

in the ureter or pelvis of the kidney, although in some instances pressure from outside the ureter, such as that due to parametritis or to a pelvic tumor, may obstruct the flow of urine. The lumen of the ureter may be blocked by inflammation, usually of a gonorrhoeal or tuberculous origin. Traumatism, such as a severe contusion of the abdomen, may be followed by hydronephrosis, resulting from the presence of blood clots within the ureter or from extravasation of blood and cicatricial contraction outside of the ureter. Hydronephrosis may develop in a movable kidney after kinking or twisting of the pedicle of the organ. This strangulation is temporary, but is apt to recur, and is associated with some formation of fibrous tissue which tends to increase the obstruction.

The mucous membrane at the origin of the ureter may act as a valve to obstruct the orifice. Such valvular action is more likely to occur if displacement or dilatation of the kidney causes the ureter to arise at an abnormal angle. Swelling of the mucous membrane facilitates this and other forms of obstruction.

A calculus or other foreign body may block the lumen of the ureter and produce hydronephrosis. The symptoms may be violent in case the obstruction is sudden and complete, or so mild as to be scarcely noted if the obstruction is incomplete and very gradual. A tumor will be felt in the lumbar region, the lower portion of it usually lying behind the colon. The hydronephrosis may be so great that the tumor extends as far as the median line, or even into the pelvis. Complete hydronephrosis of short duration gives a tense and exquisitely tender tumor, whereas in a chronic case the tenderness is slight or wanting, and fluctuation is easily made out.

If a hydronephrosis lasts for a long time its fluid loses more and more the characteristics of urine. Spontaneous cure is still possible if the obstruction is relieved, even though this has been complete. With the lapse of years the renal parenchyma may be wholly destroyed, and the sac lose its contents and shrivel up. The hydronephrotic sac may rupture, as the result of traumatism, either into the peritoneal cavity or subcutaneously. Severe and even fatal hemorrhage may follow this accident. The contents of the sac may become infected and the condition change from hydronephrosis to pyonephrosis. Hydronephrosis must be differentiated from cystic tumors not connected with the kidney, such as an echinococcus cyst of the liver, dilated gall-bladder, and ovarian tumors.

The following procedures are recognized to-day as suitable in the treatment of hydronephrosis.

Ureteral catheterization of the pelvis of the kidney followed by irrigation with nitrate-of-silver solution will occasionally cure hydronephrosis.

Retropertitoneal puncture of the sac was formerly the routine treatment. It is still of value as a means of affording temporary relief under circumstances in which a better operation cannot be carried out. It carries with it the risk of infection, for even if the skin and trocar be aseptic the contents of the sac may not be, so that infection may follow the withdrawal of the instrument. Puncture should of course be made in the loin behind the peritoneal reflection.

If hydronephrosis is due to kinking of the ureter in connection with movable kidney, fixation of the organ may prevent its recurrence.

Lumbar nephrotomy will cure many cases of hydronephrosis. If it does not do so the obstruction may be reached and overcome through the sac, or by exposure of the ureter outside of the sac.

If there is a valvular action of the mucous membrane at the mouth of the ureter this may be overcome by a longitudinal incision sutured transversely. Stricture of the ureter may be successfully treated in the same manner. A portion of the sac may be resected.

Ureteral stricture may be dilated by instruments passed through the pelvis of the kidney, or the stricture may be resected, or the ureter may be cut across below the stricture and reimplanted into the pelvis of the kidney.

Under certain circumstances an anastomosis may be established between the sac and the bladder.

If none of these operative measures succeeds in curing the patient, and the opposite kidney can be shown to be functionally capable of doing the work of both, the diseased organ should be extirpated so that the patient may be saved from a persistent urinary fistula and from the evils of a suppuration which is certain to develop in the sac sooner or later if there is a persistent fistula.

The lumbar incision is best suited to the removal of the sac. The peritoneum should not be opened, but freed from its attachment and displaced inward. If it is necessary to evacuate the contents of the sac before removal, the wound made by the trocar should be carefully sutured. The sac will then be smaller and less tense, and its removal will usually not be difficult. The mortality of this operation in recent years is about six per cent.

A hydronephrotic kidney may be removed transperitoneally through an anterior incision. This method permits of an inspection of the other abdominal organs, but it exposes the abdominal cavity to infection from the contents of the sac, and there remains, behind the posterior peritoneum, a large cavity which is sometimes difficult to treat. It has been drained through the lumbar region and also anteriorly by stitching together the anterior and posterior layers of peritoneum around the wicks of gauze used to drain the retroperitoneal space.

**Suppuration in the Kidney.**—Infection of the kidney may take the form of suppurative pyelitis to which may be added one or many abscesses in the parenchyma. The condition is then spoken of as surgical kidney, or suppurative nephritis. If there is retention of urine and pus the condition is called pyonephrosis. A hydronephrosis may become a pyonephrosis by reason of infection.

