THE
ETIOLOGY OF BRIGHT'S DISEASE
AND THE
PREALBUMINURIC STAGE.

BY
FRED. A. MAHOMED, M.R.C.S.,
RESIDENT MEDICAL OFFICER OF THE LONDON FEVER HOSPITAL.

COMMUNICATED BY
W. H. BROADBENT, M.D.

(Received March 16th—Read April 14th, 1874.)

No classes of disease are more irresistible in their progress, or more hopeless in their prognosis when once fairly established, than those bearing the name of Bright; sooner or later, in one way or another, they invariably bring about the death of the patient. As we can do little or nothing towards their cure, except in the very earliest stages, it behoves us to find, if possible, some means for their prevention when threatening, or for their detention and arrest at their commencement.

I believe that the observations which I desire to discuss in the present paper take us one step, and that an important one, in this direction, and therefore they are, perhaps, worthy of record.

One of my earliest observations with the sphygmograph was that the pulse of acute Bright's disease closely resembles that which had previously been described and illustrated by the sphygmograph as occurring in chronic Bright's disease, or, more strictly speaking, with cirrhosis of the kidney. Both conditions were accompanied by a pulse of high tension—that is to say, one which usually required a considerable amount of pressure, and especially was distinguished by a prolongation or undue sustension of the tidal wave.

This observation has since been repeated and brought before the profession by Dr. Galabin in his thesis on "The Vascular Changes in Bright's Disease," but it only forms a small part of the truth of the matter.

When I observed this I also noticed that a somewhat similar, though not so well-marked, form of pulse occurred in other conditions, especially in the exanthems, erysipelas, and pregnancy, and that in these conditions albuminuria was particularly liable to occur. I therefore suspected that the vascular condition was the cause of the albuminuria, and not the albuminuria that of the vascular condition, as generally supposed. It is not, however, till lately that I have had the opportunity of testing and confirming my views.

The observations I have now to bring before you are briefly these :

1st. That previous to the commencement of any kidney change, or to the appearance of albumen in the urine, the first condition observable is high tension in the arterial system, due either to the presence of a noxious material in the blood, such as lead, alcohol, uric acid in gout, scarlatinal poison, or what not, which alters the relation between the blood and the tissues, and destroys their chemical affinity for each other ; or else to a sudden chill causing contraction of the superficial vessels and congestion of the internal organs.

2ndly. If this condition of high tension be sufficiently severe, transudation of the characteristic crystalloids of the blood, notably hæmoglobine, occurs before albumen appears

in the urine, and they can be detected in that fluid by the guaiacum test for blood.

3rdly. If this condition be allowed to continue, albumen is subsequently found, and, if still unchecked or uncontrollable, Bright's disease in one of its forms ensues.

4thly. If checked before the albumen appears, or immediately after its appearance, by a brisk purge or other appropriate means, the condition is suddenly changed—the tension disappears from the pulse and the crystalloids from the urine.

Before proceeding further, it would be, perhaps, as well to give some particulars concerning the two indications to which I particularly desire to draw your attention. The characteristic features of a pulse of high tension may be enumerated as follows :

1. A pressure above one ounce, and sometimes as high as ten ounces, is employed to develop the pulse-tracing to its greatest extent.

2. The percussion wave is usually well marked and distinctly separated from the tidal.

3. The dicrotic wave is very small, and often scarcely perceptible; the vessels, however, are full during the diastolic period, and collapse slowly.

4. The tidal wave is prolonged and too much sustained. A similar result can be produced experimentally in a schema of the circulation by making the contraction of the ventricle laborious and prolonged, as it would necessarily be under these conditions of high tension. This feature is often indicated in the tracing merely by a slight rounding of the tidal wave, and any such tendency must be looked upon with suspicion; implicit confidence, however, cannot be placed in it, as a similar appearance is produced by degeneration of the arteries, but if due to this cause a very slight pressure is sufficient to extinguish the pulse, while a pulse of high tension generally requires a more considerable one.

The most constant of these indications is the prolongation of the tidal wave; any one or all of the other characters may under certain conditions be absent.

A few observations with regard to the manner in which I have employed the guaiacum test for blood are desirable. By a careful use of this test infinitesimal traces of blood, or rather its characteristic crystalloids, can be detected in urine which to the naked eye, to the microscope, to the spectro-scope,¹ and even to the nitric acid test for albumen, affords no indication whatever of any abnormality. I am aware that this test is open to some fallacies; saliva, nasal mucus, and a salt of iodine in the urine (as happens when the patient is taking iodide of potassium), all cause a development of a blue colour with the tincture of guaiacum, some without and some after the addition of ozonic ether. But these fallacies, if a little care be used, can all be guarded against. Again, some believe that a faint development of blue cannot be held as conclusive of the presence of blood; but I feel sure when, after innumerable experiments with negative results, the appearance of a slight blue reaction is found invariably to herald the approach of, coexist with, and linger after, albuminuria, and at the same time, and as invariably, to be coincident with the signs of high vascular tension, all will agree with me in placing it in the first rank of our most valuable clinical tests.

My mode of procedure when applying it has been as follows:—One end of a small slip of white blotting-paper has been dipped in the urine and dried over the flame of a spirit lamp; by this means the dilute solution of the crystalloid is concentrated by evaporation; two drops of the

¹ I am indebted to Mr. Ashby, of Guy's Hospital, for many careful spectroscopic examinations. Mr. Ashby has devoted especial attention to the spectra obtained from the various constituents of the blood, and has published some of his observations in the 'Guy's Hospital Gazette' of Nov. 29th, 1873. Mr. Ashby failed to detect any sign of blood in the spectra obtained from urine which gave a slight reaction with the guaiacum test. In one case especially, in which the urine afterwards became loaded with blood, when the blue reaction was first discovered and was then well marked, Mr. Ashby could find no distinct indication in the spectrum. On the following day, when the reaction with the guaiacum test was intense, Mr. Ashby discovered sufficient indication in the spectrum to lead him to suspect the presence of blood. The urine was examined on each occasion by strong sunlight passing through a column of urine about eight inches deep.

tincture of guaiacum have then been dropped on the paper, and, after a minute or so allowed for the spirit to evaporate, a single drop of ozonic ether let fall in the centre of the guaiacum stain. Some time, perhaps a quarter of an hour, will elapse before the reaction becomes visible, especially if the reaction be slight; when it appears it is not permanent, it will begin to fade in a few hours, and will have disappeared in the course of a day or two.

