

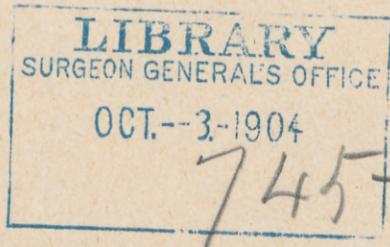
FENGER (C.)

Diseases of the Kidney,  
Amenable to Surgical  
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DISEASES OF THE KIDNEY, AMENABLE TO SURGICAL TREATMENT\*.—By Christian Fenger, M. D., Professor of Clinical Surgery, Rush Medical College, Chicago.

CENTLEMEN:

Before entering upon the consideration of the topic assigned to me, I desire to acknowledge my appreciation of the compliment paid in inviting me to speak before this association, and to express the pleasure that it gives me to appear before you on this occasion.

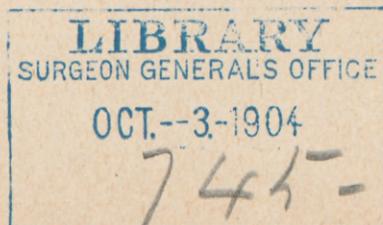
ORIGIN AND GROWTH OF SURGERY OF THE KIDNEY.

The surgery of the kidney began thirty years ago, when on August 2nd, 1869, Gustav Simon, of Heidelberg, removed a kidney by the lumbar method for an irreparable ureteral fistula. This operation demonstrated that a man could live in perfect health, if not perfect security, with only one kidney.

This new field of surgery developed rapidly, as may be seen from a review of the literature on this subject. If we take, for example, the *Virchow-Hirsch Jahresbericht*, and count the number of papers on surgery of the kidney therein noted, the count will not include all the papers written on this subject, but will give a relatively correct idea of the growth of the literature.

In the first decade, from 1869 to 1879, less than twenty articles appeared; in the next decade, from 1879 to 1889,

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about three hundred, or an average of thirty papers a year, while in the third decade, from 1889 to 1899, about eight hundred papers, or an average of eighty a year, appeared.

The latest field in surgery, that of surgery of the ureter, is, as might be expected, inseparably connected with the surgery of the kidney, and of the uro-genital organs.

The surgery of the ureter is represented in the literature during the last decade by ninety papers, eighty-seven of which appeared between 1894 and 1899. Thus the surgery of the ureter is only about five years old in its recent development.

STAGES OF DEVELOPMENT OF SURGERY OF THE KIDNEY: PERIOD OF RADICALISM. — *Nephrectomy or nephrotomy through diseased kidney tissue.* The first decade of kidney surgery might be termed the period of nephrectomy or radical surgery, during which the loss of one kidney was not considered so much as was the speedy cure of the patient. Nephrotomy and nephrectomy were performed indiscriminately in suppurating kidneys with or without stone, nephrectomy in calculus kidneys without suppuration and even for floating kidney with healthy secreting tissue, as done by Martin, of Berlin, in 1878.

PERIOD OF CONSERVATISM. — *Operation through healthy kidney tissue (Morris.)* At the beginning of the second decade the first steps in the direction of conservatism were taken, and instead of nephrectomy, less radical operations were made to remedy the disease without sacrifice of the "noble tissue of the kidney," as Tuffier calls it. In 1881 Hahn made nephropexy or nephrorrhaphy for floating kidney thus saving the healthy organ which previously would have been removed.

The most important step, however, and one whose consequences have been most far reaching, covering the entire field of kidney surgery, we owe to Henry Morris, of London, who, on February 11th, 1880, had the courage to operate through healthy kidney tissue and remove an oxalate of lime stone from an undistended, healthy-looking kidney, by an incision through the renal parenchyma.

No operator, prior to this time, had dared to encounter the hæmorrhage which follows incision through healthy kidney substance. Thus stones had been removed only from suppurating and often distended kidneys, where the interstitial nephritis made the incision almost bloodless.

From this important operation of Morris dates the possibility of the development of conservatism which is pressing forward, fighting its way toward the goal of renal surgery, which is the preservation for the patient of all kidney tissue available for secretion.

