fits 5 57.
Night fits 5 27.

Interparoxymal alkalinity 1.48.

7 a.m. Blood taken at 11 a.m. 1.385
2-30 p.m. 1.398.

Strong fit 2-46 p.m.

Blood taken at 3.30 p.m. 1.12
4:45 p.m. 1.385
8 p.m. 1.538.

2 a.m. 9 p.m.

Blood taken 9-15 p.m. 0.831
10 p.m. 1.12
11 p.m. 1.36
1 a.m. 1.48

50 minutes after. Leucocytes, 14,000.

Differential Count. Polymorphs. 60%. Eosinophile 3%.
Large Hyaline. 8%. Small Hyaline 20%. 
Case XI

H.T.M. age 21, admitted February 2, 1900

Duration of Epilepsy 8 years. Bodily condition suffers from Constipation & Insufficiency.

Family History: Father alive & well. Mother died of Cancer, age 44. Epilepsy + Phthisis on Mother's Side.

Mental condition: A simple in manner, does not exhibit mental impairment. After Epi. in moderate remission.

History of life: Had his first fit when 13 years of age. Grand mal. Epigastric Aura 5 minutes before the fit. Recovery from mental confusion gradual.

Record of fits from admission to Dec 31, 1901.

Day fits 156. Night fits 104.

Wet Plasma alkalinity 1.648.

Alkalinity during Aura 1.385

1/2 hour after fit 1.18

1 hour " 1.385

2 hours " 1.48

12 hours " 1.538

12 hours after one fit

Leucocytes 9,000.

Differential Count: Polymorphonuclear 70%.
Large Hyaline 17%, Small Hyaline 20%.

Eosinophile .3%.
H. A. H., age 46, admitted August 24, 1893.

Duration of Epilepsy 20 years. Bodily condition good.
No family history obtained.

Mental Condition: I very forgetful; irritable; keeps much of himself on religious subjects. I very
annoyed. Has no idea of time or place.

History of fits: has very frequent Petit Mal
Figures. Mental confusion lasts about an hour.
Record of fits from admission to Dec. 31, 1901.


Alkalinity in the interparoxysmal period. 1.538
Alkalinity 20 seconds before fit. 1.385

Sit 11 A.M.

Blood taken at 11-15 A.M. Alkalinity 1.385
12-15 P.M. 1.48
2 P.M. 1.538

3 Strong P. U. 7 P.M.

Blood taken at 7-10 P.M. 1.831
8 P.M. 1.12
9 P.M. 1.76
11 P.M. 1.43
1 A.M. 1.48

One hour after. Leucocytes. 23,000.

Differential Count: Polymorphonuclear. 58%.
Large Hyaline 8%, Small Hyaline 32%, Eosinophile 3%.
K.G.J., age 49, admitted November 20, 1897.

Duration of Epilepsy: 43 years. Bodily condition fair.

Family History: Father died in an Epileptic fit.

Mother, alive, intemperate, maternal aunt insane.

Mental Condition: Irregular, stupid and very demented.

History of fits: Had his first fit when 6 years of age, he did not have a second until 15 years later, this was followed by another 4 years afterwards when they became more frequent. Grand mal, no aura, mental confusion lasts about 1 hour.

Record of fits from admission to Dec. 31, 1907.

Day fits: 32 Night fits: 114.

Interparoxysmal alkalinity: 1.538: 1.48.

Two fits, 8:30 A.M.

Blood test at 9 A.M. alkalinity: 1.12


" 12 A.M. " 1.43.

" 1 A.M. " 1.48

1/2 hour after the fit, Leucocytes: 20,000.

Differential Count: Polymorphonuclears: 58%.

Large Hyaline: 6%. Small Hyaline: 39%.

Eosinophile: 2%.
36.

19th, age 24, admitted August 24, 1076. Duration
of epilepsy, 10 years. Bodily condition fair.
Family History: Father, mother alive, healthy.
One brother alive, healthy.
Mental Condition: C. dull, slow, feeble-minded.
Memory for recent events defective, after fits to day.
Institution, inosculate.
History of fits: Developed her epilepsy, when 12
years of age. Grand Mal. had severe frontal
headache 1 to 2 hours before fit. Mental confusion
lasts about 1 2 hour.
Records of fits: from admission to Dec 31, 1901.
Day fits 4 45. Night fits 34.
Interparoxysmal alkalinity. 1.538 1.48.

4 fits from 10 am to 11 am.

Blood taken at 11 am. Alkalinity 1.12

11.30 am. Alkalinity 1.12

1 pm. 1.385

3 pm. 1.48

6 pm. 1.59.

Alkalinity during Aura. 1.385.

6 hours after 4 fits. Leucocytes. 11,000.
Differential Count: Polymorphonuclear 61.7%.
Large Hyaline 6%, Small Hyaline 25%. Eosinophile 8%.
G. M., age 23, admitted January 26, 1900

Duration of Epilepsy: 22 years. Bodily condition good.


Mental Condition: Very feeble-minded. Memory defective. Has no idea of time. After fits is available. Has hallucinations of sight.

History of fits: Developed his Epilepsy when 6 years old. Grand mal. No warning. Mental confusion lasts about 3 hours.

Record of fits from admission to Dec. 31, 1901.

Day fits 100. Night fits 172.

Interparoxysmal Alkalinity 1.538.

One severe fit, 8-30 P.M.

Blood drawn at 9 P.M. Alkalinity 1.26

10 P.M. 1.385

11 P.M. 1.48

1 A.M. 1.59

24 hours after two fits. Serum hypo. 9.000

Differential Count: Polymorphonuclear, 70%.

Large Hyaline 14%. Small Hyaline 28%.