One great advantage that the test appears to possess is the absence of all incumbrance to the physician; all that he requires to carry are a few slips of perfectly clean blotting-paper, one end of which he dips in the urine and dries, while on the other he can record the name of the patient; the test he can apply at home. Care must be taken that the urine be free from all contamination with saliva, &c., and that the patient is not taking any salt of iodine.

The guaiacum and ether must be fresh, and it is well to test both them and the blotting-paper employed, to guard against their contamination with anything that might give rise to a fallacious result. Especial care must be taken in selecting the blotting-paper; some papers give a slight but distinct reaction with the test, and I once nearly fell into many errors through this source of fallacy.

I may mention that on adding the ozonic ether an apparent bluing of the white paper ensues; this, however, is merely due to the moistening of the paper, and disappears entirely as it dries.¹

¹ Since the present paper was written Dr. Stevenson discovered in a specimen of urine I took to him for examination that a far brighter and more perfect reaction can be obtained by applying the guaiacum to the fluid in the ordinary way than on the blotting-paper. From urine which gave by the above method but a faint reaction, requiring some practice to recognise it, a brilliant blue colouration was obtained by applying the test to the liquid. The mode of procedure is to place a drop or two of urine in a small test-tube; add one drop of the tincture of guaiacum and a few drops of ether; agitate and allow the ether to collect at the top, forming an upper layer of fluid. If hæmoglobine be present the ether carries up with it the blue colour that is produced, leaving the urine colourless below. In this method no error can arise from the blotting-paper, which is no longer required, and was a frequent source of fallacy.

I have applied the test to urines of all descriptions—to the pale urine of hysteria, to intensely high-coloured urine, to that of phthisis and other wasting diseases, to urine containing bile, sugar, excess of uric acid, lithates, phosphates, and excess of mucus, but in none was any reaction produced.

Finally, the class of cases for which this test is available appears disappointingly small, though, perhaps, on this account the indications obtained by it are still more valuable.

The reaction can be obtained only in the earliest stage of either the acute or chronic form of Bright's disease, usually before the albumen appears or when it is present in only small quantities. It does not occur in chronic albuminuria, except when blood is also present in the urine; when this happens the guaiacum test gives by far the earliest indications of its presence that can be obtained. Even in those cases in which it precedes the appearance of albumen it fades when the albumen becomes copious, and appears again as it diminishes or after it has disappeared. In cases of albuminuria produced by intense fever and due to venous congestion, as in enteric fever, pneumonia, and sometimes in the febrile stage of scarlatina, when the fever is intense and the albuminuria only slight, no reaction showing transudation of the crystalloids can be obtained. It thus forms a distinction between some of the various forms of albuminuria which possesses the deepest interest, and perhaps affords a key to the mechanism of albuminuria and the method of its production. These matters, however, will be referred to hereafter.

The series of cases to which I especially desire to draw your attention this evening are all of one type. Their characteristic features are these :—

They all occur in patients recovering from scarlet fever. The symptoms in question may arise at any time during desquamation, namely, from the defervescence of the fever to six weeks or even longer afterwards. Their almost universal forerunner and probable cause is

constipation; another but much less frequent cause is a chill; in the cases to be considered constipation is almost invariably present. One day passed without an action of the bowels is sufficient to give rise to the symptoms in question. The immediate result of this constipation appears to be the retention of a quantity of effete material in the blood, which, by disturbing the relation between that fluid and the tissues, interferes with the capillary circulation and produces a condition of high tension throughout the system. The condition is indicated by the following symptoms:—By the signs of high arterial tension afforded by the sphygmograph which have already been enumerated; by a more or less marked blue reaction if the guaiacum test be applied to the urine as above described. In this first stage, if the tension be not very high, no albumen may be found in the urine; if the symptoms are not immediately relieved, on the following day the blue is either brighter or albumen appears in the urine either in small or large quantities; if it be still neglected or prove intractable, the more severe signs of kidney disease occur, such as bloody and scanty urine, dropsy, uræmia, &c. If, however, these symptoms are detected and a sharp purgative be administered, they fade as rapidly as they came; the blue reaction disappears from the urine and the high tension from the pulse. The albuminuria is variable in its intensity; in some only the prealbuminuric stage occurs, the further development of the disease being arrested; in other cases, which appear to be due to chill rather than to constipation, no reaction with the guaiacum test is obtained, the albumen, however, being very copious; again, in others the blue reaction is obtained both at the commencement and after the disappearance of the albumen from the urine, though not while it is abundant; in fact, a large quantity of albumen or chronic albuminuria alike appear incompatible with the transudation of the crystalloids, though high tension is still exhibited in the sphygmographic tracings obtained in these cases.

The relation of albuminuria to rheumatism in scarlatinal patients affords another most interesting and important

problem for solution ; both appear frequently to be produced by the same cause, namely, constipation, yet the two appear somewhat antagonistic, for the tendency of a rheumatic patient to albuminuria often appears much less than in other cases, yet the two conditions occasionally coexist in the same person.

