in diabetes, while fission-fungi and yeasts appear in ammoniacal urines. Bacteriuria is observed after the use of unclean catheters. The tubercle bacilli may be found in phthisical cases with renal complications. The presence of infusoria has no pathological significance. The parasites which affect man and which may be found in the urine, are as follows, viz., *Distoma hæmatobium*, *Filaria sanguinis hominis*, *Echinococci*, *Eustrongylus gigas*, and sometimes *Ascarides*.

CHAPTER VI.

DISEASES OF THE URINARY SYSTEM.

Contents.—Acute and chronic parenchymatous nephritis—Cirrhotic Bright's disease—Waxy disease of the kidneys—*Differential diagnosis of the three forms of Bright's disease*—Diabetes mellitus—Diabetes insipidus—Renal calculi—Hydronephrosis—Pyelitis, and suppurative nephritis—Perinephritis, and perinephric abscess—Malignant disease of the kidney—Tubercle, cystic disease, and hydatids of the kidneys—Floating kidney—Paroxysmal hæmaglobinuria—Chyluria—Active and passive congestion of the kidneys—Uræmia, *and the diagnosis of kidney affections.*

Bright's disease is a group of acute and chronic diseases of the kidneys, having *albuminuria* as a characteristic symptom. Albuminuria alone, however, is by no means pathognomonic. The classification is as follows, viz. :—

I. Acute and chronic parenchymatous nephritis, or acute and chronic Bright's disease.

II. Cirrhosis of the kidneys, or cirrhotic Bright's disease.

III. Waxy disease of the kidneys.

Acute Bright's disease may be subdivided into *glomerular nephritis* and *tubular nephritis*, according as the glomeruli or the tubules are most affected—the former being the case in scarlet fever. Glomerulo-nephritis is known as the scarlatina kidney.

Sir T. Grainger Stewart tabulates the different forms of Bright's disease thus, viz. :—

I. Inflammatory—
- (A) Glomerular nephritis.
- (B) Tubular nephritis, { Simple. / Fatty kidney. / Atrophied kidney. } As stages.
- (C) Both forms together.

II. Cirrhotic Bright's disease.

III. Waxy disease of the kidneys, { Simple. / Enlarged. / Atrophied. } As stages.

IV. Combined forms.

Clinically, the atrophied stages may be regarded as cirrhotic Bright's disease.

Acute Parenchymatous Nephritis—Tubular Nephritis—Acute Desquamative Nephritis—Acute Bright's Disease.—Pathology.—The kidney is increased in size and weight. The capsule strips off easily and reveals a smooth surface beneath it. The cortex is pale, with small extravasations throughout its textures; and the pyramids are deeply congested. The microscopic examination reveals changes in the convoluted tubules, almost exclusively. Fine deposits—cloudy granulations—are seen within the epithelial cells, and these, producing distention, almost occlude the tubules which frequently become dilated and tortuous.* In the later stages, fatty degeneration of these products of inflammation give the organ a yellow mottled appearance (large fatty kidney). In the extremely chronic stage, the organ becomes atrophied. According to Grainger Stewart, *all* forms of Bright's disease end in atrophy, if the patient live long enough, and the disease do not terminate in recovery.

The **causes** of acute Bright's disease are, sudden exposure to cold when the skin is warm and perspiring; scarlatina, diphtheria, typhus, diabetes, and erysipelas; pregnancy; substances which irritate the kidneys, as cantharides, turpentine, copaiba, &c.; and hereditary influences. Acute Bright's disease is commoner in youth than in the aged; and a constitutional type is described—pale, light-haired, and flabby individuals—who are predisposed to this form of the disease.

Most frequently the early **symptoms** of acute Bright's disease are obscure, and there is little constitutional disturbance. Œdema of the ankles, or a puffiness of the eyelids, is often the first symptom which attracts attention, and calls for examination of the urine. At other times, there is a history of a chill followed by fever and lumbar pains, with painful, and frequent, attempts at micturition, resulting in the passage of a few drops of urine, often bloody.

The urine is diminished in quantity, and sometimes there may be entire suppression, which may lead to very urgent symptoms, and death within a few days (*uræmia*). The specific gravity is increased to 1,025 or 1,030 in the early stages, and this is due to the diminished amount of water secreted; but soon, if the disease proceed, it is as low as 1,010 or 1,005. The urine is acid in re-action, and it is often loaded with urates; and if it contain only a small proportion of blood, it has a smoky appearance. When the quantity of blood in the urine is greater, the colour is from a red hue to a dark-brown, according to the amount. Albumen is always present in this form of Bright's disease, and it may be roughly estimated by the quantity which appears with an inch of urine in the test-tube, when the cold nitric acid test is applied. In severe cases, the amount of albumen may show from a half to three-fourths of the bulk of urine within the test-tube. The maximum is about 35 grammes in twenty-four hours.

* In the scarlet fever kidney, these changes affecting the glomeruli more than the tubules, the Malpighian bodies are more prominent on section of the kidney. The microscopic changes are also observed in this neighbourhood (glomerulo-nephritis). In acute nephritis the inflammation frequently extends to the intertubular substance.

The tube casts found in acute Bright's disease are epithelial and hyaline, granular and blood casts, along with numerous free blood corpuscles, granules, and *débris* (see Figs. 21, 22, 23). The quantity of urea excreted is much diminished, and so are the other solid constituents of the urine. The œdema of the ankles and eyelids appears early, and it soon extends to the other parts of the body, and to the serous cavities if the disease advance. The tension of the pulse increases with the onset of the dropsy. In the later stages, as the amount of water in the urine increases, the acidity diminishes, and there is an increase in the quantity of the solid constituents excreted; but the quantity of urine voided is still below the normal, and of a low specific gravity. The tube casts are then seen to be fatty, as in the chronic form, while the dropsy is much increased. There is loss of appetite, nausea and vomiting, and often diarrhœa; and the patient soon becomes anæmic and emaciated. The vision may become impaired from simple anæmia, or it may be the result of *albuminuric retinitis*.