Morris' operation has made it possible to save the kidney from the destructive influences of the stone; namely, suppuration and dilatation which are finally bound to occur.

I consider Morris' operation on healthy kidney tissue of far greater importance, however, because in addition to allowing resection of the kidney, it paves the way for the exploratory incision which now, in less than twenty years, has grown to be an operation of far-reaching diagnostic as well as therapeutic value.

In the third decade the latest step toward conservatism was made, namely, the surgery of the ureter. This somewhat limited field of surgery has, with the exception of ureterectomy for tuberculosis and septic pyelitis, no other object than to save the secreting kidney tissue above from disturbances from below, due to retention or infection.

In a review of this nature, the time at my disposal will permit me to indicate only a few points in urinalysis and the present status of treatment of surgical diseases of the kidney.

Tuffier's experiments on dogs have demonstrated that the minimum amount of healthy kidney tissue necessary for life, is one to one-and a-half grams for each kilogram of body weight. An adult man should have three hundred grams of kidney tissue; if his weight is seventy-five kilo grams, or one-hundred and fifty pounds, he needs only seventy-five to one-hundred and twelve grams of the three hundred grams of kidney tissue; that is, he can spare two-thirds or three-fourths of the normal amount of kidney tissue before crossing the danger line, and he may live in perfect or

relative health for years during the destruction of the kidneys until the last fourth is reached when sudden uræmia sets in.

When the amount of kidney tissue approaches the lowest limit, the quantity of urea diminishes, although the amount of urine may still be normal. It is therefore a matter of vital necessity to examine the urine for urea before operating.

Compensatory hypertrophy or regeneration of kidney tissue of the healthy kidney when its fellow has been removed or destroyed by disease has been studied experimentally by Tuffier. After extirpation of one kidney he removed by successive partial operations portions of the remaining kidney aggregating in all the weight of the kidney first removed. From this he concludes that as a quantity of kidney tissue equal to both kidneys was removed without disturbing the health of the animal, at least the necessary one-fourth of the kidney tissue must have been formed by regeneration or compensatory hypertrophy.

EXAMINATION OF THE URINE (Bacteriological).—After thorough cleansing of the external genital organs and of the urethra the bladder urine must be withdrawn by a sterile catheter, lubricated with boiled olive oil, and collected in sterile test tubes. If there is doubt whether the pus or blood comes from a diseased bladder or from the kidneys the bladder should be washed out and the urine collected directly from the ureter by means of a catheter left in the bladder. An aspiratory puncture with a fine needle above the symphysis, and removal of the urine through an aspirator syringe, as practiced in Johns Hopkins Hospital, does away with the danger of infection by the catheter and protects against contamination of the bladder urine.

Examination of the collected urine must be made without delay as the urine changes rapidly by decomposition. The reaction, whether acid, alkaline or neutral, should be noted. Microscopical examination after sedimentation by means of the centrifuge may reveal red blood corpuscles, white corpuscles, pus cells, crystals, cylinders and epithe-

lial cells from the urinary tract, or, very rarely, abnormal cells from tumors. Chemical examination should be made for albumin, blood and sugar. If the filtrated, purulent urine contains much albumin, disease of the kidney must be suspected, since the longer the pus cells remain in the urine the more of them will be dissolved.

**Quantitative Examination for Urea.** After the patient has been on nitrogenous diet for some time, a sample from the twenty-four hour urine should be examined, by Esbach's method, for example. The hypobromite solution should always be made fresh. As alkaline decomposition of urine diminishes the urea, the bladder should be washed out, so that acid urine may be voided, and the examination should be made as soon as possible after the urine has been passed.

If the quantity of urea is below normal, as is found in tumor, stone and pyonephrosis, it may be concluded that the other kidney is not healthy, and consequently that operation is dangerous. As an aid in the differentiation between disease of the bladder and of the kidney, and to ascertain from which kidney the blood or pus is excreted, resort is made to cystoscopy. Direct cystoscopy through a tube, the light being thrown into the bladder, previously distended with air, from a head mirror as practiced by Kelly, is useful in women. Indirect cystoscopy is made by means of Nitze's cystoscope, in which an electric lamp in the bladder, previously filled with water, illuminates the bladder wall.