Calculi may give rise to suppuration, or they may develop in consequence of alkaline fermentation, which may be due to suppuration. Infection in the kidney may come through the blood or through the ureter. The former is known as hæmatogenous infection, and the latter as urinogenous infection. The kidney is one of the chief avenues for the removal of germs from the body, and it is not surprising that they occasionally lodge and develop in its tissues. The gonococcus is the microbe most frequently found in urinogenous infection. Obstruction to the flow of urine greatly favors the development of bacteria in the kidney.

The symptoms of renal suppuration are varied. The trouble may begin as an acute fever, with chills and great pain and tenderness; or it may develop after a cystitis, or after an injury. If the urine is obstructed the renal tissue will be destroyed with a rapidity far greater than that which takes place in hydronephrosis. Recovery may follow rupture of an abscess into the renal pelvis and the discharge of pus through the ureter; or an abscess may break through into the paranephric tissue and be evacuated externally, cure of the trouble resulting. Such cases, however, are exceptional. Usually the suppuration continues and smaller abscesses fuse and form larger ones until the kidney becomes a pus sac.

Sometimes the symptoms are so well marked that the disease is easily recognized. At other times pyuria will come on gradually and continue for a long time without pain. If the urine suddenly becomes clear, and pain and tenderness develop in the loin, it is probable that obstruction has taken place.

A differential diagnosis of renal pyuria and purulent cystitis can easily be made by irrigating the bladder until the fluid returns clear. After a few moments' rest the bladder should again be irrigated. If the fluid is again purulent, the pus probably comes from the kidney. A more certain diagnosis can be made with the cystoscope.

The best treatment for pyonephrosis is immediate nephrotomy. Care should be taken to drain every abscess, and a probe should be passed through the ureter to the bladder. The kidney should be freely drained. If the destructive process has not gone too far, this treatment will often effect a cure. If the ureter is obstructed, and the obstruction cannot be overcome, and if the other kidney is functionally active, the diseased organ should

be removed. This may be done at the first operation if the kidney is found to be greatly disorganized. But if considerable parenchyma is present it is better not to sacrifice the organ unless the separated urine has been tested and the functional activity of the opposite kidney demonstrated. All surgeons agree that a suppurating kidney should be operated upon through a lumbar incision. The mortality of nephrotomy for renal suppuration is about twenty per cent. The mortality of primary nephrectomy for suppuration is about twenty-five per cent., and that of secondary nephrectomy about sixty per cent.

Some surgeons do not believe in nephrotomy as a treatment of renal suppuration, taking the ground that it rarely cures the patient, and therefore prolongs the course of the disease. The views given above are those of Schede as expressed in the "Handbuch der praktischen Chirurgie" (Ferdinand Enke, 1901).

**Paranephritis.**—The fatty capsule of the kidney may undergo suppurative inflammation. This condition is known as paranephritis. The suppuration may be due to extension from within the kidney, or to an extension of inflammation from the stomach, liver or gall-bladder, intestine, or one of the vertebrae. It may follow appendicitis or diseases of the pelvic organs, or pus in the pleura may break through the diaphragm and so give rise to paranephritis. It may also follow acute infectious diseases, for the blood-vessels of the fatty capsule are intimately connected with those of the kidney, so that the fatty capsule may become infected without involvement of the kidney itself. Doubtless there are forms of paranephritis which are not suppurative, but their diagnosis can hardly be made, and therefore they may be neglected. When pus is introduced into the fatty capsule it quickly destroys the existing tissue and extends around the kidney. Unless it is evacuated externally the pus increases rapidly in quantity and may reach from the diaphragm to the pelvic brim. As the abdominal wall covering the fatty capsule is quite thin, the presence of pus will soon show itself in œdema and redness of the skin, and the abscess may break spontaneously just above the crest of the ilium or just below the twelfth rib. It may open into the pleural or peritoneal cavity, or into the duodenum, colon, or bladder. It may involve the spleen or liver. The abscess may contain urine mixed with pus.

The symptoms may develop suddenly with chills and fever and great pain, or they may come on slowly, with a lower temperature curve, which has no characteristic form. Until the abscess develops the diagnosis may be obscure; later, it is easily made. There will be a bulging on the affected side, especially when the patient is in a sitting posture. Fluctuation can sometimes be made out.

The abscess should be freely opened by an incision in the lumbar region posteriorly to the peritoneal reflection. This incision may be vertical, transverse, or oblique.

The mortality after operation in uncomplicated cases is about seventeen per cent., while that after operation in complicated cases is about fifty per cent. If the paranephritis is secondary to suppuration of the kidney the mortality after operation is still higher, being nearly fifty-five per cent. Recent statistics show that the danger to the patient is not from the operation, which is comparatively simple, but from the damage to the other organs caused by the suppuration. Upon this will depend the prognosis.