The *history and course* of acute Bright's disease are modified by the cause, as in scarlatina, diphtheria, &c. Pregnancy can only be viewed as an exciting cause, apt to produce congestion of the kidneys in patients already predisposed to Bright's disease. In scarlatina, the glomeruli being more affected than the tubules, there is a greater diminution in the quantity of urine passed, and there is more chance of suppression. In acute Bright's disease, arising spontaneously, the fever (if any) lasts only for a few days. Recovery from this form is quite common; but death may ensue in the course of a week from uræmia. The case generally progresses slowly, and the dropsy appears gradually, unless the urine be very scanty, and then dropsy may occur within a few days. Death may result later from exhaustion, or by gastro-intestinal disturbance and anæmia. In the cases which recover, it may be three months before the health is restored.

The **chronic form of Bright's disease** may follow the acute; but more commonly it develops insidiously, the result of chronic alcoholism, syphilis, malaria, chronic suppuration, or metal poisoning. It may arise from any cause which depresses the vitality of the tissues in those predisposed, constitutionally, to Bright's disease.

The pathological condition is that of the *large white kidney of nephritis*. The cortical part of the kidney is much enlarged, and there is hyperplasia of the connective tissue, which, by contraction, subsequently leads to atrophy of the organ. Instead of the epithelium of the tubules being affected with cloudy swelling—as in the acute form—there is fatty degeneration within the cells, and the tubules are filled with the products of the epithelial cells destroyed.

The **symptoms** develop slowly, when not preceded by the acute form. For some time, there may be only loss of appetite and strength noticeable, but gradually the patient's face acquires a pale and characteristic earthy colour. The œdema of the ankles and face now appears, and quickly spreads over the whole body. The scrotum may be immensely distended, and there is more dropsy, ultimately, in this form of Bright's disease than in any other. The serous cavities become affected, and hence pleuritic and pericardial effusions are frequent. Œdema of the lungs and glottis are common complications, the latter being highly dangerous, as it may cause death by suffocation. The changes in the urine are the same as in the acute form; but there is often less albumen, and the *hyaline and fatty* tube casts predominate. They become more and more granular, fatty, and broader in shape as the disease advances. The skin becomes sodden. The mucous membranes are dropsical, and hence vomiting and diarrhœa are common symptoms. At first the heart-sounds are accentuated; but later they are only feebly heard, while the pulse—at first increased in tension—becomes quick, small, and compressible. *Albuminuric retinitis* is common, and the impairment of vision may be one of the first symptoms calling attention to the state of the kidneys. Dyspnœa results from œdema of the lungs, or from pericardial or pleuritic effusions. Epistaxis and erysipelas are common. Sometimes convulsions and other symptoms of uræmia develop. A fall in the specific gravity of the urine indicates a diminution of the solids excreted, and this symptom may precede, for a few days, the onset of uræmia.

Complete recovery from the chronic form of Bright's disease is always possible, but it is somewhat rare. Partial recovery to moderate health is frequent, although albumen may be detected in the urine a year or two after the dropsy has disappeared. Recurrence is the rule, and the prognosis will depend upon the amount of the dropsy, and the state of activity of the kidneys. Death may ultimately be due to pneumonia or pleurisy, to phthisis, exhaustion, or uræmic coma.

Cirrhotic Bright's Disease. Interstitial Nephritis. Granular Contracted Kidneys. Gouty Kidneys.—Pathology.—The kidneys are much reduced in size and weight. The capsule is thickened and adherent, and when removed reveals an irregular surface. The tissue of the kidney is tough and resistant on section, and cysts of various sizes are present throughout its substance. The cortical portion is much atrophied. The organ is red-brown usually, but often it is of a yellow or fawn colour. Microscopically, the capsule is seen to be much thickened, and there is increase of the connective tissue throughout the organ, especially beneath the capsule and around the Malpighian bodies. The tubules are seen to be compressed. The organ may be affected unequally. The secondary changes are hypertrophy of the heart and arterioles, and these alterations in the heart and blood-vessels produce a condition favourable to cerebral hæmorrhage. *Albuminuric retinitis* is common in this form of Bright's disease.

The causes of cirrhotic Bright's disease are still obscure—gout, alcoholism, lead-poisoning, valvular heart disease, pregnancy, malaria, and hereditary influences being suggested. It is a disease of middle life, and it affects males much more than females.

The **symptoms** develop very insidiously, and it is not until the

disease is well advanced, as a rule, that any diagnosis is made. Thirst, and the secretion of large quantities of urine (making it necessary to rise frequently during the night) are early indications of cirrhotic Bright. Sometimes it is amblyopia, hemianopsia, diplopia, or other impairment of vision which first suggests the possibility of the disease being present. Frequently, a secondary disease, or a group of symptoms apparently referable to quite another system than the renal, prove to be due to cirrhosis of the kidneys. Examples of these conditions are cerebral hæmorrhage; *uræmic asthma;* cough and palpitation; convulsive seizures; vertigo and headaches, acidity, indigestion, and flatulence; epistaxis; or dermatitis, &c. As the disease advances there is failure of the strength, and loss of body weight. The skin becomes dry and yellowish, and the hair "spiky." The urine is pale in colour, feebly acid, of low specific gravity (1,003 to 1,008), and greatly increased in quantity (80 to 300 ozs. or more). There is usually albumen present, but only in small quantities, and often it is absent for a time, so that repeated examinations are necessary in suspected cases. The solid constituents of the urine, especially urea, are reduced. Pale, transparent hyaline casts are present, but they are not numerous, and they must be carefully searched for. The sediment should be collected from a large quantity of urine. There is great breathlessness upon exertion. There is little dropsy in the cirrhotic form of Bright's disease, so long as the urine voided is great in quantity; but any sudden diminution in the quantity increases the œdema, and usually, then, uræmic symptoms supervene. The œdema of the ankles may be due to the debility, or to failure of the heart in the later stages of the disease. During the earlier course of cirrhotic Bright's disease, the left side of the heart becomes much hypertrophied, and the second sound is heard to be much accentuated. These changes, according to most authors, are held to be due to the increased tension in the arterioles. The pulse is full and slow, incompressible and tense. After fatty degeneration of the hypertrophied muscular fibres—in the very latest stage of the disease—the heart-sounds are feeble, and the pulse is small, more frequent, irregular, and weak. Pericarditis, endocarditis, hydrothorax, bronchitis, pneumonia and pleurisy, and œdema of the lungs are complications. Erysipelas and eczema are common in all chronic forms of Bright's disease. Uræmia is the usual termination—the symptoms being ushered in by obstinate vomiting and diarrhœa, headache, and vertigo. Dickinson describes "albuminuric ulcerations of the bowels" due to hæmorrhages, and which may lead to peritonitis and perforation.