To return to the cases, however, these symptoms are occasionally, but not invariably, accompanied by a slight increase of temperature ; this varies from 99° to 100° Fahr., and is highest in the morning. The pulse is hard and sustained. The signs of high vascular tension pointed out by Dr. Sibson are present in well-marked cases, namely, a forcible and sustained apex beat, prolongation of the first sound of the heart, and a reduplication of this sound near the apex over the septum, while at the base the first sound is dull and indistinct, the second loud and clacking. There are often no constitutional symptoms, the appetite being good, and no pain being felt either in the back or in the head ; in fact, these patients often express themselves as feeling well. But in some cases lumbar pain is complained of, in others there is loss of appetite and sometimes vomiting. In many cases slight oedema about the lower extremities can be detected by careful examination.

Unfortunately the amount of urine passed in twenty-four hours has not been measured in the cases quoted, but in other similar cases this observation has since been made. In these it has been found that the amount of urine secreted is invariably diminished when the tension of the pulse is increased or albumen or crystalloids are present ; the amount of urea excreted by the kidneys under these conditions being very markedly diminished. Microscopical examination of this secretion yields no definite result, for in the early stages neither blood-cells nor desquamating swollen renal epithelium-cells are found ; it is only when the condition has lasted for some few days that the latter can be discovered. I believe, therefore, that the term acute desquamative nephritis does not convey the true impression of the case, for the shedding of the epithelium only occurs as a secondary

condition; it is due to the increased proliferation of epithelium-cells from the increased blood supply. The further discussion of this matter I must defer till a later period. In the mean time I propose briefly to refer to a few illustrative cases and exhibit the sphygmographic tracings obtained from them; unfortunately I cannot at the same time show the amount of blue reaction by the guaiacum test that occurred in each, as the blue does not remain permanent, but fades in a few days.

The cases of scarlet fever referred to in this paper were all admitted into the London Fever Hospital under the care of Dr. Broadbent, by whose kind permission I make use of them.

It will be unnecessary to quote any of those severe cases of renal disease following scarlatina whose well-known symptoms are scanty and bloody urine, and early dropsy, which run the usual course of acute Bright's disease, and die either in the first, second, or third stage. With these all are familiar; the cases on which this paper is founded illustrate the commencement of these by symptoms which I believe are usually overlooked; some of the present cases, if not arrested, would probably have developed to the same extent, while others would have passed off unnoticed both by patient and physician.

The pulse of scarlatina is one of high tension from the commencement; even in the most severe cases it never becomes markedly dicrotic, though in some conditions the tension falls greatly during diastole, so that the diastolic portion of the pulse-trace becomes an almost horizontal line, yet the dicrotic wave is not developed. Fig. I and Fig. II, 1, are examples of this form of pulse occurring in very severe cases.

No. I.—Fig. I was obtained from a lad, aged seventeen, who had an extremely severe attack of scarlatina complicated by pericarditis and pneumonia, from which he ultimately recovered. During the greater part of his fever his urine was albuminous and at one time bloody.

Eighth day of fever. Intense fever. Urine albuminous.

The woodcut illustrates his pulse when most nearly approaching dicrotism. The prolongation of the tidal wave is well marked, and it shows considerable tension.

No. II.—Though the urine never became actually albuminous in the following case, the condition which immediately precedes it was once present.

A. D—, a clerk, æt. 19, was admitted into the London Fever Hospital on November 26th, 1873, suffering from scarlatina anginosa. Five days previously he was exposed to contagion. The day of admission was the third of his fever and the second of the rash. His attack was a severe one; his temperature was very high, he had great œdema of his uvula, and extensive sloughing of the left tonsil and anterior pillar of the fauces, with a tongue dry and brown in the centre. Fig. II, 1, represents his pulse on the fifth day of his illness; the urine was not albuminous, and the tidal wave is not sustained (in Fig. I an exactly opposite condition exists). On this day there was the greatest amount of dicrotism that was ever present, and yet this wave is very small.

On November 29th, the sixth day of his fever and the most critical of his illness, with his temperature at 105° and the slough in his throat increasing, his pulse appeared to be losing power (Fig. II, 2), the heart was becoming exhausted, and owing to its enfeebled contraction the percussion wave has disappeared, the upstroke being rather sloping; a similar condition in a continued fever would be accompanied by hyper-dicrotism, but in scarlet, the pulse, which is non-dicrotic throughout, is especially so in this condition. Under the influence of free stimulation and good nourish-

FIG. II.

1. Intense fever. Urine normal.
Nov. 28th, 5th day.

2. Intense fever. Urine normal.
Nov. 29th, 6th day.

3. Convalescent. Urine normal.
Dec. 6th, 13th day.

4. No albumen. Blue with
guaiacum test. Dec. 20th,
27th day.

5. No albumen. Blue with
guaiacum test. Dec. 21st,
28th day.

ment he passed safely through the crisis, and the following day his temperature had fallen and his pulse regained power. His urine was free from blood and albumen during the whole of his fever.

On December 1st, the eighth day of his illness, he had an

attack of rheumatism, his urine on this day containing an excess of uric acid; this excess is almost invariably present in cases of scarlatina at about this period, and, perhaps, accounts for the coincident rheumatic tendency. His bowels had been confined for one day when the rheumatism appeared, and it is probably to the arrested excretion of effete material by the bowel that the rheumatism was due; his pulse-tracing exhibited no increase of tension coexistent with the attack of rheumatism.¹ During the next five days, the bowels being purged, the rheumatism quickly subsided, the uric acid in the urine decreased, the temperature became normal, and the pulse assumed a healthy form, which it maintained during the greater part of his convalescence. Fig. II, 3, is an example of this type of pulse obtained on the thirteenth day of his illness.

We now come to a series of phenomena to which I particularly desire to call attention. During the twelve days succeeding that on which the last tracing was obtained his bowels continued freely open, convalescence proceeded satisfactorily, and his urine and pulse remained normal; but on the twenty-sixth day of his illness his bowels were rather constipated and his pulse, which was irregular, showed a decided increase of tension; his urine, however, gave no abnormal reaction.