Eosinophile 3%.
Case XVI

C. B. M., age 31, admitted December 8, 1899.

Duration of epilepsy, not known. Brady condition fails
suffers from Constipation.

No family history obtained.

Mental Condition: Simple retardation in manner and
habit: mental reaction slow, memory very defective.

History of fits: Grand mal, no aura, mental
confusion lasts about 3 hours.

Record of fits from admission to Dec. 31, 1901.

Day fit 16, Right fit 16 2.

Interparoxysmal alkalinity 1.535 : 1.48

3 fits, 10 minute interval between the seizures.

Blood taken ¾ hour after alkalinity 1.12

" " 1 " " 1.26

" " 3 hours " 1.48

" " 5 " " 1.59.

" " 12 " " 1.59.

8 hours after one fit. Leucocytes: 8000.

Differential Count: Polymorphonuclear 62%.
Large Hyaline 6%. Small Hyaline 23%.

Eosinophile 9%.
C. X. age 37, admitted August 15, 1893: Duration
of epilepsy 7 years. Bodily condition fair.
No family history obtained.

Mental Condition: is very dull and slow-minded.
Memory much impaired, has no idea of time. After
3 fits is worse, intractable

History of fits: had his first fit 7 years ago. Grand
mal. no warning. Mental confusion lasts 3 hours.
Record of fits from admission to Dec. 31, 1907.

Day fit to 1:90. Night fit to 998.

Interparoxysmal alkalinity 1.59. 1.28

10 minutes after fit. Alkalinity 1.0387
30 " " " " 1.16
2 hours " " " 1.3875
3 " " " " 1.28
6 " " " " 1.59.

3 days after. 1st. Serum 1:20, 12000.

Differential Count. Polymorphonuclea. 56.7%.
Large Hyaline 77.0. Small Hyaline 32.7.
Eosinophile 57.0.
A. age 52: admitted Sept 30, 1896: Duration
of epilepsy: not known: Bodily condition fair.
No family history obtained.
Mental condition: Dull, stupid, children in
memory & conversation. Memory much impaired: after
fits, has hallucinations of smell. Becomes abusive.
History of fits: Grand mal. No aura. Mental
confusion lasts about 3 hours.
Record of fits from admission to Dec 31, 1901.
Day Fits 14, 43. Night Fits, 3, 13.
Total convulsive alkalinity: 1.538.

11 A.M.

Head taken at 2 P.M. Alkalinity 1.26
  "  " 3 P.M. " 1.385
  "  " 5 P.M. " 1.48
  "  " 7:30 P.M. " 1.69.

3 hours after two fits.

White cells 13,000.
Differential count. Polymorphonuclear, 52%.
Large Hyaline 4%. Small Hyaline 38%.
Eosinophile 3%.
Case H.

Age 19, admitted March 8, 1900. Duration of Epilepsy, 2 years. Bodily condition good. No family history obtained.

Mental Condition: Is very feeble-minded and unable to read or write. Habits very faulty. Has very little idea of time or place.

History of fits: Has always been dull and stupid, had his first fit two years ago. For the following twelve months had several slight seizures; a few months before admission, he had had numerous strong fits. Grandmal recovery from mental confusion gradual. Record of fits from admission to Dec. 31, 1901. Day fits 50, Night fits 50.

Interparoxysmal alkalinity 1.535.

Lr. 11 A.M. Blood taken at 12 A.M. Alkalinity 1.535

<table>
<thead>
<tr>
<th>Time</th>
<th>Alkalinity</th>
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<tbody>
<tr>
<td>1 P.M.</td>
<td>1.523</td>
</tr>
<tr>
<td>3 P.M.</td>
<td>1.548</td>
</tr>
<tr>
<td>6 P.M.</td>
<td>1.539</td>
</tr>
</tbody>
</table>

14 days after admission. Leucocytes 9,000

Differential Count: Polymorphonuclears 68%.

Large Hyaline 6%. Small Hyaline 20%.

Eosinophile 14%. 
M.A.K., age 22, admitted, Oct. 18, 1894.

Duration of Epilepsy: 4 weeks. Bodily condition good.
No family history obtained.

Mental Condition: Emotional & Intractable.
Memory defective; after fits in intensely noisy
disturbed impulses. Developed persecutory delusions.
History of fits: Had his first fit 4 weeks ago.
prior to his admission. Grand mal. Epileptic
aura. Mental confusion lasted about 4 hours.
Record of fits from admission to Dec. 31, 1907.
Day fits 30.3. Night fits 18.4.5.
Interparoxysmal alkalinity 1.538. 1.48
taken at 2 A.M. 1.463.

2 fits in quick succession.

Blood taken 1/2 hour after. Alkalinity 1.0387.

1 hour after, 1.56.

2 hours after, 1.43.

4 hours after, 1.59.

14 hours after, two fits; Leucocytes, 14,000.

Differential Count.

Polymorphonuclear 57%.

Large Hyaline 57%. Small Hyaline 34.70

Eosinophile... 5%.
J.B., age 36, admitted August 11, 1899.
Duration of Epilepsy 13 years; Body condition good.
Family History: Father and mother alive, healthy.
Brothers living, healthy, one brother died abroad.
Cause unknown. Patient has had Syphilis.
Mental Condition: Is simple child in manner.
Does not appreciate his surroundings. Is very
demented, has very little idea of time.

History of Fits: Had his first fit 13 years ago.
Gradually increased in frequency, later fits were
very rare, intractable.

Record of Fits from admission to Dec. 1, 1901.
Day Fts. 142. Night Fts. 150; for the last
3 months all his fits have been nocturnal.

Alkalinity in the interparoxysmal period 1.48
9 hours before a fit 1.43.

Fits, 9-30 P.M.
Blood taken at 9:00 P.M. Alkalinity 1.12
10:30 P.M. 1.26
11:30 P.M. 1.385
10:30 A.M. 1.538.