To collect the urine separately from each ureter, we resort to catheterization of the ureter by means of a long, fine, flexible ureteral catheter inserted by the aid of the cystoscope. An instrument devised by Harris for this purpose may be tried.

Direct examination of the kidney through an extra-peritoneal (lumbar) incision is the last step in a positive diagnosis. When the surface of the kidney has been laid bare, we may palpate or aspirate as in cystonephrosis and stone, or excise a piece of kidney tissue for microscopic examination, or we may bisect the organ longitudinally down into the pelvis, in case of stones in the calyces, stenosis, valve formation or abscess. Division of the healthy kidney tissue

even in the median line, causes considerable hæmorrhage, which may be controlled by compression of the renal vessels, by the hand of an assistant, or an intestinal compressor, or directly by packing with gauze.

#### MOVABLE KIDNEY.

An elastic abdominal supporter with a pad under the ribs, together with appropriate internal treatment, should always first be tried, as many patients obtain a sufficient degree of relief therefrom. If this treatment fails, the operation of nephrorrhaphy or nephropexy which was first made by E. Hahn, in 1881, should be performed. The operation is as follows: After lumbar incision and division of the capsule the kidney is laid bare, pushed up into its normal location, and the fibrous capsule, together with a layer of the cortical substance, united with the fascia and outer periosteum of the twelfth rib by three or more sutures. To avoid relapse, however, it is advisable to follow the suggestion of Tuffier, who in addition to the sutures, dissects out a flap of the fibrous capsule two cm. broad and of the length of the kidney, and unites this flap with the borders of the divided muscles. Nephrorrhaphy has a mortality of about one to one and one-eighth per cent; about sixty-five per cent. of permanent cures; in ten per cent. improvement takes place, and relapses occur in twenty-two per cent. of the cases.

#### CONTUSION OF THE KIDNEY. (Subcutaneous rupture.)

Absolute rest in bed for three weeks is essential to avoid the danger of secondary hæmorrhage. Stimulants should be given during the period of shock and morphine for the pain. Local application of cold (ice-bag) is often employed, and Tuffier recommends compression of the costiliac space by a pad of cotton, held in place by a flannel bandage. The patient should be put on light, liquid diet. Ergot, acetate of lead, or other hæmostatics may be employed. It is important to avoid the use of the catheter, and absolutely essential to secure asepsis if the catheter must be used. Hæmorrhage or infection may necessitate operative treatment. Hæmorrhage from the larger vessels may

be stopped by ligature or tampon, but if the whole kidney is found to be crushed it should be removed. Infection may require evacuation of pus by nephrotomy followed by drainage, or nephrectomy if the greater part of the kidney tissue is destroyed, or if the kidney is the seat of multiple abscesses.

#### WOUNDS OF THE KIDNEY.

Gun-shot wounds should be sealed after thoroughly cleansing the skin, and the patient should be kept in bed for at least three weeks. If a large swelling and symptoms of anæmia appear, the kidney should be laid bare and the hæmorrhage stopped by ligature or tampon, or nephrectomy should be made if the renal vessels are injured. Incised wounds with external hæmorrhage should be freely opened and the kidney examined. If the wound is aseptic the kidney can be sutured; if infected the hæmorrhage should be stopped by packing and the wound united later on by secondary suture. If urine exudes, drainage is required. If infection of the accumulated blood and urine occurs as indicated by onset of fever, pain and increased lumbar swelling after eight or ten days, free incision (nephrotomy) or eventually nephrectomy must be made. The hæmaturia almost always stops spontaneously, but if it persists despite rest and ergot, and if copious, the patient's life has been saved by nephrectomy (in five out of six cases: Tuffier). If the bladder is filled with coagula, causing vesical retention, catheterization is usually resorted to, but this is difficult as the clots often occlude the eye of the catheter. It is, therefore, better to use Bigelow's litholapaxy evacuator. If this procedure is unsuccessful, suprapubic puncture and aspiration of the urine and liquid blood may be of assistance during the few days required for the crumbling of the coagula. If aspiration is tried in vain, the bladder must be opened either by perineal section, or, preferably perhaps, by epicystotomy.

