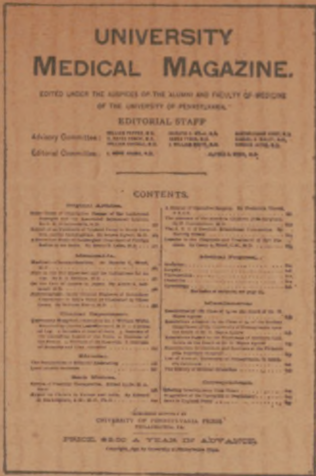
REPRINTED FROM


UNIVERSITY
MEDICAL MAGAZINE.

EDITORIAL STAFF

CONTENTS.

MARCH, 1893

A CLINICAL LECTURE ON CHLOROSIS.

By James Tyson, M.D.,

Professor of Clinical Medicine in the University of Pennsylvania.

A CLINICAL LECTURE ON CHLOROSIS.[1]

By James Tyson, M.D.,

Professor of Clinical Medicine in the University of Pennsylvania.

The patient is a young woman 18 years old, who works in a book-binding establishment. Her father and mother are both living and in good health, as are also her brothers and sisters. She herself was well up to the time of her present illness. Her special duty in the bindery has been to bronze the backs of books, and at this she has worked from ten to fifteen hours per day for the past two years. Last summer, however, she took a vacation, and it was during it, on the Fourth of July, that while running she was taken with vertigo. Then, apparently for the first time, her paleness attracted attention. She returned to her home in the city, and soon afterward, in the late summer or early autumn, applied to the hospital dispensary for treatment. Dr. Fussell, who was on duty in the dispensary, prescribed for her, and directed her to return. Feeling improved after taking the medicine she failed to report as directed, but soon realized that she was growing worse. Then she returned to the hospital, and was admitted to the wards about November 1.

Note now the peculiar faint greenish pallor of her face characteristic of her disease. More vivid is the paleness of the lips, contrasting strongly with the bright red of good health. Her other symptoms are not numerous, being mainly shortness of breath on exertion, a feeling of weakness and an indisposition to exertion. This girl has been overworked. Her nutrition is at fault. This defect manifests itself in an imperfection of the blood, which we will study more closely, since the superficial examination gives no clue to its real alteration. Fortunately

[1] Delivered at the Hospital of the University of Pennsylvania.

we are now enabled to do this with a precision formerly impossible. With appropriate apparatus we can not only count the corpuscles, but we can also measure the hemoglobin, their most important constituent. More than one instrument has been devised for this purpose. I like best the Thoma-Zeiss cytometer for counting corpuscles and Fleischl's hemometer for measuring the hemoglobin, for the description of both of which I must refer you to the books on clinical diagnosis. I may mention, however, in passing, that cytometers bearing the name of Quinke, Mallassez, Hayem and Gowers have been devised by these observers, while Henocque has also constructed a hemoglobinometer and Bizzozero an instrument for both uses, corpuscle counting and color measuring.

The following are the directions published by Zeiss himself for the use of the Thoma instrument made by him.

This apparatus consists of three parts:

(1) A graduated pipette (melangeur) with india-rubber tubing and mouthpiece.

(2) A divided cell upon an oblong slip.

(3) A cover-glass with plane ground surfaces.

In order to count the red corpuscles of human blood the tip of any finger is cleaned with water and alcohol and then rubbed between the fingers of the other hand. A slight arterial hyperemia of the tip of the finger will arise, so that a fairly deep puncture with a lancet-like needle is sufficient to cause a drop of blood to appear. The point of the pipette is quickly placed into it and the blood sucked in up to division 1. Then the point of the pipette is cleaned from the blood sticking to it by a cloth kept ready for the purpose, and it is placed into a 3 per cent. filtered solution of common salt. This also is immedietely sucked up, so that the fluid enters into the spherical enlargement of the pipette. As soon as the sphere is filled up to Division 101 the sucking is interrupted and the mouthpiece of the india-rubber tube closed by putting the finger upon it. The contents of the spherical enlargement are now to be mixed by careful shaking. Thus in this sphere ninety-nine parts by volume of salt solution are mixed with one part by volume of blood, or 100 parts by volume of the mixture contain one part by volume of blood, for the fluid in the capillary tube does not enter into the mixture.

If the blood is sucked in up to another division, say 0.5, instead of division 1, then with the same mode of proceeding another dilution is obtained, viz., 1 : 200.

Afterward, by blowing air into the india-rubber tubing, the salt solution may be removed from the capillary tube, and by constant shaking about one-half of the sphere is emptied. The next drop of the mixture is emptied upon the middle of the bottom of the divided cell, after the latter has been carefully cleansed. The cover-glass is immediately placed over it, and the apparatus is transferred to the horizontal stage of the microscope and left standing quietly for some minutes, so that the blood corpuscles may settle down.