Patient was subjected to the Suprarenal
Treatment for 21 days, apparently without any
effect. The fits did not increase in frequency.
There was no perceptible rise in the blood pressure.
Case X

A.W., age 21, admitted March 22, 1894.

Duration of epilepsy: 6 years. Bodily condition: feeble, poorly nourished. Pulse high.

No family history obtained.

Mental condition: of very simple-minded intellect. Could only add simple numbers, could not rotate correctly. After fits, is irritable, impulsive, irascible.

History of fits: Had his first fit when 7 years of age, a short time before admission, had an attack of Status Grand Mal no aura. Record of fits from admission to December 31, 1907.


Interparoxysmal alkalinity: 1.538. 1.48

2 Slight fits, 9 A.M.

Blood taken 9:30 A.M. Alkalinity: 1.12

11 A.M.: 1.43

1 P.M.: 1.43

5 P.M.: 1.59.
P.S. age 32 admitted November 8, 1895.

Duration of Epilepsy 29 years.

Mental condition fair. Suffers from heterophrenia.

No family history obtained.

Mental Condition: So dull, speech indistinct, mental reaction slow. So easily excited. To very unstable.

Memory very defective. Has very little idea of time or place. After fits is violent and impulsive.

History of fits: Had his first fit when 3 years of age. He had 3 fits a month up to 14 years of age. He had no fits from 14 to 25. Since has had him frequently. Grand mal, precordial aura, which he describes as a pleasurable feeling as though his heart were stopping. Record of fits from admission to December 31, 1907.

Day fits 1475. Night fits 475.

Interparoxysmal alkalinity. 1.428; 1.423.

Alkalinity during aura 1.26

30 minutes after fit 1.128

1 hour 1.26

3 hours 1.23

6 hours 1.29.
J. C. age 48 admitted April 20, 1894.

Duration of epilepsy, 15 years. Bodily condition fair. Muscular movements very tremulous.

Family History: Father, mother, and one sister known as Brookwood Asylum. Father committed suicide.

Mental Condition: As dull, morose, irritable-minded after fits, in moods, wanders aimlessly round the ward. Has hallucinations of sight and hearing.

History of Fits: Had his first fit when 28 years of age. Grand mal, no aura. Mental confusion lasts about 5 hours. Record of fits from admission to December 31, 1907.


Interparoxysmal alkalinity: 1.538 : 1.48

Three fits from 9 a.m. to 11 a.m. alkalinity
Blood taken at 11:30 a.m. 1.0357

10 a.m. 1.26
11 a.m. 1.43
11:30 a.m. 1.538
10 p.m. 1.538
Case XXV

G.H., age 26, admitted October 19, 1893

Duration of Epilepsy: 6 years. Body Condition Fair
Family History: Father and mother alive and healthy, no history of Tuberculosis, Epilepsy, or Mental Incoherence. Mental Condition: Simple and Childish in manner, incoherent in his remarks, expresses delusions of persecution "Says people follow him about to shoot him," after fits is violent and abusive.

History of fits: Had his first fit 6 years ago, said to be caused by a large piece of wood falling on his head... Grand mal, aura. Left eyelid twitches 2 minutes prior to the fit. Mental confusion lasts about 12 hours. Record of fits from admission to Dec 31, 1907.


Interparoxysmal alkalinities: 1.538 : 1.43

Alkalinity during aura: 1.26

" 15 minutes after fit: 1.0387

" 1 hour " : 1.383

" 2 hours " : 1.43

" 4 hours " : 1.538

" 12 hours " : 1.57.
W.S., age 21, admitted November 1, 1894.
Duration of Epilepsy, not known. Family Condition
fair, usually constipated.
No family history obtained.
Mental Condition: is simple. Childish in
manner, talk after fits is irritable, quarrelsome
and develops delusions of persecution.
History of fits: Patient says he has had fits since
9 years old. Grand mal, aura, 2 minutes
prior to the fit, which he describes as a
painful sensation in his right forearm.
Mental confusion lasts about 6 hours.
Record of fits from admission to Dec 31, 1907.
Interparoxysmal alkalinity 1.538; 1.45

Alkalinity 60 seconds before a fit. 1.18
" 1 hour after 1.26
" 2 hours " 1.385
" 12 hours " 1.538
" 12 hours " 1.59.


Family History: Father died of head injury. Mother, alive and healthy. Maternal grandfather died of Pneumonia.

Mental Condition: Simple and childish in manner talk, mental reaction slow, intellect weak. Memory defective. Agitation troublesome, irritable. Emotional & impulsive.

History of fits: Had his first fit when 13 years of age. Had "Brain Split" when 4.

Grandmal spigastic aura. Mental confusion lasts about 6 hours.

Record of fits from admission to Dec. 31, 1901:
Day fit 1420. Right fit 121.

Interparoxysmal acalculia 1: 48.

1/2 hour after two severe fits. Acalculia 1.0387

1 hour " 1.26

2 hours " 1.385

4 hours " 1.538

12 hours " 1.59.

Mental Condition: Severe. He is slow and retard in manner and speech. Memory defective. He is unable to give a coherent account of himself after the fit is very excited.

History of fit: Developed his epilepsy when 21 years of age. Grand mal, no aura. Mental confusion lasts about 5 hours. He has had several strong fits since admission.

Interparoxysmal alkalinity 1.538 : 1.48

Two strong fits 10 A.M.

Blood taken 10.30 A.M. Alkalinity 1.5387

11 A.M. 1.96
1 P.M. 1.43
5 P.M. 1.538
8 P.M. 1.538
Case XXIV

C.W. age. 27. admitted October 14, 1899.