On the following day he had no action of the bowels what-

¹ As mentioned above, the same condition, namely, slight constipation, in similar cases is alone required to produce albuminuria, and a question of extreme interest presents itself for solution by the physiologist, namely—What chemical conditions determine whether this transient constipation will produce rheumatism or albuminuria in a given case? That the two are closely allied seems certain; yet in two otherwise exactly similar patients, why do we find in one increased tension and albuminuria, in the other no increase of tension and rheumatism? It is possible that in the albuminuric patient the chemical changes are not sufficiently rapid, and effete albuminous and therefore colloid materials are present which impede the capillary circulation, and when increased in amount by constipation produce high arterial tension and albuminuria; while in the rheumatic patient the changes have been more rapid, the colloid being changed into the crystalloid, uric acid, and though the capillary circulation is less impeded, its presence in an excessive degree gives rise to an attack of rheumatism.

ever, and the tension of the pulse became greatly increased (Fig. II, 4), three ounces of pressure being now required to develop it, whereas one ounce was previously sufficient; the tidal wave, moreover, was too much sustained. On applying the guaiacum test to the urine a distinct blue reaction was obtained, showing transudation of the hæmoglobine and perhaps other crystalloids of the blood, though the most careful testing failed to discover any trace of albumen. On the following day, after a purge, the bowels were relieved, but not freely so; the blood pressure was immediately reduced, two ounces sufficing to develop the pulse (Fig. II, 5), but the tidal wave continued sustained. The urine still gave a blue reaction with the guaiacum test, though fainter than before; no trace of albumen could be discovered by the most delicate testing. The purge being repeated, the bowels were freely open on the succeeding day, the tension became much less, the pulse wave being larger and the tidal less sustained; the pulse had again become irregular, owing to the heart not having yet adapted its action to the changed vascular condition. The urine now gave no reaction with the guaiacum test, and it remained free from albumen. The patient left the hospital on the following day, but appeared a fortnight after to report himself; both the pulse and urine were then normal. During the time when this increased tension existed he complained of no constitutional symptoms whatever, and considered himself in his usual health. The case possesses much interest as showing the earliest commencement of a condition that might have developed into Bright's disease, its detection and immediate arrest.

No. III.—The next case I desire to bring before you affords a typical illustration of the class to which it belongs.

G. A—, a lad in a city warehouse, was admitted into the London Fever Hospital January 25th, 1874, suffering from scarlatina, on the second day of his fever. His attack was not a severe one. He had a profuse rash and free desquamation; he became convalescent without any complication. During the whole of his convalescence he had a tendency to

constipation, which was treated by frequent purgatives. On the twentieth day of his illness, his bowels having been confined for one day, his urine was found to be albuminous, and a blue reaction was obtained with the guaiacum test.

On the following day, his bowels being still confined, his urine was highly albuminous, while the reaction with the guaiacum test was diminished. Fig. III, 1, was obtained on

1. Albumen. Blue with guaiacum test. Feb. 14th, 21st day.
2. No albumen. Blue with guaiacum test. Feb. 17th, 24th day.
3. Much albumen. No blue. *Before pack.* Feb. 22nd, 29th day.
4. A trace of albumen. No blue. *After pack.* Feb. 22nd, 29th day.
5. Much albumen. No blue. *Out of bed.* May 15th.
6. No albumen. No blue. *In bed.* May 15th.

this day ; it shows a condition of high tension and contracted arteries ; three ounces of pressure was required. Although he had this well-marked albuminuria, he suffered from no constitutional symptoms whatever ; he expressed himself as feeling

in every way quite well. He had no nausea or pain in the loins. On the following day, the twenty-second of his illness, having been well purged, his urine contained only a faint trace of albumen, which was discovered with difficulty, while the blue reaction was now more distinct. The pulse-tracing still indicated the same high tension as on the previous day. The blue reaction lasted for several days longer; it existed altogether for nine days, albumen being present only on the first three, and on only one in any large amount. During the remainder of the time the pulsé exhibited a gradual diminution of tension and return to the normal form. Fig. III, 2, obtained three days after the last, shows the arteries relaxing and the pressure decreased.

In this case the ordinary physical signs of high tension were present; the heart's impulse was forcible and sustained, the first sound was dull and prolonged, near the apex reduplicated, but at the base distant and indistinct, while the second was loud and clacking at this spot. There was slight subconjunctival oedema, and by firm pressure slight pitting could be obtained over the tibiæ. The ophthalmoscope revealed nothing abnormal. His appetite was good throughout. His morning temperature ranged between 99° and 100°, while in the evening his temperature fell below normal. The day his temperature became normal the blue disappeared coincidently from his urine and the tension from his pulse. He was allowed to get up on the following day; he did so, however, without wearing flannels and received a chill; his bowels were at the same time confined. On the next day, the twenty-ninth of his illness, his urine was found to be loaded with albumen, but no reaction was obtained with the guaiacum test; his pulse-tracing again indicated high tension and very contracted arteries (Fig. III, 3). He was placed in a hot pack for two hours, and profuse perspiration was induced; by this means his condition was completely changed. The next urine secreted contained only a trace of albumen, the blue reaction was still absent, and his pulse-tracing demonstrated a relaxation of his arteries, a great reduction of tension, and a normal condition of pulse (Fig.

III, 4). His bowels, however, still remained confined, and although on the following day his urine was normal the pulse indicated rather too much tension. On the succeeding day, after a free purge, his pulse became perfectly natural, the tidal wave being scarcely perceptible, and the urine and temperature were also normal. On four occasions after this his urine became albuminous; each time the albumen was copious, and no reaction was obtained with the guaiacum test. His urine during this period was measured and found to be deficient in quantity; on one occasion it was as low as 22 oz., and it never exceeded 48 oz. It was noticed at this time that when up and about he invariably suffered from cold extremities; this symptom is very frequently present in scarlatinal convalescents who are liable to albuminuria; they would be popularly described as suffering from "bad circulation," and such an expression would be scientifically correct if qualified with the word "capillary." The cold extremities are due, I believe, to "bad *capillary* circulation," the poisoned blood moving slowly through the capillaries from diminution of capillary power or chemico-vital attraction, hence the heart has increased work and high tension is produced. With this symptom unchanged he went out of the hospital on March 27th, having been ill about nine weeks. He continued under observation, and albumen reappeared in the urine; as it remained persistent he was readmitted on April 24th, it being then upwards of three months since he was taken ill.

