

amyloid change is clearly begun, the case usually terminates in death in a few months, but may extend to years. Uræmia, as manifest in vomiting, purging, amaurosis, partial and general convulsions, etc., does not occur in amyloid disease, unless the contracting kidney also develops, or there is a sudden appearance of parenchymatous nephritis. Death by cerebral hæmorrhage is also rare. Hypertrophy of the heart and of the arterioles does not take place in this form of kidney-disease. The termination is often by some acute inflammation, as pneumonia, pleuritis, or purulent peritonitis, etc. The duration will necessarily be much influenced by the occurrence of such inflammation. Many of the cases terminate by exhaustion, the bodily forces being worn out by the protracted suppuration and the loss of albumin, but especially by the profuse diarrhœa. The termination may, then, be due in most cases to lesions of other organs. The question of recovery is largely that of the associated diseases. The data do not yet exist for deciding on the possibility of an arrest of the amyloid change in the kidneys, or the regression of deposits already made, but it is extremely doubtful whether a genuine case ever terminates in recovery. In a reported case of recovery there must ever remain a doubt respecting the accuracy of the diagnosis.

**Diagnosis.**—Amyloid kidney is to be distinguished from parenchymatous nephritis and interstitial nephritis. The history of the case is here highly important, especially the constant relation of suppuration to lardaceous degeneration. In parenchymatous nephritis the urine is scanty, high-colored, of high specific gravity, and deposits an abundant sediment, containing urates, granular casts, tubular epithelium, and red-blood globules; in amyloid kidney the urine is abundant, pale, of low specific gravity, deposits very little sediment, containing a few hyaline casts and occasional waxy casts, but no blood-corpuscles. In parenchymatous nephritis, dropsy forms quickly and is extensive; in amyloid kidney, the effusion is slight and confined to the lower extremities and to the peritoneal cavity. Amyloid kidney is distinguished from chronic interstitial nephritis by its history and association with suppuration in some form, and with the evidences of the same change in the liver, spleen, and intestinal canal. In chronic interstitial nephritis the symptoms of uræmia are very pronounced at some period; in amyloid kidney these symptoms very rarely occur at any period.

**Treatment.**—As when the amyloid deposits have taken place it seems doubtful if their removal can be effected, it is highly important to stop all sources of suppuration, and thus prevent the deposition of the altered fibrin. Attention should be directed at once to the cure of suppuration. As syphilis and the suppuration connected with it are a fruitful source of mischief in this direction, this malady should be efficiently treated and cured, and all cases presenting a syphilitic history should be given a thorough course of the iodide of potassium.

Dickinson, influenced by his theoretical notions, advises the internal use of the potash and soda salts, supplying artificially the alkali which is carried off in the pus, while the fibrin is deprived of it. He at the same time enjoins the free use of eggs and milk, to supply the material lost in the urine. A combination of the chloride of gold and sodium ( $\frac{1}{15}$  gr.) and bichloride of mercury ( $\frac{1}{30}$  gr.), persistently administered, accomplishes more than any other remedies. Iron, cod-liver oil, and a generous diet are demanded by the condition of feebleness and anæmia. The exhausting diarrhœa resists all means of treatment, but the most efficient remedy, according to the author's experience, is Fowler's solution and opium tincture—three drops of the former and five to ten of the latter, three or four times a day.

#### PYELITIS AND PYELONEPHRITIS.

**Definition.**—*Pyelitis* means an inflammation of the pelvis of the kidney; *pyelonephritis* includes pyelitis and a consecutive or simultaneous suppurative inflammation of the kidneys. They are here considered together to avoid repetition, and because of their frequent association.