It is necessary for a successful operation that the divided cell and cover-glass should be thoroughly cleaned. If this is done properly the Newtonian rings will be perceived along the edge of the cover-glass as far as it rests upon the wall of the cell, and this indicates that the cover-glass lies well upon it. At the same time it must be seen that no fluid enters between the cover-glass and the wall of the cell. On the contrary, the drop of blood should be placed in the center of the cell, and spread thence to fill up the space between the cover-glass and the bottom of the cell for some square millimeters.

Special care should be taken to keep the pipette in clean condition. Every time after having been used, it should be rinsed with (1) the diluting fluid, (2) distilled water, (3) absolute alcohol, and (4) ether. If dust or coagulated blood should still stick to the pipette, it should be removed with strong acids or alkalies by repeated rinsings, assisted, if necessary, by a bristle.

The corpuscles may be counted by any object glass magnifying about 300 diameters.

Every fifth square of each horizontal and vertical row of squares is crossed by an additional line to facilitate the counting. Each square occupies an area of $\frac{1}{400}$ sq. mm., and above each square there is a space of $\frac{1}{4000}$ c. mm., since the distance of the bottom of the cell from the lower surface of the cover-glass amounts exactly to $\frac{1}{10}$ mm. The corpuscles which first were suspended in this space have now settled and are lying on the bottom of the cell, where they may be counted. The corpuscles lying upon the lines should be counted, but, of course, only once. Thus, all corpuscles lying on the horizontal lines should be counted in the squares above them, and all corpuscles lying on the vertical lines should be counted in the squares to the right of them.

The calculation is as follows: If by a dilution of the blood in the proportion of 1 : a in n squares z corpuscles have been counted, then 1 c. mm. of undiluted blood will contain:

$$4000 \times \frac{a \times z}{n} \text{ blood corpuscles.}$$

If, for example, by a dilution of the blood in the proportion 1 : 100, as we supposed above, in 200 squares altogether 2570 red blood corpuscles were found, then the calculation will give for 1 c. mm. of blood—

$$\frac{4000 \times 100 \times 2570}{200} = 5,140,000 \text{ blood corpuscles.}$$

For counting the white blood corpuscles a pipette should be used which allows a dilution in the proportion of 1 : 10, and instead of the salt solution an aqueous ⅓ per cent. solution of acetic acid should be chosen for diluting. The red corpuscles will disappear in this fluid, but the white ones will remain and are easily counted. The method of calculation is the same as that given above for the red blood corpuscles.

Studies by Thoma and others, with a view to determining possible errors with the instrument whose use has just been described, go to show the constant errors to be insignificant, less than 1 per cent., while the accidental and variable errors, which are unavoidable, diminish with the number of corpuscles counted. Thus, by counting 200 corpuscles they amount to 5 per cent. of the total result.

1,250	corpuscles	amount to	2	per	cent.	of the	total.
5,000	"	"	1	"	"	"	"
20,000	"	"	½	"	"	"	"

Recently, in 1885, Professor Blix, of Upsala, Sweden, suggested the use of centrifugal force in estimating the volume of red blood corpuscles, and Dr. S. G. Heden has devised an instrument called the *hematokrit*, for this purpose. Dr. Judson Daland has further improved this instrument so that after the blood, diluted with an equal bulk of a 2.5 per cent. solution of bichromate of potash,[1] has received the requisite amount of rotation, the percentage *volume* of red corpuscles may be read off from the cylindrical tubes in which the blood is placed, and from this deduced the *number* in each cubic millimeter by simply adding six ciphers to the reading.

Dr. Daland[2] regards the hematokrit as both more speedy and more accurate than the cytometer, basing his conclusions on a very large number of comparative observations. He used also a great variety of fluids for dilution, and concluded that the above solution of bichromate of potash is, for many reasons, the best. The hematokrit also enables one to measure the volume of colorless blood corpuscles, but no method has as yet been devised for calculating their number.

In the patient before you the blood count was made with the Thoma-Zeiss apparatus, and there were found upward of three millionsof red discs, with no disproportionately large number of white corpuscles. Now, the number of red discs per cubic millimeter in health is put down at five millions for men and four and a half millions for women. But a very considerable range must be admitted, and while three and a half

[1] This solution is also an excellent one for diluting the corpuscles when counting them with the Thoma-Zeiss counter, and is the one commonly in use at the Hospital of the University of Pennsylvania.

[2] A Volumetric Study of the Red and White Corpuscles of Human Blood in Health and Disease.—UNIVERSITY MEDICAL MAGAZINE, November, 1891.

millions of corpuscles is less than normal it cannot be asserted that this number is not compatible with perfect health, and the amount of hemoglobin may still be sufficient.