The scarlatinal poison was shown to be still existent in a most striking manner; on his returning to his house of business, about a week previously, he communicated the disease to another lad who shared his sleeping room. He still suffered from cold extremities, and the interesting discovery was now made that while keeping his bed his urine was perfectly normal, but that immediately he left it his urine became highly albuminous. This change was instantaneous, half an hour in either condition sufficing to alter the character of the urine. Corresponding to this altered secretion there existed the changed condition of circulation

on which it depended. Fig. III, 5, illustrates his pulse while out of bed, his urine being albuminous; while Fig. III, 6, represents his pulse on the same day, three quarters of an hour after taking to his bed, the urine being normal; at the same time it was ascertained by volumetric analysis, albuminuria being produced, that a large diminution in the excretion of urea occurred from that which took place in a corresponding period of time while the patient was in bed and the urine normal, although the diet on each occasion was exactly similar. This fact is easily accounted for by the diminished tissue changes which take place when the capillary circulation is retarded.

These symptoms were not overcome till he was clothed in thick flannel from head to foot, and he left the hospital apparently cured five calendar months after his first admission.

No. IV.—The following case was one in which albuminuria never actually occurred, though the prealbuminuric condition of high tension and transudation of crystalloids was at one time present.

E. W—, a butler, æt. 29, was admitted into the London Fever Hospital on the second day of his fever, suffering from a severe attack of scarlatina anginosa. His throat presented patches of exudation almost diphtheritic in appearance, while his urine during the fever was slightly albuminous, though it gave no reaction with the guaiacum test. During his convalescence he had several slight attacks of rheumatism, and his temperature kept up, varying from 99° to 101° for thirty-four days, though without any apparent cause. His appetite was good and his bowels regular, with rather a tendency to be relaxed. The first tracing on the card was taken on the twentieth day of his illness, his bowels being open, urine normal, and pulse-tracing perfectly natural. On the twenty-seventh day, however, his bowels having been slightly confined, his pulse shows a great increase of tension; in appearance it exactly resembles one of chronic Bright's disease. The urine,

FIG. IV.

1. Normal. Feb. 12th, 20th day.

2. No albumen. Blue with guaiacum test. Feb. 19th, 27th day.

3. No albumen. No blue. Feb. 20th, 28th day.

4. Normal. Feb. 21st, 29th day.

though containing no albumen, gave a well-marked reaction with the guaiacum test. The following day, after a purge, the tension was considerably diminished (Fig. IV, 3), while the crystalloids could no longer be detected in the urine. On the following day both temperature and pulse (Fig. IV, 4) were normal. This condition never recurred in this patient.

No. V.—C. W—, a housemaid, æt. 19, had been nursing scarlet-fever patients; she believed this to be her second attack. Her fever was a very mild one. She was admitted on the second day of her illness. She had very little rash and merely a slight reddening of her fauces. Her bowels had a tendency to constipation throughout. The tracing obtained on the day of her admission indicates contracted arteries and a firm pulse, but the tidal wave was not

1. Normal. Nov. 21st, 2nd day.

2. Albumen. Blue with guaiacum test. Nov. 27th, 8th day.

3. No albumen. Very faint blue. Nov. 29th, 10th day.

prolonged. Her urine was now normal. Three days after this she suffered much from earache and otorrhœa. Her bowels were confined, but the urine was normal. On the eighth day of her illness, her bowels not having been open for two days, her urine was found to be faintly albuminous, while it gave a distinct reaction with the guaiacum test. Her pulse was one of well-marked high tension. She complained of pain in the small of her back and headache. She had subconjunctival œdema, the face looked puffy, and her legs were slightly œdematous. On the following day, her bowels having acted once only, her symptoms were but partially relieved. The urine was still faintly albuminous, though the blue reaction was very much less than on the previous day. The tracing obtained on this day showed a decided diminution of tension. On the next day, her bowels having been further relieved, her condition was altogether improved. The pain had disappeared from her back. Her temperature became normal for the first time, while her urine contained no albumen, and gave but a very faint reaction with the guaiacum test. The tension of her arterial system was diminished, her pulse-tracing being normal, though still firm, with somewhat contracted vessels (Fig. V, 3). Her legs continued slightly œdematous for three or four days after this, but her urine never again became albuminous. It is interesting to notice that in this case,

although the albumen was very scanty throughout, the constitutional symptoms were well marked; while in the lad previously mentioned, whose urine was highly albuminous and the albuminuria frequently recurring, no constitutional symptoms were ever present.

1. Albumen, and bright blue with guaiacum test. Oct. 25th, 24th day.
2. No albumen. Blue less intense. Oct. 30th, 29th day.

No. VI.—The two tracings in the above woodcut afford good examples of the condition of high tension accompanying albuminuria in a child of five, during his convalescence from a mild attack of scarlatina. On the twenty-fourth day of his illness, when the first tracing was obtained (Fig. VI, 1), the albuminuria had certainly existed three days, and it may have been longer; the tension had, moreover, been relieved by a sharp purge on the previous day.

The second tracing was obtained on the day that the albumen disappeared, the blue reaction still remaining, though less marked. The tension of the pulse has greatly diminished, and the muscular coat of the arteries has relaxed, so that the pulse is larger; a day or two afterwards the blue completely disappeared. In this case transudation of the crystalloids of the blood occurred throughout, and continued for several days after the disappearance of albumen from the urine.