**Renal Calculus.**—Urinary salts are deposited upon any foreign body which finds its way into any portion of the urinary tract, and this fact explains the formation of some renal calculi. Sometimes the nucleus is very small, made up of merely a few epithelial cells or a clump of microbes. Other nuclei are macroscopic—a piece of catheter, a pin, or a sliver of necrotic bone. Some investigators believe that a foreign body forms the nucleus of every calculus, but whether this be true or not, it is certain that no such nucleus can be demonstrated in a large majority of cases. Others have shown that every

calculus contains an organic framework, and have thought thereby to explain their development; but it has been found that every crystal formed in the urine has an organic framework, so this theory of formation of calculi seems insufficient. Still others have based a theory upon the fact that the composition of urine varies a good deal at different periods of the day. They have supposed that crystals form in the kidney when the urine is concentrated, that these are dissolved by subsequent dilute urine, and that a failure of the urine to redissolve such crystals is the starting-point for the formation of a calculus.

While the exciting cause of a calculus cannot be given in many instances, certain predisposing causes are well known. Thus, if the urine is constantly overlaid with uric acid and its salts, as, for example, in gout, the formation of renal calculi is facilitated. After severe spinal injuries renal calculi form with great frequency, due perhaps to the development of bacteria in the urinary tracts of such patients.

Calculi are far more common in certain countries than in others. They occur more often in childhood and after the fortieth year than in early adult life. Their relative frequency in males and females is about 20 to 1, a discrepancy which is only partly accounted for by the ease with which a small stone may pass through the female urethra. Various articles of food and drink have been thought to favor the development of calculi, but the testimony upon this point is not very convincing.

Renal calculi are given different names, according to their size. If very small, they are spoken of as sand; if as large as the head of a pin, they are called gravel; while larger calculi are spoken of as stones. Some calculi will form only in acid urine, and others only in alkaline urine.

Nearly all calculi may be classified, according to the substances of which they are composed, into three groups: (1) uric acid and urates; (2) calcic oxalates; (3) calcium and triple phosphates. There are a few rare instances of the occurrence of calculi composed of calcium carbonate, cystin, xanthin, indigo, or some other substance. A calculus may be composed of one substance throughout, or it may be made up of layers of different substances indicating different conditions which existed during its formation. Thus, a calculus may have a centre composed of uric acid, covered by a layer of calcium oxalate and an outside layer of triple phosphate (Fig. 3081, c).

The commonest renal calculus is one composed of uric acid, either alone or mixed with urates. If pure it is of a pale yellow or reddish or brownish color, and has a smooth or granular surface. It is very hard and has a specific gravity of about 1.5. Its cut section shows a concentric arrangement. It develops in acid urine.

A calculus of calcic oxalate is usually small. It is yellowish or reddish, or brown or black from the presence of blood pigment. It is very hard and its surface is covered with small spines. On cut section there will be seen a concentric arrangement of wavy lines. It develops in acid urine.

A triple phosphate calculus is composed of ammonio-magnesium phosphate or calcic phosphate. It has a smooth or slightly granular surface of white or gray color, and on cut section appears amorphous or lamellated. Such a calculus has a low specific gravity. It develops in alkaline urine. It is usually single and may grow to a very great size.

The shape of a calculus is due in great measure to the situation in which it develops. Thus, a single calculus is rounded, and if formed in a tubule or in a calyx it will be shaped something like a pea or a bean. If formed in the pelvis of the kidney it may be much larger and may show prolongations corresponding to the calices (Fig. 3077). If two or more calculi are found in the same cavity their surfaces will be faceted where they have lain in contact with each other.

Necrotic tissue may become incrustated with urinary salts while such tissue is still attached to the body.

This incrustation is more apt to occur if secondary infection has taken place and the urine has become alkaline.

Every calculus exercises a deleterious influence in its neighborhood, but its action may be slight so long as the urine is normally acid. If infection occurs and sets up alkaline fermentation of the urine, the destruction of the

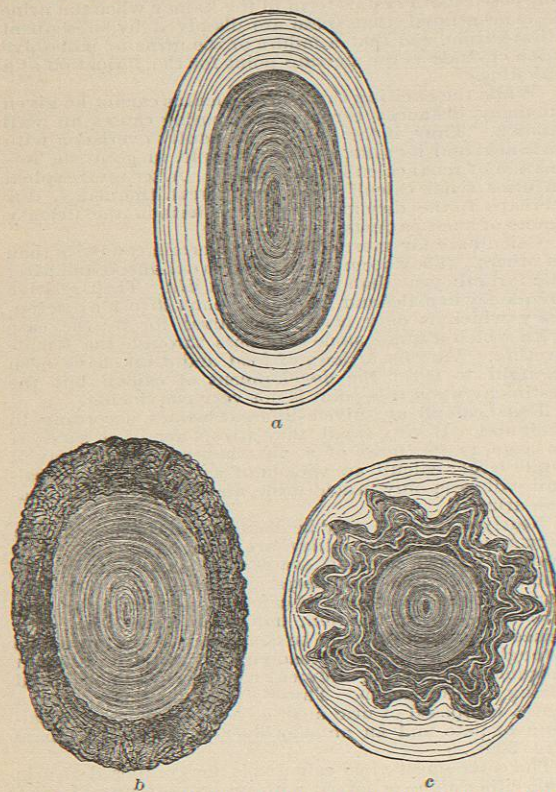


FIG. 3081.—Urinary Calculi. *a*, Centre of uric acid, outer covering of phosphates; *b*, centre of uric acid and outer covering of calcic oxalate; *c*, calculus of uric acid, calcic oxalate, and phosphates. (From Sonnenburg.)