#### NEPHROLITHIASIS.

*Medical Treatment* should always be resorted to after operation for removal of stone and when operation is deemed unnecessary or dangerous. In acid lithiasis with urate or

oxalate stones, lithia water, from a pint to a quart a day, and half a teaspoonful of bicarbonate of soda with the meals should be given for six weeks, to be repeated three or four times a year. The alkaline mineral waters, open air exercise, regular diet, no abuse of alcoholics will serve as an outline for treatment. In alkaline or phosphatic lithiasis the urine should be made acid by the use of boracic acid in doses of fifty cgm., or salol in one-third gram doses three or four times a day. Three or four pints of cold boiled water should be taken daily by all patients.

*Surgical Treatment.* The operations for nephrolithiasis are nephrolithotomy, pyelolithotomy, nephrotomy and nephrectomy.

Nephrolithotomy, or removal of stones from a healthy, non-infected kidney, was first made by Morris in 1880. Through an oblique lumbar incision the kidney is isolated, brought out into the wound and palpated in order to feel stones in the pelvis. The stones in the calyces are sought for by puncture with an aspirator needle and if found are removed by an incision made with the needle as a guide. If retention exists, the pelvis is found by aspiration and the kidney opened on its convex surface on the needle as a guide. When the pelvis is opened exploration is made with the finger or metal sound. The stones are extracted after division if they are very large, but always with as little manipulation as possible. The hæmorrhage from healthy kidney tissue is considerable and must be controlled by compression of the vessels in the hilus, or by local pressure with gauze sponges. The thermo-cautery may also be of use as a hæmostatic measure in these cases.

The ureter is then examined with a metal probe to determine its permeability and to detect stones. The stones extracted should be carefully examined to determine whether pieces have been broken off and left in the kidney. If asepsis is certain the wound in the kidney should be united by catgut sutures by which hæmostasis is assured. Primary union may take place.

*Pyelolithotomy.* If the stone is located in the pelvis near the ureter it may be removed through an incision in the

posterior pelvic wall. This operation possesses the advantage that there is no hæmorrhage, but has the disadvantage that stones are more easily overlooked and that the operation is said to be more frequently followed by fistula (Rovsing).

Nephrotomy, or opening into a suppurating kidney to evacuate pus and remove stones if present. The kidney is opened at its most prominent point over one of the thin walled sacs. Exploration is then made with the finger and steel sound for stone. This must be done carefully, as stones were either not found or as all stones were not removed in sixteen per cent. of one hundred and fourteen cases reported by Tuffier. The thin, atrophic kidney wall does not bleed. The wound in the kidney is united to the skin and the cavity packed and drained in order to overcome the pyelitis by local treatment.

Nephrectomy which was formerly much in vogue has been almost entirely abandoned. It possesses the advantage that if the patient survives he is cured by a single operation, but the mortality is thirty-eight per cent. as against thirty-three per cent. mortality for nephrotomy. For this reason, many operators follow the advice of Guyon, first, to make nephrotomy and later on nephrectomy if demanded. This secondary nephrectomy after the lapse of months or years is a relatively safe operation.

Calculus Anuria. When the only useful kidney is closed by stone, nephrotomy, as suggested by Thelen, in 1882, should be done during the period of tolerance. Hot baths, careful massage of the ureter, electricity and chloroform narcosis may be tried for a day or two. If the patient is not operated upon Tuffier and Legueu's statistics show that twenty-eight per cent. recover by spontaneous expulsion and that seventy-two per cent. die, while operation has saved sixty per cent.

#### PYONEPHROSIS AND PYELONEPHRITIS.

Treat or cure the cystitis and overcome the causes of retention, (stricture, enlarged prostate, abdominal tumors, etc.)