**Causes.**—Probably the most frequent cause of pyelitis is the extension of a morbid process from the bladder to the pelvis of the kidney, by the ureter. Catarrh of the bladder is lighted up by decomposition of the urine, consequent on its retention. Whenever an obstacle exists to the discharge of urine from the bladder, the decomposition ensues, the urine becomes ammoniacal, and the mucous membrane the seat of an active catarrhal process. Stricture of the urethra, enlarged prostate, the pressure of the retroverted uterus, pregnant uterus, or of a pelvic tumor, etc., act by hindering the urinary discharge. An inflammation of the mucous membrane of the bladder, due to gonorrhœa or other causes, will have the same effect by causing fermentation of the urine. A renal calculus, or other foreign body, present in the pelvis of the kidney, will produce catarrh directly by irritating the mucous membrane. Decomposition of the urine and catarrh extending to the pelvis of the kidney are produced by paraplegia: the bladder being paralyzed, the urine is retained and undergoes putrefactive fermentation. Diuretics of the stimulant kind, as copaiba, turpentine, and cantharides, irritate the mucous membrane of the pelvis of the kidney in passing through these organs. Whenever the urine decomposes, vibrios and bacteria appear in it in immense numbers; the urea is decomposed and converted into the carbonate of ammonia; the ammoniaco-magnesian phosphate crystals are formed in great quantity, and much phosphate of lime is separated by the inflamed mucous membrane. Pyelitis occurs as a complication in various infective maladies—in pyæmia, puerperal fever, the exanthemata, etc., and may result from the extension of a neighboring inflammation.

**Pathological Anatomy.**—The changes consist in the ordinary catar-



rhal process, the mucosa and the submucosa becoming very much thickened in old cases, the vessels varicose, and the epithelium much changed by the proliferation of its cells, etc. If the morbid process began in the bladder, the evidence will be plain, and the ureters may or may not be affected by the same changes. If the pyelitis has existed for some time, the kidneys will be seen to be in a process of suppuration—one or both. The organ is more or less enlarged, is deeply congested and reddish, except certain spots which present a yellowish-white color, are wedge-shaped, and extend through the cortex to the apex of the cone. On section these patches present here and there points of suppuration, are swollen, and the capsule is more or less firmly adherent to them. Suppuration occurs soon all along the extent of these patches between the tubules. Several of these suppurating patches uniting, considerable abscesses form; the kidney elements are disassociated, broken up, and disappear; and from the cones the suppuration proceeding destroys the cortical part, and ultimately nothing remains but a bag of pus having irregular walls marked by septa, remains of calyces. It seems well established that the suppurative inflammation in the kidneys is set up by the presence of bacterian colonies which have migrated from the inflamed bladder. With high powers the bacteria are seen arranged in parallel lines within the tubules. They appear as minute, globular, highly refracting granules. After a time the same bodies are seen in the interstices with pus-corpuscles. The epithelium of the tubules is at first cloudy, granular from fatty degeneration, but is soon destroyed, the whole tube being filled with the branching filaments and spores. According to Klebs (Ebstein), the inflammation proceeding to suppuration is excited by the bacteria.

**Symptoms.**—The pyelitis or pyelonephritis usually encountered is associated with chronic cystitis, ammoniacal urine, and the systemic state produced thereby. When due to the presence of a calculus in the pelvis of a kidney, the symptoms are different in some respects; hence the consideration of this form is properly postponed to the section devoted to this topic. In the form of pyelitis now under consideration, there is usually more or less irritability of the bladder, and the urine is somewhat more abundant than normal. The urine is neutral or alkaline in reaction, milky in appearance when voided, and deposits a copious sediment, whitish or faintly yellowish-white in color. The upper layer of the sediment is more distinctly whitish, lighter, and easily disturbed with a little agitation, whereas the bottom layer is heavier, firmer, and unites in an homogeneous mass which sticks closely to the vessel, and when dislodged rolls out in a tenacious, gelatinous mass. There is some albumin present, but not more than is proper to pus. On microscopic examination there are present mucus and pus-corpuscles, chiefly large crystals of ammoniaco-magnesian phosphate, and by no means frequently epithelial cells from the pelvis of the kid-

neys. In the form of pyelitis arising from decomposing urine in the bladder, it is difficult to find the morphotic elements belonging to the kidney. Besides the corpuscular and crystalline forms above mentioned, the urine contains numberless bacteria. There is more or less



FIG. 42.—Various Forms seen in Pyelitis.