No. VII.—The following case has been substituted since the reading of this paper for one previously inserted, in order especially to give a well-marked example of the

blue reaction affording the first indication obtained from a urine that afterwards became distinctly bloody.

1. Much albumen. Bright blue.
May 30th, 27th day.

2. Faintly albuminous. Bright blue. June 6th, 34th day.

W. B—, a boy, æt. 13, was admitted into the London Fever Hospital on May 5th, 1874, suffering from a severe attack of scarlatina; his temperature was very high, ranging from 104° to 105° up to the eighth day of his fever; his throat was severely ulcerated and sloughy. After the defervescence of his fever his temperature kept high during his convalescence, varying from 100° to 101° ; he, however, appeared well in himself, and there was no apparent cause for the high temperature. On the twenty-third day of his illness his bowels were confined, and his urine on this and the following day gave a blue reaction with the guaiacum test. After a sharp purge his urine, on the twenty-fifth day, was again normal; on the evening of this day he had a bath, and got up the following day; the urine secreted after this was albuminous, and again gave the blue reaction; on this day, the twenty-sixth of his illness and the first of leaving his bed, the urine secreted in the twenty-four hours measured only 15 oz. A pulse-tracing obtained on the following day (Fig. VII, 1) shows a condition of cardiac excitement with exaggerated percussion and tidal waves, a form of pulse which is often seen in young subjects suffering from acute Bright's disease. His temperature began to rise rapidly on this day, reaching 102° in the evening, and the glands at the right angle of the jaw became inflamed and swollen; his urine was albuminous, and the blue reaction very bright.

On the following day (the twenty-eighth of his illness) his temperature had risen to 103.6° , while his urine was albuminous and gave a very bright blue reaction; on this day it was distinctly bloody, and many blood-corpuscles were seen by aid of the microscope. Early the next morning a sharp purgative was administered, which produced nine actions of the bowels, and reduced the temperature to 98.6° ; the pulse also fell from 116 to 72 per minute; the blood disappeared from the urine; the blue reaction remained, but only a small amount of albumen was discoverable. Three days after this the same symptoms were repeated. Glandular swelling occurred at the opposite angle of the jaw, and the temperature rose to 104.5° , the urine again becoming bloody; but the purge being repeated, the temperature fell the next day and the condition of the urine improved, though not so much as on the first occasion.

After three days his urine was only faintly albuminous, but the blue reaction was still well marked; this condition persisted for a long time, up till the fifty-fourth day of his illness, that is, thirty days since the appearance of the blue. The albumen was variable in amount during this period, and on one or two occasions disappeared entirely; for three days the blue reaction also disappeared, and again returned. While in this condition the urine was examined by the spectroscope, but no characteristic blood spectrum was obtained. The pulse, of which Fig. VII, 2, is an example, retained the same character throughout; it is typically one of high tension. He had no œdema nor any constitutional symptoms, his bowels were kept freely purged. On the fifty-third day he was placed in a hot pack, and copious perspiration was induced; on the following day his urine was perfectly normal, and continued so for the next ten days, during which he remained under observation.

With regard to this case it is highly interesting to observe that the chief cause of his symptoms appears to have been a *chill*, and although purgation very greatly relieved them they were not removed till his skin was brought thoroughly into action by the hot pack.

From these few typical cases I think some important deductions may be drawn; doubtless they are already foreseen. I believe it is now generally admitted that the renal disease following scarlatina is exactly similar in its nature and progress to that usually known as the inflammatory form of Bright's disease; it will probably be agreed, moreover, that the cases I have quoted in the present paper indicate the earliest symptoms of this disease, and it will also be allowed that some, if not all of these, might have developed under unfavorable circumstances into the more severe condition. We have, then, during the convalescence of scarlatina, an opportunity afforded us for watching the mode of origin and first indications of the ordinary so-called "inflammatory Bright's disease."

But can the term "*inflammatory*" be fairly applied to this disease? I take it that, correctly speaking, it cannot; it does not describe the true condition, and it must convey a false impression of its pathology. It is not an actual inflammation of the kidney that gives rise to the symptoms produced. It is a general blood poison, by which the kidney is not alone affected, but it suffers in connection with other organs, notably those of excretion. This view is not a new one; a lecture by Dr. Walshe is published in the 'Lancet' of 1849, entitled "Bright's Disease not a Renal Disease, but primarily a Blood Disease," in which that accomplished physician arrives at this conclusion, though from arguments of a different nature; he deduces his theory from the clinical history of these cases, and takes a case of renal disease following scarlatina as an example.

Drs. Fenwick and Wilson Fox have both demonstrated that a similar condition to that which exists in the kidney exists also in the stomach and duodenum; it probably exists also throughout the intestinal tract. They have found inflammatory Bright's disease associated with a corresponding affection of these organs, namely, increased proliferation of the cells lining the follicles, producing distension of the follicles with cells and granular matter, similar to the affection of the kidney-tubules, while cirrhosis of the kidney they have found accompanied by intertubular changes.

We may moreover anticipate, reasoning by analogy and from experience, that the skin is affected in a similar manner, namely, that the sweat-glands become blocked from a similar proliferation of cells, and are unable to act, thus producing the dryness and roughness of the skin with which all are so familiar in Bright's disease. This, however, I have never substantiated by observation, nor have I seen it described ; if it should be so we have all the organs of excretion simultaneously affected and in a similar manner ; then, why should the kidney give its name to the disease except because its symptoms are most urgent, and therefore cause the others to be overlooked ?