parenchymatous tissue and the formation of new fibrous tissue will go on much more rapidly. Therefore, if the case is of long standing the kidney may atrophy and shrink to a small fibrous sac around the calculus. Or there may be produced chronic interstitial nephritis without much change in the size of the organ. The calculus may obstruct the flow of urine and lead to hydro-nephrosis or, more often, pyonephrosis, with more or less destruction of the renal parenchyma. The kidney may then contain numerous abscesses connected with one another and in many of which there may be calculi. This alkaline fermentation of the urine of course stops the deposition of crystals of uric acid or calcic oxalate, but it does not stop the growth of a calculus already formed of one of these substances. Indeed the size of this stone may increase more rapidly than before, but the new layers deposited will be made up of phosphates (Fig. 3081, *a* and *c*).

One of the risks of allowing a renal calculus to remain untreated is the danger to the second kidney. Some observers state that calculi exist in both kidneys in fifty per cent. of the cases of renal calculus. If infection is added to the calculus, the risk of injury to the second kidney is much greater. The ureter on the infected side,

and also the bladder, will speedily become contaminated, and there is a grave risk that the infection will travel up the opposite ureter.

A renal calculus usually causes symptoms which are unmistakable, although no single subjective symptom can be spoken of as pathognomonic; but the diagnosis can be made absolutely if the stone is so large that it can be palpated, or if palpation produces a creaking or grating as one stone is rubbed upon another. In exceptional instances a probe passed through the ureter may demonstrate the existence of a renal calculus in the kidney. Furthermore, radiography may be looked upon as an absolute method of diagnosis if the picture shows clearly the outline of the stone. Its failure to do so does not always disprove the existence of the stone, since some calculi, notably those composed of uric acid, are so easily penetrated by the x-ray that a good deal of practice and just the right kind of apparatus are necessary in order to differentiate such concretions from the surrounding tissues (Fig. 3077).

The symptoms usually depended upon for making a diagnosis of renal calculus are pain, hæmaturia, presence of gravel or sand in the urine, enlargement of the kidney, attacks of anuria, and vesical irritation. The presence of one or more of these symptoms is more significant if the patient is of a gouty or rheumatic diathesis and is in the habit of passing urine containing an excess of uric acid and urates, and from which these salts are easily precipitated. The diagnosis is still further strengthened if the patient gives a history of attacks of colic, or of long-continued, dull pain in the lumbar region, increased if jars and muscular exertion. If a stone is unaccompanied by inflammation and does not obstruct the flow of urine, it may cause little or no real pain. Furthermore, a kidney in this condition will not be especially sensitive. If a small stone becomes loosened and enters the ureter intense pain will be caused in the lumbar region. This pain will often radiate along the ureter into the bladder or into the testicle or the head of the penis or down the thigh. It may also extend upward, or throughout the abdomen. The pain may be so intense that the patient is collapsed and wet with perspiration, and consciousness may be lost.

There is usually violent vesical tenesmus with the passage of a few drops of dark urine which possibly contains blood; or, if the calculus obstructs the flow of water from the affected kidney while that from the other continues, the urine passed may be normal. Such an attack accompanies the passage of a stone through the ureter and subsides when it enters the bladder. The attack may also be due to any acute congestion or to venous distention, or to obstruction of the urine, however caused.

The hemorrhage which accompanies a renal calculus may be so slight that it is recognized only upon microscopical examination. Such examination should be made daily in suspected cases, since the constant presence of a few red blood corpuscles in the sediment is one of the best signs of renal calculus. The amount of blood may also be much greater, and, in rare instances, the hemorrhage may even threaten the patient's life.

Increase in the size of the kidney is not an infallible sign of calculus, for the organ is not always enlarged by a calculus, and it may be enlarged as the result of tuberculosis, tumor, or obstruction to the escape of urine, however caused.

The anuria which often occurs in cases of renal calculus is of reflex origin. It is most frequently seen in connection with the attacks of renal colic which accompany the passage of a stone through the ureter, or which are due to obstruction to the flow of urine or blood from the kidney, caused in some other manner, or to injury of the kidney. There is also an hysterical anuria. Reflex anuria usually passes off as soon as the acute attack is over and is generally followed by a temporary polyuria.

The symptoms of vesical irritation accompanying renal calculus, such as urgency and frequency of micturition and pain in the urethra at the close of the act, are so

similar to those caused by cystitis that a cystoscopic examination is often required to differentiate between the two.

In case of a renal calculus the mucous membrane of the bladder will not appear inflamed. If the mouth of the ureter is brought into view, the surgeon may observe the discharge from it of cloudy, purulent, or bloody urine. Pressure on the affected kidney will increase the flow of pus, unless the ureter is blocked. In that case no urine will flow from it into the bladder. The discharge of pus from the ureter does not prove that the renal suppuration is due to calculus, though this is one of the commonest causes of pyelitis. A diagnosis of tuberculosis may be eliminated by a bacteriological examination of the urine which should be drawn for the purpose through a catheter in order to avoid contamination with the smegma bacillus.