Duration of Epilepsy 20 years. Bodily condition fair. Mental disease, usually consipirated.
No family history obtained.

Mental Condition: of dull of cobble-minded.
Mental reaction slow. Memory defective for recent events, after fits no memory. Impulsive.

History of fits: Had his first fit when 7 years of age, said to follow Scarlet Fever. Grand mal no aura. Mental confusion lasts about 1/2 hour.

Record of fits from admission to Dec. 31, 1907.


Intermaximal alkalinity 1.148. 1.143

Strong fit. 2 P.M.
Blood taken at 2.20 P.M. Alkalinity 1.12

" 3 P.M. " 1.26

" 5 P.M. " 1.48

" 7 P.M. " 1.53 8
H. J. H., age 44 years, admitted November 4, 1893.

Duration of Epilepsy: 6 years. Bodily condition good.

Family History: Father, mother, dead. 2 uncles

1 Grandfather died of Tuberculosis.

Mental Condition: So dull, & feeble-minded.

Memory much impaired especially for recent events. After fits, is irritable. Grumbles much.

Says his food is poisoned.

History of Fits: Developed his Epilepsy when 38 years of age. Grand mal. no aura.

Mental confusion lasts about 5 hours.

Record of fits from admission to Dec. 31, 1901.

Day fits 188. Night fits 219.

Interparoecysmal alkalinity: 1.48.

1/2 hour after two fits Alkalinity 1.0387

1 hour " " " 1.026

2 hours " " " 1.48

3 hours " " " 1.538

5 hours " " " 1.538

8 hours " " " 1.59
J. A. C., age 19, admitted October 12, 1893.

Duration of Epilepsy 10 years. Bodily condition good. No family history obtained.

Mental Condition: A very dull feeble-minded woman after fits. Responses vague, delusions of persecution. Memory very defective.

History of fits: Grand mal, mental confusion lasts about 3 hours... Record of fits from admission to Dec 30, 1904: Day fits 340; Night fits 762.

Interparoxysmal alkalinity 1.538

5 fits from 7 P.M. to 10:30 P.M.

Blood taken at 11 P.M. Alkalinity 1.331.

- 1 P.M. 1.76
- 2 P.M. 1.43
- 5 P.M. 1.59
- 9:30 P.M. 1.538.
L D A. age 44. admitted August 17, 1895.

Duration of epilepsy, 30 years. Bodily condition fair. No history of constipation.

No family history obtained.

Mental Condition: of dull acutely mind.

Memory much impaired. After fits is troublesome, moody and impulsive.

History of fits: Has had fits for 30 years.

Grand mal, last aura. Mental confusion lasts about 5 hours. Record of fits from admission to December 31, 1907.

Day fits 691. Night fits 199.

Interparoxysmal alkalinity 1.538: 1.48

2 Strong fits, 9 Am.

Blood taken at 9-30 Am. Alkalinity, 1.18

"  "  11 Am " 1.43

"  "  1 Pm. " 1.48

"  "  3 Pm. " 1.59

"  "  7 Pm. " 1.59
Case XXXIV


Duration of Epilepsy: 14 years. Family condition fair. Suffers from indigestion.

Family History: Father dead, cause unknown. Mother dead, cause, heart disease. Patient the only child.

Mental Condition: As simple child in manner and speech, has some religious affection with mild excitement.

History of Fits: Had his first fit when 6 years of age, did not have another for 10 years, since he has had them frequently. Grand mal, no aura mental confusion lasts 3 hours.

Record of Fits from admission to December 31, 1906. Day fits 575 Night fits 203.

Interparoxysmal alkalinity: 1.48 1.46

One Slight Fit. J. M.

Blood taken at 4 P.M. Alkalinity 1.385

" " 4 P.M. 1.48
" " 6 P.M. 1.59
" " 10 P.M. 1.59
Case XXXIV

A. R., age 40. Admitted, November 11, 1875.

Duration of epilepsy, 24 years. Physical condition fair. Papillae irregular. Left contracted.

No family history obtained.

Mental Condition: Dull, confused and simple-minded. Memory much impaired.

Has no idea of time; after fits is violent, hear voices. Rebukes to him.

History of fit: Had his first fit when 16 years of age. Grand mal. No aura.
Mental confusion lasts 6 hours.

Record of fits from admission to Dec 31, 1877.

Day fits 77. Night fits 352.

Interparoxysmal alkalinity 1.538 1.48

3 strong fits from 1 P.M. to 2.30 P.M.
Blood taken at 2.45 P.M. Alkalinity 1.5387

1.385

1.59

1.638
Case XXXV
C.F., age 65, admitted February 1, 1898
Duration of Epilepsy: 10 years. Bodily Condition
fair. A line very atonic, albumin in urine
Has been in the Army & lived 12 years in India
Scars on both limbs.
No family history obtained.
Mental Condition: Dull. Feeble minded
Mental reaction slow. Memory much impaired
after fit is pugnacious, violent & abusive.
History of Fits: Had his first fit 10 years ago.
Grand mal. Epigastria aura. Mental
Confusion lasted about 4 hours.
Record of Fits from admission to Dec 31, 1907.
Day Fits 147. Night Fits 190.

Interparoxysmal alkalinity 1.662.
Alkalinity during Aura. 1.86.

Slight fit 10 A.M.
Blood drawn at 10-15 A.M. Alkalinity 1.86

12 P.M. 1.68
2 P.M. 1.59
6 P.M. 1.59.
J. W., age 54, admitted December 13, 1900

Duration of Epilepsy: Bodily condition fair.
Mental condition: Brain: arteriosclerotic.
No family history obtained.

Mental Condition: Is simple and childlike in manner.
Talk: Memory much impaired both for recent and remote events, after fits he tends to be troublesome and wander wildly about the ward.