Primary hæmatogenous pyelonephritis in a patient who has free passage of urine is amenable to internal treatment. The lines upon which the treatment is based are rest in bed, increased diuresis by drinking large quantities of water or milk and bicarbonate of soda up to thirty grams, daily. (Tuffier). Salol in doses as high as three grams a day has been recommended, but is apt to cause poisoning (hæmoglobinuria). Boric acid and the alkaline waters are safe agents to employ.

When the disease is unilateral or the sepsis acute, operative treatment is indicated. Nephrotomy is the operation of choice; lumbar incision, evacuation of the perinephritic abscess, incision of the kidney, evacuation of pus and stones, division of the partition walls in a multilocular cavity, irrigation, packing with sterile gauze and drainage after suturing the kidney wound to the skin.

If the suppuration persists, secondary nephrectomy may be required. If a fistula remains and the kidney is worth saving, a secondary operation to re-establish the passage through the ureter is required. Primary nephrectomy should be made only when the kidney tissue is filled with multiple abscesses and acute sepsis demands the removal of the organ.

Weir in an article on "The Surgical Treatment of Surgical Kidney" reports seventy-one cases of acute surgical kidney, ascending infection, twelve of which, or seventeen per cent., were unilateral. Thus, if the condition of the patient permit, exploratory lumbar incision may be made on one or both sides and the kidney removed, if needed. He reports a case of gonorrhœal cystitis in a man of twenty-five. During convalescence, acute septic infection of the right kidney occurred. On the eleventh day after the initial chill, the patient had right renal pain. He was taken to the hospital where a diagnosis of ileotyphus was made, and icebags applied for the pain. A swelling appeared in the region of the right kidney. On lumbar incision it was seen that the kidney was twice its normal size. No pus was evacuated on puncture. An incision one inch in depth revealed multiple miliary abscesses and ecchymoses. The kidney was therefore removed, and the patient recovered.

Nephrectomy should also be made in all cases where no active kidney tissue remains. As it is, however, usually impossible during an operation to determine the secretory value of a kidney, nephrotomy should always be first resorted to.

In operations for nephritis, as in all operations on the kidney, it is not permissible to employ poisonous antiseptics. Sterile water should be used and sterile gauze, not iodoform gauze as has been so often recommended.

#### TUBERCULOSIS OF THE KIDNEY.

Internal treatment has symptomatic value only. Operation may effect a cure which will last for years. Nephrectomy, total or partial, the latter being rarely applicable, is the operation of choice. It is applicable when the other kidney is healthy and when the patient's condition as regards tuberculosis in other organs permits. It has, however, been seen that tuberculosis in the bladder has improved after nephrectomy. The tuberculous ureter may be excised with the kidney if the patient's condition permits. Subcapsular nephrectomy with curetting of the adipose capsule has the advantage of being easy of execution but has the disadvantage of not removing all the tuberculous foci.

Nephrotomy for evacuation, curetting and local treatment is recommended by as high an authority as Guyon, to be followed by secondary nephrectomy when the patient's health is improved. Guyon gives the excellent advice on technique of the operation, to suture the divided adipose capsule to the skin before opening into the tuberculous kidney in order to avoid infection of the wound.

Nephrotomy as a curative operation is being abandoned, as not one of the ninety cases reported by Vigneron and Facklam was cured, and as the operative mortality was twelve or thirteen per cent., making the mortality from the disease thirty-three to thirty-eight per cent.. On the other hand, of eighty-eight primary nephrectomies reported by Facklam, 28.4 per cent. died, and 40.9 per cent. resulted in perfect cure; in fourteen cases the patients lived from two to eight years after the operation. No operation should be

made when the urea is diminished below one-third of the normal.

#### MALIGNANT TUMORS OF THE KIDNEY.

Nephrectomy should be made by lumbar incision in case of the smaller tumors, but the transperitoneal operation will be required if the tumors are too large to be removed through a lumbar wound. The tumor is operable if it is limited to the kidney and if there are no metastases in the lymphatic glands. In many cases this cannot be determined, before exploratory incision renders palpation of the organ possible. If it is found that enucleation cannot be completed in perfectly healthy tissue, the operation should be abandoned. The prognosis of the operation is grave; the operative mortality before 1890 was over sixty per cent., but has decreased in the last five years to twenty-five per cent. (Wagner.) Radical cure is rare but the instances are increasing in which a permanent good result is obtained. Israel reports three patients out of eleven operated upon who were in good health after three years. I have one case in which the patient is still in good health, eight years after operation. Local relapses may come on later, after three years or more. Therefore Tuffier gives six years as the time which must elapse before the patient may be said to be permanently cured.