The ophthalmoscopic examination during the early course of cirrhotic Bright, reveals the optic discs swollen; veins enlarged and tortuous; arteries small; hæmorrhagic extravasations; and white spots upon the retina. Ultimately there is optic atrophy. The impairment of the vision may be due, however, to anæmia, or to chronic uræmia.

Waxy Disease of the Kidneys. Lardaceous or Amyloid Disease.—**Pathology.**—There is a waxy or amyloid degeneration affecting the renal vessels, and the vascular tufts of the glomeruli. The afferent and efferent vessels, vasa recta, and renal epithelium are also affected. The pathological process is of the nature of an exudation, or deposition, of amyloid or waxy material, which reacts to *iodine solution*—the affected parts becoming red-brown in colour when it is applied. The kidneys are increased in size and weight. The capsule strips easily, and reveals the surface of the kidney pale and glistening. On section, it is found to be firm in texture, and the cortical part is enlarged and pale, while the cones are deeply congested. The supra-renal capsules, liver, spleen, intestines, &c., are also waxy. In the later stages the kidneys become atrophied. Frequently, parenchymatous inflammation co-exists.

The **causes** of waxy disease are chronic suppurations and ulcerations, phthisis, diseases of bones and joints, syphilis, cancer, and scrofula.

The **symptoms** of waxy disease of the kidneys arise in connection with the above-mentioned causes, and hence they are often obscured, or regarded as secondary, to the prominent symptoms of the primary wasting disease. There is anæmia, and more or less œdema of the lower extremities. There may be general ascites, especially if the liver be also involved. The urine is pale and increased in quantity, and is of a low specific gravity—especially if cirrhotic Bright's disease be also present. It may be diminished in quantity, and high in specific gravity, if the waxy disease be associated with parenchymatous nephritis. The secretion of urea is not diminished. Albumen is present when the disease is fully established. Transparent hyaline casts are found in the urine, and they are highly refracting when composed of waxy material. There is gradual weakness and exhaustion as the disease advances, and uncontrollable diarrhœa, sometimes vomiting, may terminate the case. Cases recover when the cause can be removed. Uræmia is only common in the combined forms. Complications are the same, but not so frequent, as in the cirrhotic form.

The Diagnosis of the Different Forms of Bright's Disease.—The symptoms and physical signs may conveniently be summarised in columns, thus:—

Acute and Chronic Bright.	Cirrhotic B.	Waxy B.
Develop insidiously; or there is chill, fever, and lumbar pain. Sometimes presence of an obvious cause.	Develops slowly, without chill; and cause not so obvious.	Develops slowly, and a cause very obvious; and evidences of waxy disease elsewhere.
Œdema; and in chronic form, great dropsy.	Little dropsy.	Little dropsy usually.
No hypertrophy of heart in the acute; heart-sounds accentuated in the chronic, and further evidences of increased tension in the blood-vessels, later.	Great hypertrophy of the heart, and great tension in the blood-vessels.	No hypertrophy, or tension.

Acute and Chronic Bright.	Cirrhotic B.	Waxy B.
Uræmic symptoms common.	Uræmic symptoms common.	Uræmic symptoms rare.
Urine diminished.	Urine increased.	Urine increased.
Urea diminished.	Urea diminished.	Urea may be normal or slightly reduced.
Urine contains blood.	Urine contains no blood.	Urine contains no blood.
Specific gravity of urine is at first high, but it becomes low; in the chronic form it is low.	Specific gravity low.	Specific gravity low.
Urine dark and deposits urates.	Urine pale, and no sediment.	Urine pale, and no sediment.
Albumen in large quantities; but less in the chronic form.	Albumen small in amount.	Albumen small in amount.
Epithelial, granular, and blood casts predominate; hyaline and fatty casts in the chronic form. There are numerous tube casts.	Hyaline casts predominate; no blood casts. The tube casts are few in number.	Waxy casts predominate; and no blood casts. The tube casts are few in number.

The Treatment of Bright's Disease.—**Acute Bright's Disease.**—In adults, when the symptoms are urgent, one-tenth to an eighth of a grain of pilocarpine nitrate should be injected hypodermically. If called to a case of uræmic convulsions, chloroform inhalations may be used; but the injection of half a grain of morphia is still better treatment, although the state of the kidneys would seem to contra-indicate the use of it. Chloral and bromide of potassium are useful in less urgent cases. Vapour baths should also be used in all cases, and these may very readily be given by means of Allan's spirit kettle. Filling bottles with hot water, and pulling damp stockings over them, is a method that will always be available. Half a dozen of such bottles may be laid around the patient as he lies between blankets. Purgatives are also indicated, and those are best to use which produce watery stools. The compound powder of jalap is the usual one (sixty grains or more for an adult), and one-sixteenth to an eighth of a grain of elaterium may be combined with it. Croton oil may be used. Diluents, as milk, or milk and lime-water if the stomach be irritable, and cream of tartar freely diluted, should be allowed. Stimulants are to be avoided. A mustard leaf over the kidneys, or dry cupping, is also of value during the early stages of acute Bright's disease. Digitalis is sometimes used as a diuretic, but it is of doubtful service in the early stages, when the tubules are blocked rather from congestion and inflamed membranes, than from inflammatory débris. Water should be freely imbibed. The diet should be non-nitrogenous, except when the patient is anæmic. Iron tonics are valuable when the acute symptoms have subsided.