uneasiness felt posteriorly just under the false ribs and extending downward along the course of the ureters, and the usual distress arising from the bladder under these circumstances. The strength declines, the body loses flesh, and there is more or less fever, increasing toward evening and with a morning remission. In some cases, when pyelonephritis is developed and suppuration is going on in the kidney, the fever has a distinct typhoid type, and has been mistaken for typhoid; for the cerebral disturbance—low-muttering delirium—*sub-sultus tendinum*, and stupor, due to uræmia, come on with septicæmic fever, diarrhœa, and exhaustion, due to suppuration. In still a third group the symptoms are those of pyæmia. Chills occur at irregular intervals, followed by very high temperature, the thermometer indicating 104°, 105°, or 106° Fahr., and then a profuse sweat. The face has an earthy hue, the countenance is anxious, and the features are retracted and pinched. The exhaustion is extreme, the pulse feeble and rapid. During the febrile exacerbation there is usually more or less delirium. A profuse diarrhœa and complete anorexia hasten the decline. Secondary abscesses may form in the articulations, or in the intermuscular septa, which increase the already rapid tendency downward.

Besides the usual form of pyelitis and pyelonephritis associated with the various obstacles to the outflow of urine, and with ammoniacal and decomposing urine, there are several milder forms. Certain renal irritants, as cantharides, turpentine, etc., and exposure of the body to cold while in a warm and perspiring state, will produce a simple, primary, acute pyelitis. There occurs more or less pain in the region of the kidneys, extending downward along the course of the ureters, and there may be slight feverishness toward evening. The urine is acid and somewhat increased in quantity. It deposits a sediment composed of urates, pus, and occasional blood-corpuscles, and epithelium from the pelvis of the kidney. Pyelitis also occurs in childbed. Then it begins with chill, followed by fever, and pain in the lumbar region. The pain may have a very acute character, and, shooting down along the ureters



into the bladder, seem like nephritic colic. The urine is little changed from normal, but it contains some pus and cells of renal epithelium.

**Course, Duration, and Termination.**—The simple cases of pyelitis terminate in recovery in from one to two weeks. Those occurring in childbed, or in the course of typhoid, puerperal, or other fevers, terminate with the associated malady. Suppurative pyelitis and pyelonephritis have a variable duration, and may continue for months, even years. The progress is, of course, more rapid when the kidney is suppurating. When uræmic symptoms occur, the duration of the case is measured by weeks, and but one termination is possible.

**Diagnosis.**—In the most common variety the diagnosis is often merely conjectural, for the muco-pus is so abundant that it is extremely difficult to find the characteristic forms from the pelvis. When uræmic symptoms finally come on, there can be doubt no longer. In the simple cases the diagnosis must rest on the association of pain, with altered urinary secretion, the epithelium of the pelvis of the kidney being present.

**Treatment.**—In the simple cases mere dilution of the urine affords relief. If the urine is acid, a potash salt—liq. potassii citratis—should be administered freely. In the cases of pyelitis associated with ammoniacal urine, benzoic acid is extremely serviceable. Gallic acid, passing through the kidneys unchanged, has a local effect of a very useful kind. Excellent results have been obtained from the persistent use of eucalyptol, or fluid extract of eucalyptus. The oils of turpentine, copaiba, and cubeb have a good effect in changing the character of the mucous membrane and limiting the formation of pus; but they must be given in small doses. Quinine has a high degree of utility—to keep down the abnormal temperature, to support the powers of life, and to check pus-forming. It is important throughout to keep up the strength by suitable aliment.

#### RENAL CALCULI—NEPHROLITHIASIS.

**Definition.**—*Renal calculi* are concretions formed by precipitation of certain substances from the urine about some body or material acting as a nucleus.

**Causes.**—Calculi occur at all ages, and are very frequent in children before the fifth year, and from five to fifteen. Males are much more liable to them than females. A sedentary life and indulgence in a highly nitrogenized diet are circumstances favoring the occurrence of the uric-acid diathesis. Certain districts of country seem peculiarly disposing, the character of the drinking-water being held responsible, especially the lime present, but this explanation of the fact is wholly untenable. A special susceptibility exists in certain families,\*

\* London "Lancet," December 5, 1874.

various members of which may be attacked, while other families living under the same conditions are unaffected.