#### BENIGNANT TUMORS OF THE KIDNEY.

Lipomata, adenomata, fibromata, angeiomata, myomata and combinations of these have been found in the kidney. In most cases the tumors are small, give rise to no symptoms and are discovered accidentally on the post-mortem table. Benignant tumors have been removed by nephrectomy in about ten cases only; two of these were adenomata and eight fibromata. (Rovsing.) Serous cysts about the size of a walnut, either solitary or multiple, should be recognized during operation and removed by resection.

Echinococcus cysts are found most commonly in men between the ages of twenty and forty; ordinarily in one kidney only, and most often in the left. There is usually only one mother-cyst which begins in the cortical substance,

causes expansion and atrophy of the kidney tissue, and when large, may extend to the abdominal cavity, becoming adherent to the colon, liver, spleen, etc. Finally after one or two years the cyst ruptures, fortunately most often into the pelvis of the kidney, and evacuates part of its contents through the ureter.

The symptoms are at first vague, the tumor is globular and often movable. Rupture is marked by a sudden pain followed by renal colic as the daughter cysts pass down the ureter and vesical tenesmus when they pass out into the urethra. The cysts are usually crushed during their passage from the kidney, and we find in the urine transparent gelatinous masses, (the sac walls) and a little blood. Microscopic examination reveals the characteristic hooklets and lamellated membranes of the sac. Later on infection occurs which is attended by fever and emaciation, terminating fatally in most cases (twenty-three out of twenty-nine cases, Boeckel), spontaneous recovery being the exception.

*Treatment.*—The cysts should be opened by lumbar or transperitoneal incision, the contents evacuated and drainage maintained until the cavity is closed. The opening in the cyst wall must be united to the skin. Lumbar incision, if practicable, is to be preferred. If the transperitoneal route is chosen, the operation in two stages is preferable. Le Dentu treated nine cases and Wagner twenty-eight cases in this manner, and all the patients recovered; while out of ten cases in which nephrectomy was performed, Wagner reports three deaths, and of eleven cases of puncture alone or puncture with injection of tincture of iodine, three were cured, three remained unimproved and five died.

#### ANEURISM OF THE RENAL ARTERY.

Rovsing reports that only nine well described cases of aneurism of the renal artery are to be found in the literature. The diagnosis was made in none of these cases until an exploratory operation or autopsy revealed the true character of the disease. If the aneurism is located on one of the large intra-renal branches, the swelling is central and causes distension of the kidney. If it is an aneurism of the

trunk of the renal artery, the tumor is located outside of the kidney in the hilus, and pushes the kidney aside without making any change in the shape of the organ.

The symptoms are a rapidly increasing, tense or elastic tumor, with a feeling of heaviness and pain which may radiate down to the testicle of the same side. Pulsation has not been noted in any of the cases. Diagnosis is practically impossible before an exploratory incision has been made. The possibility of aneurism should be considered when, subsequent to an injury in the region of the kidney, a tumor of considerable size develops rapidly with no hæmaturia, especially in patients having arterio-sclerosis or syphilis. The treatment is nephrectomy, after ligature of the renal vessels as close to their origin as possible. Two patients have been saved in this manner. (Hochenegg, Hahn.)

CYSTONEPHROSIS (Hydronephrosis, Pyonephrosis.)