Chronic Bright's disease often requires the same treatment as the acute during the course of the disease. Digitalis as a diuretic is now indicated. Paracentesis abdomenis is often necessary to relieve the dyspnœa, or to help absorption of the fluid. The skin may require to be punctured when very tense with the œdema. Southey's tubes are not recommended, on account of the erysipelas which almost invariably follows. Simple pricks with a tenotomy knife are better. Iron in the form of steel drops—ten to twenty minims in water thrice daily, after food—is the best remedy for the chronic cases. The constipation and headaches which often attend its use should be counteracted by the use of mineral waters, &c. Warm clothing, limited supply of nitrogenous food, exercise, and a warm, dry, unchangeable climate are all advisable.

Cirrhotic Bright's Disease.—In cases with a syphilitic history, give iodide of potassium with minute doses of perchloride of mercury; in lead-poisoning, give iodide of potassium alone. Nitro-glycerine may be used to relieve asthmatic attacks. Iron is also useful. The treatment can only, as a rule, be symptomatic, as, *e.g.*, the treatment of dyspepsia by mineral acids and a bitter, &c. In acute attacks with uræmia, the treatment is the same as in acute Bright's disease. The diet should be simple, and should consist of milk, eggs, and fruit (if no diarrhœa). Stimulants should be avoided. Flannel should be worn next the skin, and a warm, dry climate is to be recommended.

Waxy Disease of the Kidneys.—The treatment is to check chronic suppurations, if possible; and to keep up the patient's strength with iron, cod-liver oil, and a generous diet. For the diarrhœa, Fowler's solution with laudanum—in small doses frequently repeated—is an efficient remedy. In cases associated with syphilis as a cause, iodide of potassium should be prescribed.

Diabetes Mellitus—**Pathology.**—There is a perversion of the glycogenic function of the liver, producing an excessive flow of sugar from the liver into the blood. There is great obscurity as to the nature of the disease. The liver function may be controlled by excito-secretory nerves, and diabetes may be a *functional nervous disorder*. The most important addition to our knowledge of the subject is the discovery that extirpation of the pancreas in dogs produces diabetes, and the grafting of a portion of the extirpated pancreas in the external wall of the abdomen (outside the abdominal cavity) prevents its occurrence. The morbid anatomical conditions found in diabetes are of the nature of secondary degeneration affecting nearly all the organs of the body. Irritations at the roots of the vagi have been found and also small tumours. Dickinson has described degenerative changes of the nervous tissue in the pons Varolii. Atheroma of the blood-vessels, especially at the base of the brain,

is frequently found in cases of diabetes mellitus. The liver is often enlarged and hyperæmic. The pancreas is sometimes hypertrophied, but oftener atrophied. The mucous membranes are hyperæmic and the viscera emit a sweet smell at the *post-mortem* examination. The kidneys are often enlarged. The blood serum contains more fat, and it is sometimes almost milky in appearance.

The **causes** are as follow, viz. :—Blows or falls; shock; strong emotions; cerebral disease; tumours of the fourth ventricle; long-continued errors in diet, especially in the obese; exposure to cold and fatigue; disease of the pancreas; and hereditary influences. Diabetes is commoner in males than in females, and it affects the young and the old.

The **symptoms** begin with muscular weakness and general debility. In the obese, there may be for a considerable time symptoms of indigestion, with occasionally glycosuria. Great thirst is soon complained of, and the patient perhaps notices that he is passing large quantities of pale urine, and that he requires to rise frequently during the night to relieve the bladder. There is dryness of the mouth and fauces, and often a sweet taste is noticed. The tongue is red and clean, but dry and clammy, and their is often *dry smacking of the tongue and lips* when the patient is speaking. The appetite is often voracious. The gums often swell and bleed. As a rule—except in the obese, and when indulgence in the pleasures of the table is the supposed cause—digestion is good; but sometimes a feeling of *emptiness* at the pit of the stomach is complained of and occasionally there is vomiting. The bowels are usually constipated, and the stools have a fœtid odour. The skin is dry, the face has a peculiar flush, and the furrows of the hand are often white and scaly. There is great emaciation when the disease is fully established; and there is loss of virile power in man, and suppression of the catamenia in the female. The breath of the patient may sometimes be noticed to be sweet, or it may have the odour of new-mown hay. The temperature is often sub-normal. There is œdema of the ankles, and the dropsy may soon become more general. Albumen may be present, as Bright's disease is often associated with the diabetes.

The urine is acid, and is much increased in quantity; but this will vary with the amount of water drunk. It varies from 70 or 100 ounces, to gallons, per diem. The specific gravity is high—ranging from 1,020, to as high as 1,040 or 1,050. The colour is *pale-greenish*, and there is no sediment. The sugar present may amount to from 1 or 2 per cent. to 10 or 15 per cent. Fifty ounces of sugar have been known, in one case, to be passed in the twenty-four hours. The urea is normal in amount, but sometimes it may be very much increased when the patient is confined to nitrogenous food. The other constituents of the urine are increased. "Phosphatic diabetes" is a form described — phosphaturia frequently alternating with glycosuria. Indican, skatoxylsulphuric acid, acetone, β-oxybutyric acid, are often found in the urine — the latter being supposed by von Noorden to be the cause of diabetic coma.