Attempts to dissolve formed calculi by means of internal medication of whatever nature are wholly unsuccessful. Internal medication must not on this account be regarded as useless, since dilution of the urine lessens the danger of further precipitation and the increased flow may also wash out small calculi already formed. Furthermore, bacterial action can often be prevented or lessened by the internal use of such urinary antiseptics as boric acid, salol, benzoates, urotropin, etc. Glycerin in quantities of two or three ounces at a single dose sometimes has a good effect in lubricating the urinary passages and bringing away a great quantity of calculi and sand. A part of this good result is doubtless due to the great quantity of water which the patient drinks to relieve the thirst caused by the glycerin.

The removal of a renal calculus through a lumbar incision is the correct method of dealing with this trouble. The incision in the kidney should be through the cortex rather than directly into the pelvis, since the former method facilitates the operation and gives better drainage, if drainage is necessary. Operation may be regarded as immediately necessary if anuria has lasted for two days, or if there is complete obstruction of the ureter or dangerous hemorrhage, or if the calculus has already set up suppuration. In the last-mentioned condition there is no hope that a spontaneous cure will take place, while the longer the operation is delayed the more extensive will be the destruction of the kidney. Even if the course of the trouble is aseptic it is better not to wait, since one has no means of knowing how soon infection may occur. The mortality after operation for stone in aseptic cases is less than six per cent., while in septic cases it is four times as great.

Before the kidney is opened it should be freed from its fatty capsule, after which an elastic ligature can be passed around the vessels of the pedicle. This will control hemorrhage until the exploration of the kidney is finished. The kidney should be opened along its convex border a little posterior to the line of incision employed at autopsy (see Fig. 3075). The incision should not be carried into the poles. Through this incision the pelvis and calices may be explored and all calculi removed. A probe should be passed into the ureter to demonstrate that its lumen is free as far as the bladder, or to reveal the cause and situation of any obstruction which exists. This must be overcome, even if it is necessary to prolong the lumbar incision downward and forward. A calculus situated high up in the ureter may be pushed back into the renal pelvis and thus removed, or it may be pushed into the bladder. If it cannot be removed in any other way the ureter should be incised upon it and again sutured after the extraction of the stone.

If there is an abscess in the kidney or pus in its pelvis the wound in the kidney should be drained; otherwise it may be sutured. When reflex anuria is present, however, most surgeons prefer to leave a drain in the renal incision, even though there is no pus.

Primary nephrectomy for renal calculus is an operation seldom performed, since the condition of the kidney will rapidly improve after nephrotomy. If the parenchymatous tissue of the kidney has been entirely destroyed, or

if its suppurative condition is such that it is a source of danger to the patient, it may be better to remove it than to drain it.

*Essential Renal Hemorrhage and Nephralgia.*—Hemorrhage from the kidney sometimes occurs without any such obvious cause as traumatism, calculus, tuberculosis, new growth, or the congestion which follows the sudden relief of retained urine. In tropical countries hemorrhage frequently follows infection by distomum, filaria, and other parasites. There is also an inflammatory hemorrhage from the kidney, but this is usually microscopic in character. Apart from all these causes hemorrhage may occur with or without renal colic. The kidney has several times been opened under such circumstances and nothing to account for the hemorrhage has been found. Some of these patients were true hæmophiliacs, giving a history of severe hemorrhage following slight traumatism in other portions of the body. But there is also a true angioneurotic hemorrhage which on account of its severity or the pain which accompanies it, may require operation. In some instances rest, a milk diet, and the administration of medicines to favor blood clot, have effected a cure. If the hemorrhage continues nephrotomy should be performed. This may reveal a possible cause for the hemorrhage, for such a beginning tuberculosis, for the presence of an abscess or a calculus, or for the retention of urine. This operation will usually cure either an active or a passive congestion. There is no object in removing a kidney if no apparent cause of the hemorrhage can be found, unless, in the case of a hæmophilic patient, hemorrhage from the incised organ makes it necessary to ligate the renal vessels in order to save life. The wound in the kidney should be drained and allowed to granulate.

Nephrotomy has recently been performed with success for the cure of unilateral renal pain in cases of nephritis when there is reason to suppose that the inflammation affects only one kidney. Splitting of the capsule has been advised for the cure of interstitial nephritis whether unilateral or bilateral. Its success under such circumstances is still problematical. It is based on the theory that the contraction of the capsule destroys the parenchymatous tissue, and that if the tension is relieved by incising or removing the capsule, the progress of the disease will be stopped and even lost ground may be regained.

*Aneurism.*—An aneurism of the renal artery is of rare occurrence. It may follow traumatism or develop spontaneously. In the former case it is likely to be associated with hæmaturia. It may exist for a long time without symptoms. The symptoms other than hæmaturia which have been noted are the presence of a tumor only slightly movable, smooth, and semi-fluctuating. Such a tumor does not give a feeling of pulsation nor a bruit. The aneurism may give rise to a sense of pressure, or to attacks of pain which are so severe that they have been mistaken for biliary colic. If the aneurism continues to grow it may terminate life by bursting retroperitoneally or into the peritoneum, or into the renal pelvis. If it ruptures into the renal pelvis a prompt nephrectomy may save the life of the patient. There are records of three successful operations for renal aneurism.