Dilatation of the urinary passages occurs above an obstruction to the free flow of urine. It begins immediately above the point of stenosis and extends gradually backward toward the kidney. Thus, a stricture of the bulbous portion of the urethra causes, first, dilatation of the membranous urethra, next of the bladder, then of both ureters and finally of the pelvis and calyces. If the obstruction is in or below the bladder the dilatation extends to both kidneys, while if the obstruction is located in the ureter or above it the dilatation will be limited to the kidney of the affected side. If only one of the two branches of the ureter is occluded a partial dilatation of the kidney takes place, which is limited to the corresponding half of the organ. Dilatation of the pelvis and calyces above the ureter may be termed cystonephrosis. When no infection of the retained urine has taken place, it contains a watery fluid and is termed hydronephrosis. When infection has transformed the fluid into pus, we speak of pyonephrosis.

(a) *Remittent Cystonephrosis*:—The most formidable enemies to kidney tissue are retention and infection, and it is difficult to state which of the two is the more formidable. Retention, if incomplete; that is, remittent, may, I believe

be tolerated for a long time; if complete, it is rapidly destructive.

In movable kidney with paroxysms of pain, we find upon microscopic examination of apparently healthy kidney tissue, a glomerulo-nephritis or interstitial nephritis. I do not know whether or not this is caused by retention or venous congestion from torsion of the vessels in the hilus. Whatever the cause may be, the development of the nephritis and slow destruction of the glomeruli and consequently of the secretory value of the kidney, furnishes a probable argument for operations for replacement of the kidney, for nephropexy, irrespective of and in addition to the symptomatic relief obtained by it.

Remittent or beginning retention, (and all retention is, in its early stages, as a rule, remittent,) is a condition in which we should always consider the possibility of saving kidney tissue by re-establishment of the free passage of the urine.

The obstruction may be located in the calyces; in a branch of the ureter; in the bottom of the pelvis, or origin of the ureter or in the ureter.

Obstruction in the first two locations causes a local or partial cystonephrosis and demands, for the relief of the condition, bisection of the kidney from its convex surface, and division of the partition walls.

Stenosis at the exit of the ureter (valve-formation, oblique implantation from unilateral dilatation,) requires operations which vary in accordance with the absence or presence of stricture at the upper end of the ureter.

If there is no stricture at the upper end of the ureter, the valve-formation may be overcome by a trans-pelvic operation, (Fenger, Mynter, Trendelenberg, Küster).

If there is a stricture of the ureter at its exit from the pelvis, as may be expected in infected cases, we may resort to extra-pelvic operation, plastic operation, (Fenger); or resection (Küster).

I have twice made the extra-pelvic plastic operation which has also been done by Morris, Kelly, Maurice Richardson and others. The operation consists in division of the

stricture up into the pelvis and down into the ureter and transverse union of the longitudinal wound.

Resection of the strictured end of the ureter and implantation of its upper or divided end into the pelvis has been done by Küster.

If the stenosis or obstruction is located in the ureter, it must be dealt with according to the laws laid down for surgery of the ureter.

There is one drawback or difficulty in the way of the development of surgical treatment of renal retention when the obstruction is located in the kidney and pelvis (to a less extent in the ureter); namely, that the subject cannot be well studied by experiments on animals. We can produce a stricture of the ureter but we cannot artificially produce valve-formation and oblique implantation of the ureter in the pelvis, nor can we cause obstruction in a branch of the ureter or in the calyces. Thus the best methods of operation and development of technique have to be studied and perfected by operation on the relatively rare cases met with in the human subject.

Are the results of these, so to speak, tentative, conservative operations permanent, or does relapse eventually occur?

In four of my cases no relapse occurred:

1. Woman. Valve-formation, intra- or trans-pelvic operation. No relapse six years later.
2. Man. Stricture upper end of ureter, extra-pelvic operation. No relapse six years later.
3. Man. Valve-formation of lower branch of the ureter; extra-pelvic operation; bisection of kidney; division of partition walls. No relapse after three years.
4. Woman. Excision of valve in ureter by my plastic operation. No relapse after three years.

In three cases relapse occurred:

1. Woman. Intra-pelvic operation on valve-formation without stricture. Relapse of stenosis, occlusion of pelvic orifice. Nephrectomy one year later.
2. Man. Operated on by another surgeon; later on by

myself; operation was incomplete, failed, and nephrectomy was finally necessary.