There are numerous *secondary diseases* known to be associated with diabetes mellitus which should be noted carefully, as sometimes the symptoms are obscure, and the patient often seeks relief from what he believes to be a primary affection. Impairment of the vision (by cataract, and atrophy of the optic discs, &c.) may be an early sign. Carbuncles and boils; peripheral neuritis and neuralgia; pruritus vulvæ and eczema; gangrene of the toes, &c.; a low form of pneumonia (phthisis), and sometimes a croupous pneumonia; diabetic coma, convulsions or delirium, are all examples of secondary conditions which may occur during the course of diabetes. In *diabetic coma* there is at first great restlessness, agitation, and præcordial uneasiness, sometimes delirium or convulsions, and then gradually increasing somnolence, complete coma, shallow breathing, and death. It is only in very exceptional cases that sugar is found *permanently* in the urine, and no other symptom of diabetes present.

The **prognosis** varies much, but it is always grave. It is more favourable, as regards amelioration, in those who are advanced in years, when the diet is rigidly adhered to, and is found to relieve the symptoms. In the young, diabetes is very fatal, the average duration being one or two years; but very acute cases, in children especially, may not last more than a few weeks. Cures have been reported, and certainly life has been prolonged beyond the expectation of both physician and patient; but, as a rule, sooner or later, the disease gains and ultimately produces a fatal result. The prognosis, therefore, will depend upon the success of the treatment, the state of the digestive powers under the special diet, and the amount of control gained over the excretion of the sugar.

Diabetes insipidus is characterised by the passage of enormous quantities of pale watery urine, free from sugar and albumen. Various forms are described, viz. :—*hydruria*, when the water only is increased; *azoturia*, when the urea is likewise increased; *phosphaturia*, or "phosphatic diabetes," when the earthy phosphates are in excess; and *baruria*, when all the solid constituents of the urine are increased.

The **pathology** is still obscure. The disease appears to be sometimes hereditary. At other times, a shock, injuries, cold and fatigue, and particularly syphilitic tumours of the brain, are reported to be causes of diabetes insipidus.

The **symptoms** consist of the gradual development of *polyuria* (one to five gallons of urine daily), great thirst, and the distress produced by the necessity of having so frequently to relieve the bladder. These symptoms are frequently superadded to the symptoms of a casual affection—as syphilis or brain disease. The urine, besides being greatly increased in quantity, is pale, specific gravity 1,002 to 1,006, and faintly acid. There is gradual loss of body-weight. There are disturbances of innervation, and a case *may* terminate in coma and convulsions. Many cases, however, run a very chronic course for years without apparently affecting the general health. Syphilitic cases are favourable.

The **treatment of diabetes mellitus** consists in arranging the diet. Ordinary bread, potatoes, beans, peas, rice, carrots, turnips, and parsnips, and all articles containing flour, sugar, or starch, must be excluded. Greens, lettuce, tomatoes, and spinnach are allowed. *Diabetic bread* must be resorted to, and milk may be allowed—especially butter milk and skimmed milk. Meat (fresh or salt), fish, oysters, eggs, fats, and nuts (except chestnuts) are all allowable. Light acid wines and *diabetic whisky* may be necessary, when stimulants are required. Saundby's practice is to estimate the amount of sugar excreted, and then to compare the amount after a week's nitrogenous diet. In many cases, a *baked* potato may then be allowed, and even ordinary bread—the object being to give as much carbohydrate as the patient can assimilate, the amount of sugar excreted being carefully estimated from time to time to guard against excess. A certain amount of carbohydrate diminishes acetonuria, in mild cases of diabetes (*Hirschfeld*). Biscuits made of almond flour are recommended (see appendix for tests). *Lævulose* is now prepared for diabetes. A few drops of sulphuric acid in water will satisfy thirst. Walking exercise is to be encouraged. Of the medicines used, opium and codeia have been found the most useful. Arsenic (three minims of Fowler's solution) with opium (ten minims of the tincture), is also a useful combination. Carlsbad waters may be tried.

In **diabetes insipidus**, galvanism (one electrode applied to the neck below the occiput, and the other applied to the hypochondriac regions) should be tried; and a course of iodide of potassium should be given in cases of syphilitic origin. Pilocarpin and ergotin have been sometimes apparently successful. Large doses of valerian are recommended.

Renal Calculi.—The size of these range from mere grains up to very considerable "stones." The most common are the uric acid calculi, and those composed of triple phosphates and carbonate of lime.

The uric acid calculi are arranged in concentric layers, composed sometimes of alternate layers of uric acid and oxalate of lime. The uric acid calculi are hard, and of a red-brown colour. The pure oxalate of lime calculi are very rare, and they are hard and rough. Calculi of cystine are still rarer, and they are of an amber colour. Phosphatic calculi are the next common to those of uric acid, and they are light, soft, and of a dull white colour—rough, but sometimes smooth. They are composed of lime and ammonio-magnesium phosphates, and they may form around a uric acid calculus; but this is only likely to happen when the urine becomes alkaline, and with a uric acid calculus which has long been confined in the pelvis of the kidney.

Calculi may affect both kidneys, but more usually only one. They may light up inflammation of the kidney; but if in the pelvis, a *pyelitis* results, which may extend down the ureter. The ureter becomes much thickened. The passage of a calculus down the ureter produces *renal colic*, and if it become impacted, then the ureter and pelvis of the kidney become dilated, and the pressure

backwards causes, ultimately, an atrophy of the kidney. If ulceration take place, then an abscess may form which may reach the surface in the lumbar region, or point below Poupart's ligament, or ulcerate into the important surrounding organs.

The **causes** are the gouty *diathesis*, sedentary habits, indulgence in highly nitrogenised food, and hereditary influences.