We must go further, therefore, in our study of the blood and measure the quantity of hemoglobin. This has been done by Fleischl's hemoglobinometer with the astounding result of 15 per cent. as compared with a normal 100 per cent., although this maximum is rarely reached, 90 per cent. being the more usual.

Herein, then, we have the solution to our problem and the appearance of the patient. With a moderate reduction of the number of corpuscles is associated an enormous falling off in the amount of hemoglobin. From this it appears, therefore, that the individual hemoglobin value of each corpuscle is greatly diminished. Beyond this there is nothing abnormal to note. The proportion of white corpuscles to red discs is normal. There is no undue smallness or the opposite in the size of the discs, no undue irregularity of shape. But in this reduction in the amount of coloring matter we have one of the essential conditions of an anemia which may be defined as any condition of the blood characterized by an undue diminution in the total bulk, its albumen, its hemoglobin, or of the latter two.

We have, therefore, before us, a case of anemia. What variety is it? The symptoms of pallor, vertigo, weakness, and shortness of breath on exertion are common to all varieties. So are palpitation and irregular heart action, and even anemic murmurs. There are, however, some special features in this case which have already been pointed out. There is a peculiarity in the pallor of our patient. It is a yellowish-green, and the patient is a young girl, overworked, not emaciated, but fairly nourished. Above all, there is a marked reduction in the hemoglobin without a corresponding reduction in the corpuscles. Now, these are the essential features of chlorosis, or green sickness, one of the varieties of essential anemia.

There is no enlargement of the spleen, or of the lymphatic glands. There are no essential anatomical changes in this disease. Many years ago Professor Virchow pointed out an imperfect development of the circulatory system as more or less characteristic; that the heart was small; the large blood vessels small and thin walled. Such a state of affairs, must, however, be accidental, and there is no definite morbid anatomy to the disease. Rarely there is compensatory hypertrophy of the left ventricle. We must, therefore, look upon the condition as consisting in a physiological failure on the part of the cytogenetic apparatus to supply the proper proportion of hemoglobin to the blood corpuscles. A further study of the blood discovers a marked diminution in the iron, a constituent of the hemoglobin, resulting in a lighter hue of the blood when seen *en masse*.

The corpuscles may be somewhat altered and even fantastically irregular in shape, constituting what is known as *poikilocytosis*, or they may be larger than in health, when they are known as *megalocytes*. But these alterations are not common, even in slight degree. More frequent is an undue reduction in size of the corpuscles, a *microcytosis*. They may also be appreciably paler in hue than is typical, and the blood *en masse* may appear paler. The proportion of leucocytes may be slightly lowered.

Gruber found increased alkalescence of the blood, but von Jaksch found it diminished in three cases. Whence it may be concluded that none of these features are essential or diagnostic.

To sum up then, chlorosis is a disease characterized by a defective formation of red blood cells, resulting in a deficient amount of hemoglobin, without, as a rule, any marked reduction in the number of the red discs.

The *course* of a case of chlorosis is limited by the treatment, for by judicious management a few months to a year will generally establish a cure, for the prognosis is the most favorable of that of all the anemias.

The *diagnosis* is based chiefly upon the age and sex of the patient, the peculiar greenish, pale color of the mucous membranes and the diminished hemoglobin. Ulcer of the stomach is sometimes simulated by chlorosis because of epigastric pain which occasionally accompanies it, and some little study is sometimes necessary to complete a diagnosis. The anemia which is sometimes very marked in gastric ulcer is not accompanied with such a disproportionate reduction of hemoglobin as compared with the corpuscular reduction, and they are more apt to go *pari passu*. The history of the case will also aid in the separation.

There are few things more satisfactory in therapeutics than the treatment of a properly managed case of chlorosis. Time, however, is required, and too rapid a cure must not be promised. The remedy par excellence is iron, and it does not matter what preparation of iron is used. At the present day Blaud's pill of carbonate of iron, made by double decomposition between carbonate of potassium and sulphate of iron, is very popular. Half an ounce of each are combined and made into ninety-six pills so that each pill contains five grains. Of these from one to two are given at a dose. Reduced iron is also a valuable preparation in doses of one to three grains. Arsenic is a valuable adjunct. It should be given in ascending doses. Fowler's solution is the most convenient preparation, but arsenious acid is also a good form. The latter is now made up in combination with Blaud's pill, one-fortieth of a grain in each pill. This is a small dose. If Fowler's solution is used the dose may be commenced at a single minim and gradually increased until the physiological effect results, when the dose is again reduced.

Rest in bed for a time, associated with massage and an abundance of easily assimilable food, in a word, the "rest cure," is an important auxiliary, if it can be availed of, to hasten a cure, which at best is not rapid, while a sojourn at the seaside when convalescence is fully established, is a fitting close and crowning measure of treatment.