Again, while the condition is not solely confined to the kidney, neither is it inflammatory, for what appears to be the true clinical and pathological condition ? A patient having a quantity of effete or poisonous matter in his system, that he is excreting as rapidly as possible, has the function of one of his excretory organs suddenly or gradually arrested—it may be his bowels or it may be his skin. Coincident with this we notice a sudden or gradual increase of tension produced in his vascular system generally ; the poisoned blood loses its affinity for the tissues, it is already surcharged with matter to be excreted, and cannot take up much more ; the force of chemical attraction is diminished, if not lost ; the remaining organs of excretion, previously heavily taxed, have now to do the work of the third, and, whether it be that the bowels are confined or the skin chilled, extra duty falls in each case upon the kidney. This organ, therefore, receives an increased blood supply, and that under a higher pressure than usual. But surely this condition hardly amounts to an inflammation ? A muscle in active exercise and the uterus at the menstrual epoch both have an increased blood supply, but neither could be described as “inflamed.” The increased tension, moreover, is not confined to the kidney, but is present throughout the arterial system.

The first indication obtained from the kidney of this increased blood supply and high pressure is the transudation of some of the crystalloids of the blood, indicated by a

blue reaction, more or less marked, obtained with the guaiacum test. If this condition be allowed to continue we find that albumen next appears in the urine in greater or less amount; the crystalloids may continue to transude, or as the albumen becomes copious they may disappear. The fact that these two constituents of the blood are not always present in the urine simultaneously appears to indicate that it is only under a certain degree of pressure that the crystalloids pass through the walls of the vessels, and that when the pressure is increased they cease to do so, but the colloid albumen now appears in the urine; if the pressure becomes still greater, rupture of minute vessels occurs, and blood is poured out into the kidney-tubules.

The correctness of this view of the relative diffusibility of these constituents of the blood under varying pressures might, doubtless, be readily tested by experiment; it may also be shown in this manner that albumen is capable of diffusion through the capillary walls without any pathological change occurring in them. This, however, has not yet been attempted.

During this condition of high arterial tension, whether crystalloids or albumen appear in the urine, the quantity of this fluid I have found to be invariably reduced.

So far we have traced the kidney to a condition of congestion under high pressure and seen its consequences; arguing from our knowledge of the effect of increased blood supply to any part, the next step in the process is evident—it will be an increased growth of the tissues supplied, namely, the epithelium of the tubules, and this exactly agrees with what pathologists have described. New cells are too rapidly formed, old ones too rapidly shed; these cells, moreover, growing like vegetables forced under conditions most favorable for their growth, are increased in size as well as in number; plugging of the tubules is therefore readily accounted for by either exudation of fibrine or distension with swollen cells.

I need pursue the subject no further; it is now becoming generally admitted that in the so-called “inflammatory” form the condition of the kidney gradually changes from the large

red to the white, and then to the granular and contracting form. Yet in no stage does a process of a truly inflammatory nature occur. From the condition of high tension in the vascular system that precedes and accompanies these kidney changes it will be readily judged how necessary an accompaniment must be the hypertrophy of the heart and arteries. I have attempted to prove that this high pressure in the vascular system is not the result of kidney disease, but of a primary blood poison; and I believe that the fact of increased pressure demonstrated to exist in the capillaries, by exudation through their walls of the crystalloids, negatives Dr. Johnson's view of the production of hypertrophy of the heart by the stopcock action of the arterioles, for if this existed the pressure in the capillaries would not be increased;¹ I should imagine, moreover, that the effort of the muscular coat of the arterioles to prevent over-distension by the increased pressure would be sufficient to account for their hypertrophy, while the increased work of the heart to overcome the increased pressure in the vessels would be amply sufficient reason for a similar change in that organ.

Lastly, with regard to all cases of acute Bright's disease, what I have said of those of scarlatinal origin appears to hold good. For while in those of scarlatinal origin we have an evident blood poison producing high tension, yet in all cases of Bright's disease a similar cause is undeniably present; it may be produced by a severe chill causing arrest of the action of the skin, general visceral engorgement, and increase of vascular tension from contraction of the cutaneous vessels, similar to that produced by a cold bath, a condition most readily demonstrated by the sphygmograph (such, probably, were those cases lately brought forward by Dr. Johnson in his paper on "Temporary Albuminuria after Cold Bathing," read before the Clinical Society of London);

¹ Experiments have been performed by Dr. Lauder Brunton and the author (to be reported elsewhere), in which both the blue reaction with the guaiacum test and albumen were discovered in the urine of a dog, in whom high arterial tension had been produced by ligation of the abdominal aorta below the renal vessels.

or an actual blood poison may exist, as in pregnancy, erysipelas or measles (both of them acute diseases accompanied by a pulse of high pressure like scarlatina), and in poisoning by uric acid in gout, by lead, by alcohol, or any other of the usual causes; alike under all these circumstances a predisposing condition of high pressure in the vascular system is demonstrated by the sphygmograph before any symptom of Bright's disease presents itself. Examples of a few of these are afforded by the typical tracings reproduced in Fig. VIII, the first four of which are chronic, the last two, acute conditions.

Pregnancy is well known to be frequently associated with albuminuria; it is, moreover, always mentioned among the causes of Bright's disease, while puerperal convulsions are considered by many to be of a uræmic nature, and are usually found to be accompanied by albumen in the urine. This condition has been ably discussed by Dr. Braxton Hicks in his paper "On the Pathology of Puerperal Eclampsia," published in the eighth volume of the Obstetrical Society's 'Transactions.' After demonstrating the frequent existence of albuminuria with eclampsia, he admits that the relation of one to the other has not been arrived at; he cannot say whether the eclampsia is caused by or is a cause of the renal disease, or whether both are due to one cause. The problem is, however, very clearly solved by the sphygmograph. I have found, in a large proportion of the pregnant women whom I have examined, high tension existing in the pulse (Fig. IX, 1 and 2). In none was the pulse that of low tension or dicrotic. This condition of high tension is especially confirmed by the hypertrophy of the heart which accompanies pregnancy. During the first stage of labour the pulse (Fig. IX, 3) is invariably one of high tension. This condition of tension decreases gradually after labour; it requires from a week to three or more to assume the normal form. Fig. IX, 3, 4, and 5, show the gradations of tension in one patient from the first stage of labour on the first and on the twelfth days, that obtained on the last day being almost normal.