The **symptoms** vary with the size of the calculus. If very small, a dull pain in the lumbar region (felt when the patient is at rest, and, therefore, not muscular) is the only symptom. Even a large calculus retained in the pelvis of the kidney frequently gives rise to no disturbance. When sufficiently large, and when passing into the ureter, renal colic is the result. The pain comes on almost always with great suddenness, and it is agonising. It shoots up to the shoulder blade, and down into the groin, thigh, testicle, and often to the glans penis. The testicle of one side is drawn up. The patient may, in extreme cases, roll about in agony, beads of cold sweat collect upon the brow, the features are pale and pinched, and the expression pained and anxious; vomiting is usual. Frequent attempts at micturition are made, resulting in the passage of small quantities of urine which is often bloody, and may contain pus. The patient may faint, and he is sometimes convulsed. Should there be complete anuria, then convulsions and coma may terminate the case. The paroxysm usually terminates suddenly by the calculus passing into the bladder, when there is complete relief. If a calculus ulcerate through the ureter, a fatal peritonitis is produced. The attack varies in length according to the size of the stone passing along the ureter, and the pain is always worst just as it is about to pass into the bladder. Sometimes the renal colic lasts one or two days, but more usually only a few hours. Pyelitis is present when the calculus is retained in the pelvis, and then the urine may appear "milky" from the presence of mucus and pus. The passage of mucus and pus may give rise to milder attacks of renal colic.

Hydronephrosis may result from obstruction of the ureter, and then a tumour, usually globular, may project downward from the hypochondrium; and the sac may ultimately ulcerate into the stomach or bowel, or establish a fistulous opening externally.

Although the first attack of renal colic may appear suddenly, and terminate favourably, it is more usual for the disease to run a chronic course. Repeated attacks—often milder as regards pain—is the rule; while the secondary pathological conditions, already mentioned, slowly develop, except in those cases which ulcerate into the peritoneum, &c. The latter cases are quickly fatal. Death may take place from waxy disease, exhaustion, or pyæmia. Recovery has resulted from the discharge of the calculus through a fistulous opening externally.

The **treatment** of urgent renal colic may require inhalations of chloroform, followed by morphia hypodermically (one-half of a grain). A warm bath is highly serviceable. These may require to be frequently repeated during the passage of a stone along the ureter. Potash and lithia salts are indicated when uric acid is present in the

urine. Thirty grains of acetate of potash, or forty grains of the citrate, may be given thrice daily, freely diluted; the effervescing lithia water is given in doses of five to ten ounces, freely diluted. Benzoate of ammonium (ten to twenty grains) is useful for phosphatic calculi. Butter milk and skimmed milk may be ordered *ad libitum*. A calculus lodging in the pelvis, giving rise to severe pain or urgent symptoms, should be treated surgically—by removal and free drainage.

Hydronephrosis (Dropsy of the Kidney).—This results from obstruction of the ureter, either by a calculus, or by adhesion of the mucous surfaces after inflammation; or from pressure outside by tumours, or uterine displacements, &c. It may be congenital.

There is dilatation and thickening of the ureter, which may be of the size of the small intestine. If the obstruction be great, the kidney structure may be completely atrophied, and the kidney is represented by a large saccular dilatation. The membraneous sac may be so large as to half-fill the abdominal cavity, in extreme cases. The urine within the sac is generally pale, alkaline, and of low specific gravity. It may be tinged with blood, and sometimes it contains pus. It is rare for both kidneys to be affected, although the other kidney is usually enlarged from the increased work thrown upon it

The **symptoms** arise slowly, and the diagnosis is made when a fluctuating tumour can be felt. Pains are complained of when adhesions are formed with the adjoining organs. Pressure upon the colon produces constipation; upon the diaphragm it causes dyspnœa; and upon the stomach it causes nausea and vomiting.

The **treatment** is not to interfere, unless life be endangered, and then the aspirator may be used. Manipulation of the tumour has sometimes emptied the sac, the obstruction being overcome. Further surgical procedure may be necessary.

Pyelitis, and Suppurative Nephritis.—The two diseases are almost always associated. The mucous membranes are much thickened, and the epithelium is altered. The kidney is enlarged and congested, and it has yellow spots throughout its substance. These suppurating points run together and form abscesses, and the kidney structure is broken up and disintegrated. The pelvis and calyces may be enormously distended. Bacteria are found in great numbers.

The **causes** of pyelitis and suppurative nephritis are extension of inflammation from the bladder, whether simple or gonorrhœal; decomposed urine in cases of paraplegia; and the use of catheters which have not been made thoroughly aseptic. Stricture of the urethra, enlarged prostate, and an enlarged and displaced uterus or a pelvic tumour, may so obstruct the discharge of urine as to lead to pyelitis. A calculus lodged in the pelvis of the kidney produces direct pyelitis, and the inflammation soon extends to the kidney. Pyelitis may occur also in the course of various fevers—especially

puerperal fever and pyæmia. Copaiba, turpentine, and cantharides are direct irritants to the mucous membranes of the urinary tract.

The **symptoms** are usually associated with irritability of the bladder (cystitis). In mild cases of pyelitis from cold, or from the use of irritants, there is pain in the region of the kidneys and ureters, with some fever, and the deposit of urates, pus, and epithelium is slight. In the severe cases the urine is alkaline, thick, and yellow, and soon throws down deposits in two layers. The lower layer is heavier and firmer, and when stirred it is tenacious and ropy—the upper layer is whiter, is not tenacious, and it can be decanted with the urine easily, while the lower stratum sticks to the jar. There is polyuria, and the urine contains albumen and casts, epithelial cells from the pelvis, crystals of triple phosphates, and micro-organisms. With distention there is intermittent pyuria. As the case advances there is great debility and emaciation, and frequent rigors or "chills." The fever is sometimes very like typhoid, and the case often terminates with delirium, stupor (from uræmia), diarrhœa, and exhaustion. The simple cases of pyelitis are curable in a few weeks; but the marked cases become chronic, and may extend to one, two, or three years. Suppurative nephritis shortens the duration.