*Syphilis.*—Syphilitic gummata may develop in the cortex or in the pyramids of the kidney. In the early stage these gummata have a soft yellowish centre of caseation around which is a zone of connective tissue and strangulated tubules, and still outside of this a zone of active growth with infiltration of small round cells. There is also a diffuse form of syphilis of the kidney in which the organ presents the appearance of the "large white kidney." In either form the syphilitic kidney may involve the surrounding tissues in the inflammation and give rise to a dense tumor which may easily be mistaken for malignant disease. Such a tumor may soften in spots and discharge necrotic masses through sinuses in the skin. The proper treatment is the internal administration of antisyphilitic remedies.

*Cystic Tumors.*—Three kinds of cysts may form with-

in the kidney and require surgical treatment. They are solitary cysts, the tumors of polycystic degeneration, and echinococcus. The solitary renal cyst is a benign trouble and can do injury only by pressure, in case it reaches a large size. Such a cyst contains clear serous or cloudy fluid, possibly stained with blood pigment. Large cysts of this kind are rare. They arise in the cortex and are probably due to retention beginning in a glomerulus or in a tubule. The cyst may be strictly solitary, or two or more may coexist. Their situation is usually along the convex border, or in the lower pole of the kidney. In only a few instances has operation been performed for this trouble. If an operation is undertaken, the cyst should be extirpated and the renal parenchyma sutured; or, if complete suture is impossible, the cavity may be drained.

Polycystic degeneration is a serious and usually fatal disorder which may affect the kidneys either before or after birth. The etiology is still obscure. Schede affirms that there are two forms of polycystic degeneration. In one form overgrowth of the interstitial tissue obstructs and strangulates the tubules and thus leads to the development of multiple cysts. In the other form the epithelium, especially of the tubules, undergoes proliferation and subsequent degeneration, so that the condition may properly be called adenocystoma.

Congenital polycystic degeneration is usually bilateral; and since it causes a speedy death it has little surgical interest. The polycystic degeneration of later life is sometimes unilateral, so that occasionally incision of the cysts, nephrotomy, or even nephrectomy might be of benefit. Before the kidney is removed the functional capacity of the other kidney should be definitely determined.

The natural course of polycystic degeneration is the destruction of the renal tissue. It is often associated with the formation of multiple cysts in the liver, and is frequently accompanied by arteriosclerosis and cardiac hypertrophy. Therefore death is usually not long delayed. Still there are instances in which a patient has lived ten years after such a cystic renal tumor was palpable.

The diagnosis of polycystic renal degeneration is difficult. The enlarged kidney will probably be mistaken for malignant disease. It is sometimes possible to feel the pebbly surface of the organ and in rare instances to make out fluctuation in the larger cysts. Cachexia may be absent for a long time.

Echinococcus may develop in the kidney, giving rise to a single smooth cyst which may feel as hard as a fibroma, or may yield an indefinite fluctuation or the peculiar thrill found in echinococcus cysts elsewhere. If the cyst bursts into the renal pelvis, hooks or daughter cysts may be found in the urine. Such cysts, as far as known, are always single. As the renal tissue is unaffected except by reason of pressure, the kidney should not be removed. The cyst, whether suppurating or not, should be incised, sutured into the abdominal wound, and drained.

**Suprarenal Gland.**—While little is known of the physiology and pathology of the suprarenal gland, it is usually found diseased in connection with a group of symptoms described by Addison, and which are therefore known as Addison's disease. The affection of the suprarenal gland under such circumstances is almost always tuberculous. The bronzing of the skin which is generally supposed to be characteristic of Addison's disease does not exist in about one-sixth of the cases in which the suprarenals are diseased, and it is present sometimes when the suprarenals are apparently normal. Some hold the view that Addison's disease is an affection of the sympathetic ganglion which lies near the suprarenal body, and that the gland is involved only as the lesion spreads. There are some cases which seem to show that the early removal of the tuberculous suprarenal may benefit the patient, since the disease may for a time be unilateral. In some of the few cases which have been operated upon, the suprarenal gland and kidney were so intimately adherent that it was found necessary to remove both. Benign tumors, encap-

sulated hæmatomata, and malignant tumors, of the suprarenal gland, are pathological rarities which a surgeon may be called upon to treat. It is not likely that a differential diagnosis can be made between a tumor of the suprarenal gland and one of the upper pole of the kidney. This point is not of much importance, however, since practically the same operation is required for the two conditions, and very likely both organs will have to be removed together. The gland may be reached through a lumbar or an abdominal incision. If the former is chosen, it will need to be large, and should extend well upward.