**Pathogeny.**—The researches of Dr. H. Vandyke Carter, Ord,\* Beale, and others have demonstrated the importance of mucus in determining the precipitation of the calculous ingredients of the urine. Calculi are of all sizes—from microscopic bodies up to a concretion filling the pelvis of the kidney. Beale † has shown the importance of microscopic calculi present in the urine, as indicating similar bodies of larger size in the pelvis. In the kidneys there may be an infinitude of calculi—from mere grains of sand to concretions of considerable size. Uric-acid infarctions, triple phosphate- and carbonate-of-lime infarctions, are found in the straight tubes of the pyramids in infants, and in old men, especially those affected with the gouty diathesis. Calculi of uric acid are more frequent than any other constituent, for, although this substance exists in small quantity, it is very slightly soluble. Ord shows that uric acid, crystallizing in the presence of colloids (albumin, mucus, etc.), tends to assume a spheroidal form, and Carter that a bit of mucus is the nucleus about which the crystallization takes place. These calculi are made up of concentric layers, and may be composed wholly of uric acid, or of alternate layers of uric acid and oxalate of lime. Similar modifications are impressed on oxalate of lime, but while they tend to assume the spheroidal form in the presence of mucus they also crystallize in octohedra. The uric-acid calculi are grayish-red or reddish-brown, smooth, hard, and having a specific gravity of 1.5. The pure oxalate-of-lime calculi are very rare, are very hard in texture, rough on the exterior, of a dark-brownish color. The oxalate of lime with a nucleus of uric acid are much more common than the pure oxalate. Calculi of cystine are still more rare than those of oxalate of lime; they are comparatively soft, and have a dull-yellow or amber color. Phosphatic, next to uric, are the most frequently encountered calculi. They are very light, friable, of a dull or grayish-white, or bright white, rough, and sometimes polished. The phosphatic deposit, consisting of phosphate of lime and the ammoniaco-magnesian phosphate, often forms about a uric-acid calculus which has been present for some time. This deposition of the phosphates may be expected to take place on a uric-acid calculus which has been long present in the pelvis of the kidney, if the urine becomes alkaline. The stones may be in one, but occasionally they are found in both kidneys. In the cases which have fallen under my observation, two thirds were in the left kidney. The results of the presence of concretions differ according to their situation: in the tubules, as infarctions, they excite inflammation of the kidney; in the pelvis they cause pyelitis. Gouty kidney is a result of the uric-

\* "Lancet," March 18, 1875.

† Beale on "Urinary Deposits."



acid diathesis, and deposits of this substance take place in the pyramids and the cortex, parenchymatous and interstitial nephritis develop, and the organs ultimately become granular. When nephropylitis is fully developed, extension of the morbid process to the kidney proper takes place. When pyelitis is lighted up, the mucous membrane becomes intensely injected, and a quantity of muco-pus, proliferating epithelium, and young cells, form a yellowish, rather thick, puriform fluid. If a concretion is not too large, it will be washed down into the bladder, with the phenomena of nephritic colic. Successive calculi passing, the ureter yields and dilates, and, as these concretions, in passing, excite inflammation, the walls of the ureters become thickened. An attack of inflammation may close the canal entirely, or a ureter may be closed by an impacted calculus. In either case the contents of the pelvis accumulate, the proper structure of the kidney undergoes atrophy, and after a time only a membranous sac filled with fluid and concretions remains. The ichorous contents may ulcerate through, form an abscess of large dimensions, which may make its way externally, discharging in the lumbar region, or, dissecting downward, may point underneath Poupart's ligament, or enter the colon, etc.

**Symptoms.**—A calculus may remain in the pelvis of a kidney for a long time—during many years—it is probable, without giving rise to any disturbance. Usually, very distinct symptoms are occasioned, and serious results grow out of them. A calculus causes very violent symptoms when washed into the ureter. Usually, an attack of nephritic colic occurs suddenly. Without any warning, an atrocious pain strikes the lumbar region, and radiates thence upward into the shoulder-blade and through the abdomen. Pains occur in the corresponding testis, which is retracted close up to the external ring, and more or less pain, sometimes very acute pain, is felt in the glans penis. So severe is the pain that the most self-controlled person cries out with the agony, rolls from side to side, or rushes up and down the room seeking for some alleviation in incessant motion. The face is pale and torn with agony, the features are pinched, the body is cold and covered with a cold sweat. The thigh of the affected side is benumbed, and sometimes the whole of the corresponding limb. The patient may faint, or pass into unconsciousness with a general convulsion. The stomach participates in the disturbance with nausea, or with severe vomiting. The bladder is very irritable, and frequent attempts at micturition are made, but, with much burning pain and straining, only a few drops are passed. The urine is dark, and usually contains blood, but it may be perfectly normal, for, as but one ureter is involved at one time, the urine from the unaffected kidney may pass without admixture. The urine may be not only dark and bloody, but it may contain pus. There may be complete anuria from blocking of both ureters,