The **treatment** of the mild cases is to dilute the urine. Acetate of potash should be prescribed, and barley water. When the urine is alkaline, give ammonium benzoate (ten grains, four times a day). Gallic acid is useful; and quinine should be administered to control the fever and inflammation. Iron tonics are also indicated. Small doses of eucalyptol are useful to subdue the irritation; and in pyelitis, associated with calculi, ℞ 31, is useful, especially when there is cystitis, &c.

Perinephritis. Perinephric Abscess.—The connective tissue around the kidney becomes congested and inflamed, and suppuration soon follows. The pus may rupture into the peritoneum or bowel; or it may discharge in the lumbar region; or burrow along the psoas muscle, and open under Poupart's ligament.

The **causes** of perinephritis are direct contusions and injuries; extension of a pelvic cellulitis; and chronic pyelitis.

The **symptoms** are *pain* in the lumbar region, especially when movement is attempted, or when the part is pressed. There is fever and general *malaise*. Rigors indicate that suppuration has occurred. A swelling may now be discovered in the flank, and fluctuation may be made out. The case may terminate in discharge of the pus, as indicated.

The **treatment** is to apply cold in the very early stages, and to give smart purgatives. Leeches are also applied to the lumbar region; and quinine and morphia should be given. After suppuration, a free incision should be made, and the abscess well drained.

Malignant Disease of the Kidney.—Sarcomata occur in children. In adults, cancer may be primary or secondary, and the tumour attains to a large size in a very short time.

Pain and hæmaturia are the chief symptoms, and soon the development of a tumour in the right or left hypochondrium—extending into the iliac regions ultimately—indicates the nature of the disease. There is marked cancerous cachexia as it develops.

Tubercle of the Kidney. Phthisis of the Kidney.—The tubercles may be disseminated or localised. The disease may begin in the bladder, pelvis, or testicles, and then spread to the kidneys.

The urine soon becomes ammoniacal, and it is thick with pus and detritus. Blood and albumen are present. Pain in the lumbar region is usual, and it is often paroxysmal. A tumour may sometimes be made out. If the bladder be also the seat of the disease, there is frequent micturition and symptoms of cystitis. Uræmic symptoms may supervene, or death may occur from slow exhaustion.

Cystic disease of the kidneys is generally associated with the cirrhotic condition. The symptoms are similar to cirrhotic Bright; and sometimes a tumour may be made out (see diagnosis).

Hydatids of the kidney are rare. There are no symptoms during the early development. Pain, and the development of a smooth, elastic tumour, are the first indications. The sac may rupture into the pelvis of the kidney, and give rise to severe renal colic. When the vesicles reach the bladder, the pain ceases; but, again, there is pain in the urethra in attempting to pass these bodies. Hooklets found in the urine are diagnostic, and their presence at once clears up a doubtful case. The *treatment* is the same as in renal colic; but when the case is clear, injection of iodine or bile should be practised.

Nephroptosis, or movable kidney, may cause a dragging pain in the back, with "gastric crises" (nausea, vomiting, &c.) and "kidney" pains referred to knee, heel, or thigh. Secondary peritonitis, or perinephritis, may supervene. The kidney itself can be felt, freely movable, and eluding the grasp. It may descend as low as the iliac region, but it is usually felt about midway between the inferior border of the ribs and umbilicus. It descends upon full inspiration, and ascends upon full expiration. When the kidney is squeezed there is sickening pain. The *treatment* consists of endeavouring to fix the kidney by means of a pad and spring bandages. Nephrorrhaphy may be necessary.

Paroxysmal hæmoglobinuria is a rare disease, characterised by the occasional discharge of dark, port-wine coloured urine, and associated with general *malaise* and pain in the loins. Malarial poisoning is sometimes a cause, and sometimes it appears to be due to a chill in certain individuals. There is a rapid destruction of the red blood-corpuscles. A proteid (globulin) is excreted with the pigment. On spectroscopic examination, the pigment is found to be oxyhæmoglobin, or methæmoglobin, according apparently to the length of delay in the bladder, &c. Anti-malarial remedies are usually prescribed.

Chyluria is a condition caused by the parasite *Filaria sanguinis hominis;* or sometimes by dilatation of the lymphatic vessels. The urine contains a milky coagulable deposit, pink-white in colour;

and, as this frequently clots in the bladder, there is often pain in the attempt to pass these clots through the urethra. Turpentine may be prescribed.

Simple active congestion of the kidneys arises from the use of irritating drugs, as turpentine, cantharides, copaiba, &c. Pain, and sometimes hæmaturia, with frequent micturition, are the chief symptoms. The treatment is to remove the cause, and to give diluents—as Vichy water, barley water, &c.

Passive congestion of the kidneys is due to obstructive circulatory changes—as heart disease, emphysema, and thrombosis of the veins, &c. The urine is scanty, dark in colour, acid, and it deposits urates in abundance. The specific gravity is high, and the urea and other solid constituents are increased in quantity. Albumen is present, and dropsy supervenes. The treatment is that of the central cause—digitalis and cathartics usually being indicated; and the management of the case, for a time, is the same as in acute Bright's disease.

The Diagnosis of Diseases of the Urinary System.—The differentiation of the several forms of *Bright's disease* has already been made (p. 137). The *passive congestion* of the kidneys, which results from obstructive circulatory diseases, has also been mentioned. The amount of albumen in such cases is generally small, but in severe cases it may be large. The history of the disease—especially of the early symptoms—is important; but it is often difficult to say which is the initial disease when a cycle of chronic diseases exists, as bronchitis, &c., with dilated heart, and albuminuria. It may be a case of chronic bronchitis, with emphysema and dilated heart, with passive congestion of the kidneys; or a case of chronic Bright's disease with secondary bronchitis, &c., &c. As in the lung affections, the *diagnosis*, then, is that of a "complication of diseases."