History of fits: Developed his Epilepsy about 5 years ago, a week prior to his admission he had 4 fits. Grand mal, no aura.
Mental confusion lasts about 5 hours.
Record of fits from admission to Dec 31, 1901.

Interparoxysmal Alkalinity: 1.662

Potassium at 9 PM.
Blood taken at 2.30 PM. Alkalinity 1.0387.
4 PM 1.26
5 PM 1.538
7 PM 1.57

Patient was subjected to the suprarenal treatment for 21 days. The number of fits were increased but his mental condition improved.
C. V. A. aged 18. Admitted February 14th 1903.

Duration of Epilepsy: 4 years. Bodily condition fair.

Family History: Father, mother alive and healthy.

Paternal aunt insane died at Hanover Fever Hospital.

Mental condition: Dull simpleminded. Mental reaction slow. Memory much impaired for recent events.

History of fits: Had his first fit when 4 years of age. Grand mal: Epigastric aura. Mental confusion lasts 3 hours. He has had several fits since admission mosty nocturnal.

Interparoxysmal alkalinity 1.48. 1.43

<table>
<thead>
<tr>
<th>Time after Fit</th>
<th>Alkalinity</th>
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<tbody>
<tr>
<td>1 hour</td>
<td>1.46</td>
</tr>
<tr>
<td>2 hours</td>
<td>1.385</td>
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<tr>
<td>24 hours</td>
<td>1.428</td>
</tr>
<tr>
<td>6 hours</td>
<td>1.538</td>
</tr>
<tr>
<td>24 hours</td>
<td>1.59</td>
</tr>
</tbody>
</table>
A. C., age 34, admitted May 18, 1900.

Duration of Epilepsy, 14 years. Physical condition fair, no usually constant place to sleep. Family history obtained.

Mental Condition: is dull and simple-minded. Memory much impaired especially for recent events; after fits is restless, impulsive and develops persecutory delusions.

History of fits: Had his first fit when 17 years of age. Grand mal, ocular aura about 2 minutes prior to the fit, mental confusion lasts about 4 hours. Record of fits from admission to December 31, 1901.

Day fits 88. Night fits 35.

Interparoxysmal Alkalinity 1.538 1.43

Alkalinity during Aura 1.26


15 P.M. 1.26

17 P.M. 1.43

11 P.M. 1.48
Case XXXIX

Age 44, admitted May 29, 1899.

Duration of Epilepsy, not known.

Physical Condition fair.

No family history obtained.

Mental Condition: of dull feeble-minded.

Memory very defective, has no idea of time. after fits is excited, impulsive, quick to find of making accusations against the attendant.

History of fits: Grand mal, Epigastric aura, Mental confusion lasts about 6 hours.

Record of fits from admission to December 31, 1901


Interparoxysmal alkalinity 1.48 1.43.

Strong fit 1.5

Blood taken at 1-20 AM, Alkalinity 1.0387.

<table>
<thead>
<tr>
<th>Time</th>
<th>Alkalinity</th>
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<tbody>
<tr>
<td>2 AM</td>
<td>1.385</td>
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<tr>
<td>4 AM</td>
<td>1.48</td>
</tr>
<tr>
<td>8 AM</td>
<td>1.538</td>
</tr>
<tr>
<td>1 AM</td>
<td>1.538</td>
</tr>
</tbody>
</table>
W. S. B., aged 28, admitted October 25, 1893.

Duration of Epilepsy: 13 years. Body condition fair. Suffers from Indigestion. Frequently constipated.


Mental Condition: Very simple & childish in manner & dress. Dirty in his habits. Memory very defective: after fits is restless & intractable.

History of Fits: Developed his epilepsy when 5 years of age. Grand Mal. Mental confusion lasts about 3 hours. Record of fits from admission to December 31, 1907.

Day: First fit 90. Right fit 998

Interparoxysmal alkalinity: 1.538 1.48

Dec 10 AM. Blood taken at 11 AM. Alkalinity 1.76

10 AM. 1 PM 1.48

11 AM. 3 PM 1.538

12 PM 1.538

6 PM, recurred 3 PM to 4-30 AM

Blood taken at 11 AM. Alkalinity 1.48

12 PM 1.57

5 PM 1.538
General Considerations

These results show clearly and consistently that the alkalinity of the blood in epilepsy undergoes marked variations. These variations manifest themselves in a diminution.

The average alkalinity during the interparoxysmal period is lower than the average of the control cases.

There is a sudden and pronounced fall immediately prior to the onset of the fit.

A further diminution after the fit to over.

The interparoxysmal diminution all the cases studied showed this diminution with the exception of 1.

In these cases the alkalinity was normal or varied within physiological limits. This is explained by the fact that they are simple cases with arterial degeneration, and alcoholic histories, having developed their epilepsy after 40 years of age, 1 are cases of Symptomatic Epilepsy. This interparoxysmal diminution varied in several of the cases, and it was more marked in cases suffering from Gastric Cancer and Constipation. Cases, R.D.A., J.H., C.G.A., R.
This diminution is progressive, right up to the epileptic discharge, immediately prior to which there is a marked fall. How to interpret this gradual progressive diminution is a matter of some difficulty - the constancy of the diminution is so much in evidence that the question of accidental occurrence, such as concurrent disease, anaemia, Gastric Chamakim in which the alkalinity is lowered, is ruled out. (In this period in an Epileptic's life is one of comparative health.) On the other hand, the constancy with which the alkalinity is maintained within physiological limits in health is equally as well-marked that the question naturally arises: What is the cause of the diminution?