but usually the calculi do not fit accurately, and some urine escapes alongside them. If anuria is the result, and the obstacle is not removed, death in coma and convulsions is inevitable. The paroxysm, after some minutes or hours, usually terminates suddenly by the escape of the stone into the bladder. The urine accumulating behind the stone forces it onward with increasing agony, until, at last dropping into the bladder, the horrible pain ceases, the patient utters a sigh of relief, and falling on the bed exhausted is soon fast asleep. The attacks do not

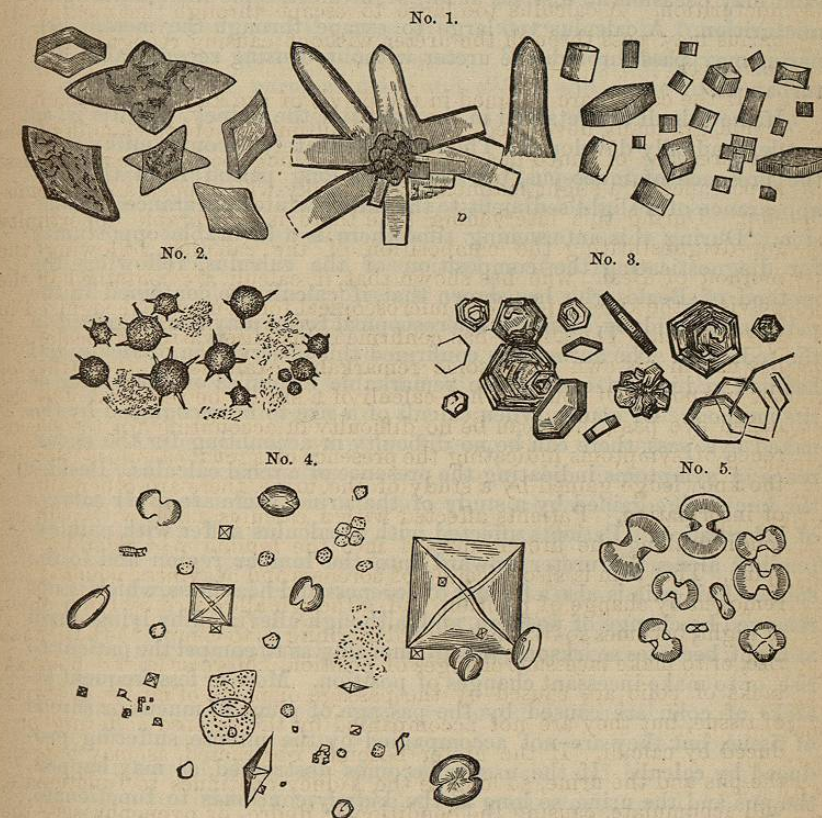


FIG. 48.—Various Crystalline Forms.  
 No. 1.—Uric Acid. No. 2.—Urate of Soda.  
 No. 3.—Cystine. No. 4.—Oxalate of Lime.  
 No. 5.—Dumb-bell Oxalate of Lime.

always come on abruptly. There may be experienced some deep-seated soreness in the lumbar region, then a quick movement as in kicking, sneezing, coughing, etc., may give rise to a sudden increase of the soreness, soon developing into acute pain. Whether the onset be sudden



or gradual, the attacks are not of equal severity. The difference we may suppose to be due to the varying sizes of the calculi. If a calculus become impacted, it will ulcerate through and give rise to fatal peritonitis. In a few cases the calculus has occupied a number of days in making the journey through the ureter, the most severe suffering, as is usual, occurring at last, owing to the increasing narrowness of the lower ureter. If repeated attacks occur, the rule is that the succeeding ones are milder, but this depends upon the size of the calculi. Gravel and sand may occasion no distress at all, or, at most, some little burning at micturition. A calculus too large to escape through the meatus urinarius may pass through the ureter without causing recognizable disturbances.