Albuminuria occurs in some individuals very readily, and it may only be transient. It sometimes is paroxysmal, with complete disappearance during the intervals. Pastry, and other articles of diet, in excess, often produce albuminuria. It occurs also in fevers, erysipelas, diphtheria, and in chronic affections of the skin. Also, in simple congestion of the kidneys with a removable cause, albuminuria is but temporary. It should be noted that albumen is present—generally in smaller quantities, however—in all diseases of the urinary system associated with blood and pus in the urine—*e.g.*, calculi, pyelitis, cystitis, gonorrhœa, &c. It is sometimes present also in persons who have none of the other symptoms of Bright's disease, and who appear to enjoy good health, although the albuminuria is permanent. Such cases, however, must always be regarded with suspicion—especially in relation to life assurance—as, even with no other sign, it is, as it were, a *leakage* from the system which must call upon the reserve strength.

Diabetes insipidus may resemble a case of cirrhotic Bright's disease in which albuminuria is absent for a time. The history, and the presence of other physical signs of cirrhotic disease, will usually

clear this up. Glycosuria must be *permanent* to constitute a case of *diabetes mellitus*. Minute quantities of sugar in the urine is a symptom of gout. It occurs frequently after chloroform and ether inhalations; and, also, sometimes in asthma, whooping-cough, epilepsy, and croup—especially after the seizure. Glycosuria is also often present after the ingestion of a large quantity of saccharine food. It should be noted, however, that transient attacks of glycosuria may precede for a time the fully developed form of it (diabetes mellitus).

Renal colic may be mistaken for biliary colic. The situation of the pain, and the subsequent development of jaundice in the one case, and of irritable bladder with hæmaturia in the other—will soon distinguish the diseases. Uric acid is the commonest calculus; but a microscopic examination of the urine is important in determining the nature of a calculus. Phosphatic crystals found in the urine may proceed from a uric acid calculus embedded within the pelvis of the kidney, and which has become encrusted with phosphates.

In the simple forms of *pyelitis* the characteristic epithelium of the pelvis of the kidney may be found in the microscopic examination of the urine. When not found, the diagnosis must frequently be conjectural.

Suppurative nephritis may be mistaken for typhoid fever in the later stages, and when the history of the case has not been made clear.

Hydronephrosis is frequently mistaken for ovarian tumour, or *vice versâ*. The development from above downwards should suggest a proper diagnosis; but sometimes aspiration is necessary before an opinion can be expressed. The fluid withdrawn from the sac in hydronephrosis contains urea, uric acid, and epithelium.

Perinephritis, *hydronephrosis*, *hydatid cysts*, *cystic disease*, and *cancer* are all characterised by the presence of a tumour, but in the first there is a history of suppuration; in hydronephrosis, cystic disease, and hydatid cysts there is an enlarging tumour without much pain. The tumour, when large enough, is felt in front, and percussion reveals the colon above and in front of the swelling, separating it from the liver or spleen dulness. In cancer there is pain and hæmaturia. The examination of the urine may reveal the vesicles of a hydatid cyst, but otherwise—without an exploratory puncture—it cannot be differentiated. *Cancer* of the right kidney resembles a tumour of the liver; but the fingers may be pushed between the liver and the tumour. In the left kidney, it has to be distinguished from splenic enlargements; but the shape, and the position of the colon—in front of the renal, and behind the splenic tumour—and the history of the case, and presence of hæmaturia, are the points to be noted. Ovarian tumours and aneurisms may be mistaken for cancer of the kidney. The mode of development, position, and form, and the presence or absence of hæmaturia are the points of importance in the differentiation. Hæmaturia, without other symptoms, should suggest paroxysmal hæmoglobinuria. A spectroscopic examination should be made in doubtful cases.

New growths of the bladder, &c., cystitis, retention and incontinence are considered in surgical works, although often coming under the physician's care. *Suppression* of urine (anuria) is often *not* surgical in its origin—as in the case of fevers, shock, and other causes not understood. Cupping and diaphoresis is the treatment of such cases. A small piece of camphor may be eaten, and is found, clinically, to be of service.

Uræmia is produced by the retention in the blood of the toxic urinary constituents. *Acute* uræmia sets up violent headache, vertigo, disordered vision, twitchings of the muscles (especially of the face), and, finally, convulsions. Between the convulsive seizures the patient lies, more or less, in a comatose condition, but sometimes he is conscious throughout. At other times there are no convulsions, and the patient becomes comatose early. The pupils are dilated, and the breathing is shallow and irregular, but sometimes it is stertorous. The patient may seem to improve occasionally, and then relapse. Sometimes there is marked and even wild delirium. If the cause cannot be removed, the case terminates in fatal coma. *Chronic* uræmia consists of the development of these symptoms more slowly. Constant drowsiness, nausea, and vomiting are early symptoms; and *albuminuric retinitis* is generally present. Intense headaches are complained of, and the acute symptoms ultimately supervene and terminate the case.

In acute Bright's disease, uræmic symptoms may last three or four days—sometimes rapid cases terminate in a few hours—and the chronic cases may extend for weeks or months, with more or less improvement during short intervals, while under proper treatment. The *prognosis* will depend upon the cause. Very acute uræmia, in scarlatinal Bright's disease, or in pregnancy, is often completely relieved; whereas in chronic Bright's disease, it generally indicates that a fatal termination is at hand. In the *diagnosis of uræmia*, alcohol, opium, belladonna and strychnine poisoning; cerebral disease; and epileptiform convulsions—should all be remembered. An examination of the urine should be made as soon as possible—drawing some off with a catheter, if necessary. In the *treatment* of uræmia, chloroform inhalations, and even a hypodermic injection of half a grain of morphia—for severe convulsions—may be given in the emergency. (See also the treatment of acute Bright's disease).

Such surgical diseases as stricture of the urethra, prostatic disease and abscess, should be remembered in connection with the secondary diseases of the kidneys, and their more remote symptoms in the later stages, which often cause patients to seek the advice of the physician.