It may be explained by the gradual accumulation of bases of an acid nature in the blood. It is interesting & instructive to note that the lowest values of alkalinity were obtained from cases suffering from Gastric Catarrh & Constipation. Various clinicians have drawn attention to the fact that Gastric & Intestinal troubles bear some relation to the Epileptic attack. That under these conditions...
the fits are more frequent. Agatini advanced the theory that the exciting cause is a toxin absorbed from the alimentary canal: by correcting these disorders he found much benefit; the number of fits were much diminished.

In gastric and intestinal catarrh, there is a condition of hyperacidity both in the stomach and intestines; the hyperacidity is due to the presence of the organic acids, lactic, acetic, butyric acids. These acids are absorbed into the circulation, diminish the alkalinity of the blood. The writer has on several occasions raised the alkalinity in these cases by giving Hydrargyrum Subchloratum, Mixture Anserinum. There is ample evidence to show that the alimentary canal is a fruitful source of toxins, which are absorbed into the blood. These on the organism bring forth abnormal manifestations of activity.

It may be the result of deficient metabolism. The alkalinity of the blood in that of the body tissues generally. The samepostal of the metabolism of the body results in an alkaline reaction. Thus, in Ecology, the general metabolism.
may be below par, with the result of a diminished value of the alkalinity of the blood due either to a deficient amount of alkalies or an excess of acid substances.

The sudden pronounced fall immediately prior to the onset of the fit. This phenomenon was observed in 15 of the cases. The blood was taken from 10 seconds to 2 minutes before the fit. It may be regarded as the bio-chemical aura of the epileptic fit, a manifestation of some morbid change or changes taking place in the organism.

When the quantity of blood in the body is taken into consideration, the fact that it forms 1/2 to 1/4 part of the body weight, the amount of acid required to diminish the alkalinity must be relatively great. Also the particular source or sources of the acid products must be qualitatively or quantitatively active. The more likely origins of these acid products are: (a) Muscles, (b) Nervous.
A. The neuronie origin.

The neurones like the other cells in the body undergo metabolic activity. Their functional activity depends upon a chemical change, a disintegration of food into chemical end products, Carbonic and lactic acids. The amount of acid formed must be infinitesimal. It is a case of the most highly developed cell evolving maximum work with consequent minimum waste products.

The explanation of the sudden diminution by the acid products of neuron metabolism seems very fallacious. The neurones concerned in an epileptic seizure are those of the Rolandic area; a cubic inch at least on either side. The acid products formed by their activity must be sufficient to lower the alkalinity of 2 gallons of blood which means an enormous quantity of acid. It requires 1.662 grammes of H SO₄ to neutralise the alkalinity of 1000 cc of blood serum. In order to neutralise the alkalinity of the total amount of blood serum requires roughly about 8 grammes of H SO₄; in fact it seems very improbable.
that all the cells of the Cerebral Cortex
say 20 grammes can produce acid substances
equal to 8 grammes of HCl. The acid
products of neurone metabolism are much
weaker, consequently the amount would have
to be greater. On this calculation, it is
impossible for the neurones to produce such
an amount of acid from so small a source.

Further, if this diminution in the
alkalinity is due to these neurone chemical
and products, what is the condition of affairs
with regard to the Cerebro-Spinal Fluid?
Compared with the volume of the blood
it is scanty, the amount present is about
2 ounces, the reaction would obviously
be acid. But an acid medium is
incompatible to the life of the neurone.
The immediate surroundings are alkaline
the Cerebro-Spinal Fluid which bathes and
comes into such close contact with the
neurones is alkaline, the blood is alkaline
the neurones themselves have an alkaline
reaction, the sea in which they live is
alkaline, the rivers which flow into the sea
has an alkaline reaction. This seems to
point out, that for physiological neuronic activity an alkaline medium is essential. Even an enceicine, abnormal or disordered cerebral metabolism will let account for the production of this diminution directly. For the above reasons the neuronic origin of the sudden drop cannot be maintained.

B. The Muscular Origin

The most important metabolie tissues in the body are the muscular, glandular tissues. Of the two the former is the more active; this is so because it is the most abundant and forms about 42 per cent of the body weight. The muscles produce by their activity the greater part of the body heat. Even during relative repose such as sleep the muscles are the seat of chemical changes and produce a sufficient amount of heat to keep up the body temperature, also in febrile Paralysis where the metabolic processes in the muscles are not impaired by organic disease. The afferent efferent channels are intact, the nutrition of the muscles is relatively little impaired.
The metabolism of the muscular tissue is under the control of the nervous system, and when the nervous system fails, muscular metabolism is interfered with, the body temperature falls.

What has been stated above with reference to the production of heat may be equally affirmed to the production of chemical end products of muscular metabolism.

The chemical change is an oxidation, a combination of oxygen with Carbon and Hydrogen, the muscular contraction is a consequence of this chemical change. Which is the first sign in the response of a muscle to stimulation. It is a debatable point whether this chemical change is directly transformed into mechanical energy which manifests itself in the muscular contraction. The large bulk of muscle engaged in the violent convulsions of an epileptic figure is an ample cause for the altered reaction of the blood. That the major part of the fall should occur before the visible violent streams of the convulsions appear, is consequently...
applicable on the following considerations.

I  The muscles normally, even when at rest, are the seat of metabolic activity. Produce the bulk of the body heat.

II  During violent exercise, the extra amount of heat produced is only a proportion of the amount of heat required to keep the body temperature within normal limits.

III  The chemical change in the fibre muscle of the muscular contraction.

IV  The sensory-motor areas of the cerebral cortex controls the metabolism of the muscles, as evidenced by Functional Paralysis: Muscular Tone: Section of the Spinal Cord with a consequent fall in the body temperature.