If the calculi are retained in the pelvis of the kidney, pyelitis is, as a rule, gradually developed. The urine ultimately becomes milky from the presence of muco-pus, but there is a long period from the first appearance of a slight sediment to the milky-white appearance on emission. During this intervening time there is a favorable opportunity for diagnosing the composition of the calculus, following the method of Beale, who has shown that, if calculi are contained in the pelvis of the kidney, identical microscopical forms may be recognized in the sediment. The author has confirmed this observation of Beale, and has had in his own cases some remarkable examples of the utility of the method. Of course, when calculi of a size to be recognized by the naked eye pass, there can be no difficulty in accounting for the occurrence of symptoms indicating the presence of a renal calculus. Besides the knowledge gained by a study of the urine, there are other sources of information. Patients affected with a calculus suffer with pain extending along the ureter upward into the lumbar region and to the spine. This pain is also a feeling of soreness and heaviness, which is not removed by change of position, and, although alleviated by lying down at night, becomes so irksome toward morning as to compel the patient to rise, or to make incessant changes of position. More or less frequent attacks of colic are caused by the passage of plugs of mucus or shreds of tissue, but they are not accompanied by the intense suffering produced by calculi. If the ureter becomes obstructed, as may happen, the pus and the urine, so long as the kidney continues to functionate, will accumulate, causing the condition of hydro- or pyonephrosis—the latter when there exists a pyelitis. The gradual accumulation of pus and the disintegration of the kidney substance will result in the formation of a sac with thick walls, presenting evidences of renal structure only on careful inspection. A tumor will form of considerable volume, projecting downward from the hypochondrium. It may be somewhat nodular, irregular, but is more frequently smooth and globular—the outline and shape being determined by the degree of accumulation; hence the tumor is the more globular and less nodular the more an-

cient. The tumor may attain to very large size; in a case in the author's charge, it was as large as a child's head. The sac may yield and the contents escape into the peritoneal cavity, or a communication may be established with the colon or stomach, or discharging posteriorly may open a fistulous communication in the lumbar region, or dissecting downward along the course of the psoas muscle may point under Poupart's ligament. The calculus may be discharged by any of these channels. When the ureter is closed, the urine, which before was full of pus, now appears clear again. An obstruction of the ureter may be temporary, and the urine after a short period of freedom from pus may become loaded with it again. When the obstruction yields, a sudden gush of purulent urine and *débris* will cause more or less pain or colic; indeed, the attack may have all the characteristics of a severe nephritic colic.

**Course, Duration, and Termination.**—Nephrolithiasis develops slowly, is very chronic in its course, and variable in the results. The exceptions to this statement consist of those cases which terminate suddenly by rupture of the ureter and peritonitis, and the very rare examples of septicæmia or pyæmia occurring with the beginning suppuration, or of uræmia from the simultaneous blocking of both ureters. Renal sand and small concretions may, after a variable period of detention, pass down the ureter and be discharged with the urine. Often concretions of considerable size, too large to pass the meatus urinarius, are thus discharged, all symptoms ceasing when the source of irritation is removed. Recovery has ensued also by the discharge of the concretion through a fistulous communication externally, the kidney undergoing atrophy, the sac closing, and the formation of pus ceasing. As one kidney may perform the duty of both, a cure effected in this way may be genuine. Death may occur from exhaustion, or amyloid degeneration may be the result of the protracted suppuration; pyæmia, or some intercurrent malady, may quickly terminate life in a portion of the cases.

**Diagnosis.**—Renal colic may be confounded with biliary colic. The two affections are frequently associated. They are distinguished by the situation of the point of maximum pain, and by the sequelæ—hepatic colic followed by jaundice and pasty stools, renal colic by excessively irritable bladder and bloody urine. Is the calculus present uric or phosphatic? The preponderance of numbers is a presumption in favor of uric acid. But the determination is made by an examination of the sand, gravel, or microscopic calculi. A uric-acid calculus, long present in a suppurating pelvis of the kidney, will become more or less deeply incrustated with phosphatic material, and the urine will contain phosphate crystals. When a tumor exists, the kidney affected is revealed. That one and not both kidneys is the seat of disease may be determined by the passage of perfectly normal urine when