FIG. VIII.

Pulses of high tension from blood poison. Urine not albuminous, but likely to become so.

1. *Gout.* Æt. 34.

2. *Chronic dyspepsia.* Mal-assimilation. Æt. 55.

3. *Lead.* Æt. 48.

4. *Alcohol.* Æt. 58. Delirium tremens.

5. *Erysipelas.* Æt. 43. Temp. 104.8°.

6. *Measles.* Æt. 14. Convalescent.

We have already seen the relation borne by high tension to kidney disease ; we have, therefore, an evident predisposition to this disease, demonstrated by the sphygmograph, during pregnancy. Unfortunately I was unable to procure the urine for examination in these cases ; I believe that a

FIG. IX.

1. Pregnant 8½ months.
Æt. 24.

2. Pregnant 7 months.
Æt. 34.

3. First stage of labour.
Æt. 30.

4. First day after.

5. Twelve days after.

reaction with the guaiacum test might often be obtained in such cases before albumen appears. The reason for this high tension is evident. The blood of the mother is overcharged with effete material, for she has to discharge the excrementitious matters of the fœtus by her own excretory organs; her blood is therefore in a measure poisoned, and like a scarlatinal convalescent does not bear its normal relation to the tissues, while the organs of excretion have to do increased work, and that under increased pressure; should, then, one of them be interfered with, as by constipation

or a chill, albuminuria appears a very probable result. This, if not soon relieved by a purge or other appropriate means, would readily develop into the more severe forms of Bright's disease.

Finally, the condition best described as cirrhosis of the kidney I believe to have a similar origin to those already mentioned. The condition of increased vascular tension from blood poison, especially that of alcohol, gout, or lead, still exists, although in a more chronic form (*vide* Fig. VIII, 1, 2, 3, and 4).

This description of blood poisoning having generally commenced insidiously, the tension has been very gradually increased, and, although a very high degree of tension is eventually arrived at, the increase has been so gradual, and the process has extended over so long a period, frequently many years, that the vessels generally, including the arterioles and capillaries, have undergone a corresponding thickening. This change in the vessels probably satisfactorily answers the question, Why is albuminuria so frequently absent in cirrhosis of the kidney? It also accounts for the crystalloids not transuding and no reaction being obtainable with the guaiacum test. This condition, namely, blood poison, high tension, and arterial degeneration, may occur without corresponding kidney change if either by the occupation, habits, or constitution of the patient, the skin or bowels do increased work and relieve the kidneys from congestion; furnace men and others accustomed to copious perspiration occasionally afford instances of this. These cases may be included under the term arterio-capillary-fibrosis.

As long as no existing cause, such as chill, producing visceral engorgement and arrested action of the skin, or any great interference with the bowels, occurs to give rise to the symptoms of the acute disease, the prolonged condition of high tension combined with a chronic and not intense congestion of the excretory organs would produce cirrhosis. For Sir William Jenner, in his paper communicated to this Society on "Congestion of the Heart," published in the 43rd

volume of its 'Transactions,' has described a very similar change, namely, induration and contraction of organs, especially the kidneys, as due to that cause. I believe that the chronic condition of increased blood supply produces increased growth of the intertubular connective tissue, and if still continued this must result in contraction and induration; atrophy of the tubules from constant pressure would now ensue. This sequence of kidney changes agrees with that described by most observers.

In confirmation of this view of the commencement of these changes I have frequently observed a condition of high tension in the pulse in cases that have subsequently developed albuminuria and symptoms of cirrhosis of the kidney, and in one or two out of a small number of observations I have obtained a blue reaction with the guaiacum test in cases where albumen was detected in the faintest possible traces, and even when it was absent. Of these I may quote one; it is that of a man of gouty family history and a free drinker, who had suffered from frequent "bilious attacks" and loss of appetite in the morning for some months before he came under observation; he was admitted into the Fever Hospital October 5th, 1873, suffering from enteric fever. Though his fever was not severe, his urine was loaded with albumen from the time of his admission; his pulse was one of high tension throughout, it never became dicrotic (Fig. X, 1).

No reaction was obtained, however, with the guaiacum test. At one time he had some slight œdema of his lower extremities. As he became convalescent the albumen gradually diminished, and at last disappeared from his urine. Fig. X, 2, illustrates his pulse at this period; it is perfectly normal. He went away to the country during his convalescence, and while there, according to his own account, he had a relapse of his fever.

When he first came to report himself, two months after his discharge, his urine was free from albumen, but gave a slight reaction with the guaiacum test. His pulse (Fig. X, 3) shows a decided increase of tension. In a fortnight's time he returned again, not feeling so well; he thought he had

FIG. X.

Commencing cirrhosis?

1. During enteric fever. Albumen. No blue.

2. Convalescent. Urine normal.

3. Two months after. No albumen. Faint blue.

caught cold. He complained of weakness and general malaise; his urine now gave a distinct blue reaction with the guaiacum test, and a faint trace of albumen was also discovered. This case, I have but little doubt, was one of commencing cirrhosis of the kidney. He still continues under observation.

Finally, while unwilling to lose the association of the name of Bright with kidney disease, I agree with many others in thinking the term is too general for scientific purposes, for as applied by some it has become synonymous with "albuminuria." I venture to suggest, therefore, that the terms Acute and Chronic Excretory Congestion concisely convey a more extended and accurate idea of the organs affected and of the pathological changes which occur in the two conditions discussed in this paper than many of those at present in use. The two other forms of kidney frequently included in the term Bright's disease, namely, the waxy and true fatty kidneys, are, of course, of an entirely different nature, and form only part of the general waxy and fatty degenerations which affect the tissues generally.