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**KINO.**—"The inspissated juice of *Pterocarpus Marsupium* Roxb. (fam. *Leguminosæ*)." U. S. P. Many substances, from different parts of the earth and different plants, have, at one time or another, appeared under this name. That which is in the market at present is chiefly the product of various species of *Eucalyptus*, the official article being very scarce and dear. Very recently, however, it has been reported that extensive new districts have been opened up, capable of yielding any required amount of official kino at a low price. The plant yielding the latter is a large, handsome Indian tree, whose wood is also valued for timber. In common with other species of *Pterocarpus*, this tree contains a bright-red juice, which exudes upon incisions being made in the trunk, and hardens, upon evaporation and drying, into dark, reddish-brown, brittle tears.

This, the East Indian (Malabar) kino, has been imported since the beginning of the present century, and for medical purposes has superseded the African and other varieties which were then used. It always comes in fragments or angular pieces, generally not larger than split peas, and oftener considerably smaller; occasionally these fragments cohere together in crumbly lumps. Kino is of resinous lustre and fracture, very brittle, its pieces are smooth and shining, opaque, except at their edges, where they are ruby-red and transparent; general color dark reddish-brown, sometimes almost black; odor, none; taste very astringent and sweetish. The saliva is colored bright red when kino is chewed. It is partially soluble in cold water, wholly so in boiling water and in alcohol, not in ether.

Kino is a homogeneous uncrystallizable substance, related to the tannic acids of cinchona and krameria, and more closely to catechu. Its deep red solution becomes violet on addition of a proto-, and dirty green with a persalt of iron. It appears to consist principally of *kino-tannic acid*, a red, transparent substance, soluble in alcohol and water, and capable of decomposing upon long standing in watery solution into insoluble *kino-red*; *kinoin* and *catechin* may be obtained from it in small quantity, and *pyrogalllic acid*, by distillation and other means.

**ACTION AND USE.**—Kino is an active astringent of the logwood and catechu kind, and is employed for exactly the same purposes. For subacute or chronic diarrhoea or dysentery it is equally good with other astringents, and less unpleasant than many of them. As a local application or injection, *tannic acid* is to be preferred. Kino can be given in substance, if desired—dose, 1 gm. (1 gm. = gr. xv.) or in aqueous infusion; as the latter is apt to gelatinize, it should be made freshly. The official tincture (*Tinctura Kino*, U. S. P.; strength  $\frac{1}{16}$ , with fifteen parts of glycerin) keeps better, and is the most generally useful form, but this also shows a strong tendency to gelatinize after a time.

*W. P. Bolles.*

**KISSINGEN.**—Kissingen, one of the most important and best known of the German spas, is a town of 4,306 inhabitants, beautifully situated in the valley of the Saale in Bavaria, about sixty miles from Frankfort-on-the-Main. It is 554 miles from Paris via Frankfort and Würzburg, and can be reached from the former city in eighteen hours. It is about six hundred feet above sea-level, and is surrounded by wooded hills affording opportunity for the "Terrain-Cur." In the circular valley in

which it is situated are extended pleasure grounds and promenades. The climate is mild, although there is considerable rain. The mean yearly temperature is 45.1° F., and the mean monthly is: May, 54.8° F.; June, 60.2° F.; July, 62.7° F.; August, 60.4° F.; September, 54.3° F. The yearly rainfall is 25.3 inches.

The season extends from May 1st to October 1st, and during this time a large number of visitors frequent this spa; in 1899, the number was 19,416, the majority of which were Germans. The accommodations are excellent and sufficient for three or four thousand persons. The drinking-water is from well source, but said to be good, and the drainage is efficient. The springs are cold saline, the principal constituents being chloride of sodium, ferrous carbonate, sulphate of magnesia, carbonate of calcium, and free carbonic acid. Three of the springs: the Rakoczy, Pandur, and Maxbrunnen are situated in the town, and two, the Schönbornsprudel and the Sool- or Salinensprudel, a short distance beyond the town limits. The Rakoczy, Pandur, and Maxbrunnen are used for drinking, and the Sool- and Pandur are the ones principally used for baths.

The following is the analysis (from Eulenburg) of the five springs:

NUMBER OF GRAMS OF SOLID CONSTITUENTS, IN EACH LITRE OF WATER.

	Rakoczy.	Pandur.	Maxbrunnen.	Sool-sprudel.	Schönbornsprudel.
Sodium chloride . . . . .	5.822	5.207	2.316	10.554	11.719
Calcium chloride . . . . .	.286	.241	.376	.250	...
Lithium chloride . . . . .	.020	.016	.007	.020	.024
Magnesium chloride . . . . .	.303	.211	.108	.330	...
Magnesium sulphate . . . . .	.588	.597	.200	.904	1.472
Calcium sulphate . . . . .	.389	6.300	.190	.856	.332
Calcium carbonate . . . . .	1.001	1.014	.565	1.304	1.855
Ferrous carbonate . . . . .	.031	.027	.002	.030	.019
Calcium phosphate . . . . .	.005	.005	.005	.004	.007
Sodium nitrate . . . . .	.009	.005	.077	...	...
Sodium bromide . . . . .	.008	.007	Trace.	.009	.011
Silicic acid . . . . .	.012	.004	.003	.001	.013
Organic matter, etc . . . . .	.022	.362	.064	.037	.383
Total solids . . . . .	8.556	7.996	3.913	14.299	15.847