It is therefore probable, there is a considerable alteration in the metabolism of the Cerbral Neurons, with consequent hyperecibility and decreased inhibition. Some time prior to the actual epileptic discharge, this modified cortical activity brings about an increase of the metabolism which occurs prior to the visible spasm. It accounts for the sudden pronounced diminution during this period.
The further diminution after the fit is over.

This diminution is well marked and was found in all the cases except after the fit had subsided. It is apparent soon after the fit is over, 3 to 10 minutes, and lasts for some hours. The alkalinity gradually rises, the rise being more marked in the first hour. The return to normal varies in different cases, but on an average takes from 4 to 5 hours. The explanation of this diminution is not far to seek, it is directly due to the acid products of muscular metabolism. Carbonic acids, lactic acids, generated during the violent tonic and clonic spasms of the muscles during the epileptic paroxysm. This phenomenon is physiological, and to some, though in a less degree after severe muscular exercise, the variations met with in the different cases depend upon the frequency and number of fits, the duration and severity of the muscular twitchings. Thus after one slight fit, the fall is 6 degrees, after 4 fits, 8 to 10 degrees. Then again, this diminution is negligible in cases of fits.
Mal. These facts together with the appearance of the fall after the spasms are over, the gradual rise to normal, seem to prove that the diminution is muscular in origin.

The relation of the diminution to the number of fits, the duration and severity of the muscular contractions holds good to a certain point. But the writer has taken blood from a patient who had 40 fits, in the short space of an hour, from another patient after 5 fits, and found the diminution to be of the same value, e.g. 69.25. This points to a limit in the diminution.

The return of the alkalinity to normal values in the different cases, in some cases, T.H., W.H., the return was quick. Certain facts observed in these cases may account for the quick recovery.

(a) Frequent voiding of urine.
(b) Frequent perspiration.
(c) Leucocytes. The greater the leucocytes the sooner the recovery.

The ultimate end of these acid products may be accounted for by excretion, they may be destroyed by the increased
number of leucocytes, or they may be used as food by some of the other tissues, or neutralised by the secretions of the glands.

It was also observed, that the return to normal basis a relation to the mental confusion of the patient after the attack. In case JH, where the return to normal alkalinity is comparatively rapid, the mental recovery is also rapid. In case JF, where mental recovery is prolonged, the alkalinity rises at a low value.

The effects of drugs upon the alkalinity is transient, it is impossible to elevate and maintain the alkalinity within physiological limits for any appreciable length of time. The Bromides elevate the alkalinity, rise to the normal of the control cases for a certain time, but on continued administration, even when the dose is increased, the alkalinity falls. The best results were obtained from Potassium Bromide. Soda Bicarb, a a 5 per cent. for in the for some time the alkalinity was maintained at a high value, but only to fall again.

In the case of JH, addition of Potass...
From 8am 20. Chloral Hydrate. 8am 20. Given after the fit raised the alkalinity from 0.831 to 1.085. This was maintained for 1½ minutes, after which it dropped again to 1.0387. 
gradually attained its normal value in 14 hours.

Supranormal extract has apparently little effect upon the alkalinity. The effect upon the mental state was good. All the patients subjected to the treatment recovered from the mental confusion much sooner.

One of the cases, W.H., improved considerably; usually after a fit, he has a headache for some hours. When taking Supranormal he did not have headaches. In all the cases, the number and frequency of the fits were much increased.

On this account the treatment was stopped.

These results are very different to those obtained by Dr. Hill. Why Supranormal should
apparently Epilepsy to difficult to say. Probably
due to a diminution of a metabolism
already below par, possibly due to its action on the arteries to an increase in the blood pressure.
The exact role which a diminution in the alkalinity of the blood plays in the production of the epileptic attack is difficult to estimate. It is of the utmost importance for any cell in the body to have a proper adequate store supply of blood, this applies especially to the Central nervous. As they are extremely sensitive to a change in environment, this is well seen in regard to toxic agents circulating in the blood. As has been stated before the conditions under which the nervous functionate is one of alkalinity, & it does not seem strange that any appreciable diminution in the alkalinity of their surroundings may bring about abnormal manifestations of activity. This applies with greater force in the case of the unstable, readily explosive epileptic nervous. The writer has obtained good results in the treatment of epilepsy by maintaining the alkalinity of the blood within physiological limits, by doing so the number of fits are much diminished. Unfortunately it is impossible to elevate maintain the alkalinity by the administration of drugs.
The Leucocytes:

I. The interparoxysmal period.
There is a wide variation in the number of leucocytes. In some cases, the leucocyte count was found to drop some hours before a fit.
In other cases, the leucocyte count was low during the interparoxysmal period. These were cases who had frequent fits. In others, there constituted the majority, there was a gradual drop right up to the paroxysm.
A probable deduction is, that the number and activity of leucocytes depend upon the health of the Epileptic in this period. That, as the acidinity of the blood diminishes, the nearer the patient is to his paroxysm, the lower is the leucocyte count, and less the activity.

II. After the fit:
There is a distinct leucocytosis which shows itself a short time after the fit, and gradually increases, attaining its maximum from about 30 to 40 minutes after. The increase is due to the large number of leucocytes.
the polymorphonuclear cells are diminished.

The larger hyaline cells are increased. The

smaller hyaline cells are much increased.

The eosinophiles are increased from 8 to 10

hours after the attack.

The leucocytes in the Status Epilepticus

is not so constant... it is subject to wide

variations. It takes a longer time to appear

is not so pronounced as after one individual

fit... In one case, 45,000 leucocytes were

counted after two fits... In another, 20,000

were counted after 30 fits in quick succession.

In another case of Status 12,000 white cells were

counted after 85 fits.