There are three bath establishments, the property of the Government: (a) the Kurhaus with forty bathrooms; (b) the Saline with one hundred bathrooms; (c) the formerly called "Actienbad" with one hundred and twenty bathrooms. For bathing purposes the waters of the Sool- or the Schönbornsprudel are often rendered more stimulating by the addition of the mother liquor remaining after the extraction of the sodium chloride at the salt works. There are also carbonic-acid gas baths, mud baths, inhalation rooms, douches, massage, and a medico-mechanic institute. There are also private sanatoria for the treatment of various diseases. The Rakoczy is the best-known spring, and over four hundred thousand bottles of this water are sent abroad every year. The usual time for drinking the waters is before breakfast, from seven to nine. From two to six glasses are drunk, a fifteen minutes' walk being taken after each glass.

Kissingen waters are recommended for a variety of maladies: Hemorrhoidal troubles, constipation, catarrhal conditions of the stomach and bowels, gouty and rheumatic affections, uric-acid diathesis, bronchitis, anaemia, scrofula, amenorrhœa, functional nervous disorders, glycosuria, obesity, malaria, neuralgia, the headache from dysmenorrhœa, cardiac diseases, and some chronic skin affections. According to Dr. Thomas More Madden, "the mother lye or concentrated saline water of the Soolensprudel, is applied with wonderful results as a local application to scrofulous glandular swellings and similar affections."

It is well to advise the visitor that here as at all other spas, the waters and baths should be used only under the direction of one of the local physicians, as otherwise harm

instead of benefit might ensue. It is not only the use of the waters, but quite as much the carefully arranged daily plan of life as to diet, rest, exercise, etc., which produces favorable results.

*Edward O. Otis.*

**KLAMATH HOT SPRINGS.**—Siskiyou County, California.

**LOCATION.**—These springs are located on the Shasta Division of the Southern Pacific Railroad, some eighteen miles from Ager. The resort is 2,700 feet above the sea-level, and is surrounded by a wild and picturesque country with snow-capped mountain peaks and hills clad in evergreen forests. There are ample accommodations for invalids and guests, as well as excellent bathing facilities. The waters are alkaline, saline, and sulphurous. Some of them are carbonated. The springs have already gained considerable celebrity in the treatment of chronic rheumatism, gout, synovitis, chronic cutaneous diseases, dyspepsia, etc.

*James K. Crook.*

**KNEE-JERK. (PHYSIOLOGICAL.)**—This term is used to indicate a perfectly normal physiological contraction of certain extensor muscles of the upper leg in response to a blow upon the *ligamentum patellæ* ("tendon tap"), the reply resembling a jerky kick.

From the first there has been a diversity of opinion as to the nature of the phenomenon and this has led to the use of a great variety of synonyms, as: Knee-jerk (K.J., K.), knee-kick, knee phenomenon, knee-reflex, patellar (tendon) reflex (Pa.R.), Patellar (tendon) phenomenon, Westphal's symptom, myotatic contraction (Gowers), and their equivalents in other languages.

Similar responses are obtained by striking other tendons, possibly any tendon. The knee-jerk is merely the best studied and most convenient member of a large group of tendon reflexes or phenomena. There are also periosteal reflexes and "muscle jerks" of a very similar character but held by many to have a different origin.

It seems strange that a phenomenon of such simplicity remained so long unnoticed. Nowadays even children play with it, but there is no clear mention of the subject in medical literature before the articles of Erb and Westphal which appeared together in the *Archiv für Psychiatrie* in 1875. Westphal speaks of the jerk as known to many laymen "as a curiosity" and admits that his attention was drawn to it by a patient. Guérin, as early as 1856, had mentioned a contraction of tendons, but he does not seem to have had the knee-jerk in mind. As these first articles laid stress upon the diagnostic importance of the subject with reference to pathological conditions of the spinal cord, the keenest interest was at once manifested and an enormous literature began to grow.

For the demonstration of the knee-jerk a very light blow upon the ligament suffices. Such a blow may be given with any thin and relatively firm body (percussion hammer, stethoscope, back of a thin book, ulnar border of extended fingers, etc.) and is commonly effective even when the knee is covered by a moderate amount of clothing. The knee should be flexed so as to put the extensor muscles in a condition of slight tension. For ordinary examinations this is accomplished by crossing the legs, by sitting on the edge of a table with the knee resting on a cushion, or even by letting the leg hang from the arm by which it is lifted from the bed. In more careful studies it is necessary to use special devices to counterbalance the weight of the leg. The tendon tap is followed immediately by a swelling of the *m. quadriceps femoris*, easily seen or felt, and a partial extension of the lower leg. The blow itself may be barely perceived, particularly when the attention is diverted. The sensation of the "jerk" is curiously vague and remote; when the movement is more brisk there is a consciousness of the moving mass but with no feeling of a corresponding effort.

The first investigators of the phenomenon, while recognizing that it was abrogated by certain pathological conditions of the cord, were not quite clear as to its constancy in health. Later and more refined studies justify