The leucocytes pass off gradually,

and undergo the changes described under the

interparoxysmal period... With regard to the

causation, the consensus of experimental

cardere seems to show that leucocytes

is to be looked upon as the reaction

produced by a chemical substance circulating

in the blood. What its special mission to

perform... e.g. the removal or destruction of

these substances... On this hypothesis, the

leucocytes following the epileptic fit may
explained. The increase of the eosinophiles some hours after the attack is much in evidence also very constant, it is probable that they finish the destruction of the wound products by means of their secretory functions.
Conclusions

I. The alkalinity of the blood in the interparoxysmal period is lower than the average of the control cases.

II. The diminution is gradual and progressive and more marked in those cases suffering from Gastric Catarrh and Constipation.

III. There is a marked, sudden and pronounced fall immediately prior to the onset of the fit.

IV. There is a further fall in the alkalinity after the fit is over. This diminution is seen from 3 to 10 minutes after the attack.

V. This after diminution depends upon the length of time, the severity of the muscular twitchings, the degree of the alkalinity in the interparoxysmal period.

VI. There is a gradual return of the blood to its normal alkalinity, which takes place in 5 to 6 hours. The rise being more marked in the first hour.

VII. If the alkalinity keeps at a low value, it may determine the onset of another fit.

VIII. The diminution after the fit is due to the chemical and products of muscular metabolism i.e. Sarco-calcic Carbo-nic acids.
to substances in direct relation to the Epilepsy.
The diminution after a nocturnal fit takes a
longer time to return to normal than the
diminution after a day fit.
It is impossible to elevate maintain the
alkalinity within physiological limits for any
appreciable length of time by the administration
of drugs.

There is a leucocytosis after a fit. The increase
is due to the Small Hyaline Cells, also
to a less extent the Large Hyaline Cells. The
Polymorphonuclear Cells are diminished. There
is an increase in the Eosinophile Cells
some hours after the attack.

The leucocytosis is not so pronounced in
Status Epilepticus... it diminishes with
each seizure.
### Table 1

Alkalinity of the Control Cases

<table>
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<tr>
<th>Case</th>
<th>Occupation</th>
<th>Alkalinity</th>
<th>Alkalinity</th>
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</thead>
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<td>1. J.C.</td>
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<td>1.662</td>
<td>1.662</td>
</tr>
<tr>
<td>2. W.B.</td>
<td>Head Attendant</td>
<td>1.662</td>
<td>1.662</td>
</tr>
<tr>
<td>3. J.D.</td>
<td>Attendant</td>
<td>1.662</td>
<td>1.59</td>
</tr>
<tr>
<td>4. Y.B</td>
<td>Attendant</td>
<td>1.731</td>
<td>1.662</td>
</tr>
<tr>
<td>5. L.E.P</td>
<td>Clerk</td>
<td>1.662</td>
<td>1.662</td>
</tr>
<tr>
<td>6. M.O</td>
<td>Porter</td>
<td>1.662</td>
<td>1.662</td>
</tr>
<tr>
<td>7. M.H</td>
<td>Porter</td>
<td>1.662</td>
<td>1.662</td>
</tr>
<tr>
<td>8. W.H.F</td>
<td>Physician</td>
<td>1.806</td>
<td>1.806</td>
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<tr>
<td>9. A.B</td>
<td>Head Attendant</td>
<td>1.59</td>
<td>1.662</td>
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<tr>
<td>10. R.P.</td>
<td>Physician</td>
<td>1.662</td>
<td>1.662</td>
</tr>
<tr>
<td>11. E.F</td>
<td>Physician</td>
<td>1.59</td>
<td>1.59</td>
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<td>12. J.N</td>
<td>Attendant</td>
<td>1.731</td>
<td>1.662</td>
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<tr>
<td>13. A.H.S</td>
<td>Physician</td>
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<td>14. J.A.</td>
<td>Attendant</td>
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<td>15. W.C</td>
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<td>16. B.A</td>
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<td>17. J.L</td>
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Table showing the alkalinity during the aura and varying periods after.

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<th>Name</th>
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<th>1 hour</th>
<th>2 hours</th>
<th>3 hours</th>
<th>4 hours</th>
<th>5-12 hours</th>
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<td>1.43</td>
<td>1.48</td>
<td>1.48</td>
</tr>
<tr>
<td></td>
<td>5 ft.</td>
<td>1.18</td>
<td>1.385</td>
<td>1.43</td>
<td>1.337</td>
<td>1.48</td>
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<td>3 ft.</td>
<td>1.26</td>
<td>1.18</td>
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<td>1.337</td>
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<td>1.337</td>
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<tr>
<td></td>
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<td>1.337</td>
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<td>1.48</td>
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<td>1.48</td>
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Note: The table shows the alkalinity during the aura and varying periods after.
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<th>Time</th>
<th>E.O.</th>
<th>W.M.</th>
<th>H.C.</th>
<th>C.E.</th>
<th>C.I.N.</th>
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<td>1.76</td>
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<td>1.48</td>
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<td>1.59</td>
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<tr>
<td>Mt.</td>
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Interparoxysmal period:
- 10 minutes after 7 fits
- 60 minutes after 7 fits
- 40 minutes after 8 fits
- 60 minutes after one fit
- 4 hours after one fit
- 60 minutes after 2 fits
- 50 minutes after one fit
- 40 minutes after two fits
- 80 minutes after one fit
- 50 minutes after two fits
- 12 hours after one fit
- One hour after 3 fits
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1/2 hour after one fit
12 hours after 5 fits
6 hours after 4 fits
9 hours after 2 fits
8 hours after one fit
3 days after one fit
3 hours after 2 fits
14 days after one fit
4 hours after 2 fits
Graph showing the flow of the stream during the early part of the year.

1.538

4th Hour after 8th

1.413

11th Hour 1.5

1.385

1.8

8th Hour after

11th Hour after 1.66

1st Hour before 1.25

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