3. Man. Stone in upper end of ureter removed by myself. One year later plastic operation on ureter by another surgeon; six months later I found complete occlusion of the ureter at site of second operation and made another attempt at a plastic operation. Patient still under treatment.

Beginning cases of open, intermittent, non-infected, cystonephrosis, when due to bending of the ureter in a floating kidney, may be treated by nephropexy, provided the bend is found to straighten out when the kidney is replaced. If no bend exists, the sac should be opened and the obstruction sought for by exploring the ureter from its pelvic origin down to the bladder. A valve or stricture may be remedied by a plastic operation or a stone may be removed from the ureter. If it is thus possible to remove the cause the kidney can be saved and should be saved if secreting kidney tissue still remains.

*Infected, Remittent Cystonephrosis, (Pyonephrosis)*, must necessarily be opened for drainage and examined as regards the removal of the obstruction, but here the question of removal of the kidney comes up and if suppurative nephritis, with multiple abscesses in the kidney tissue, is found, nephrectomy should be done, but this is extremely rare.

(b) *Stable, Permanent, Non-Infected Cystonephrosis, (Hydronephrosis)* has been treated by puncture, incision and extirpation, (nephrectomy).

Rovsing has collected from the literature ninety-two operations for hydronephrosis with the following results.

Operation,	Recovery.	Unimproved.	Died.	Total No. of Cases.
Puncture with drainage.....	1	2	9	12
Nephrotomy .....		15	13	28
Transperitoneal primary nephrectomy..	16		3	19
Transperitoneal secondary nephrectomy	7		3	10
Lumbar primary nephrectomy.....	18		2	20
Lumbar secondary nephrectomy.....	3			3

It will be seen from this table that puncture even with drainage is insufficient, dangerous and should be abandoned. Nephrectomy or total extirpation of the hydronephrotic sac

has given the best results and is the operation which should be employed in the majority of cases. Transperitoneal nephrectomy was most often performed in cases in which a large sac filled the abdomen and a correct diagnosis was not made before the operation. If it is known that a hydronephrosis is present the lumbar operation should probably always be done. If the hydronephrotic sac contains no secreting kidney tissue, as is the case in most of the very large hydronephroses, nephrectomy is indicated. A large sac which is practically valueless as to secretion and is clad with mucous membrane is very apt to become infected after nephrotomy and drainage. It is almost impossible in such cases to prevent infection and Rovsing's statistics show that out of twenty-eight cases of nephrotomy, thirteen patients died. In most cases of large, stable hydronephrosis we find the other kidney sufficient for the urinary secretion. This is demonstrated by the fact that out of fifty-two cases of nephrectomy only eight patients died.

In small recent stable hydronephroses, however, when kidney tissue can be recognized in the walls of the sac, and when remittent evacuation, found at first, has recently ceased, we may expect to find secreting kidney tissue that is worth saving. Here nephrotomy should be tried and the obstruction sought for. If the sac is too large to permit of finding the ureter, we may wait for a few months until it has retracted. During this time we must examine the quantity and quality of the urine excreted daily from the lumbar opening. If the quantity is considerable, the obstruction can be sought for and remedied by a secondary operation. If no urine is secreted, secondary nephrectomy should be done.

#### EXPLORATORY INCISION WITH INCISION OF PIECE OF KIDNEY TISSUE FOR MICROSCOPIC EXAMINATION.

Exploratory incision which is probably the most important consequence of Morris' operation on healthy kidney tissue has been developed gradually by mistakes in diagnosis.

Kidneys which presented symptoms of pain and even

attacks of simulated renal colic or hæmaturia, or both of these conditions combined, were laid open under the diagnosis of stone or tumor and none of these conditions were found. The kidney was explored more or less thoroughly by inspection, needle puncture division of capsule, division of capsule, division of cortical substance and even by bisection, laying open the pelvis and calyces.

As it was gradually recognized, according to Albarran, that this operation was without danger, and as almost all authors agreed in this regard, it was natural that it should be resorted to without hesitation. It was still more commonly practised because it was found that in many cases in which neither stone nor tumor was found and in which no definable disease of the kidney could be made out without microscopic examination, which at this time was not made, the operation relieved the pain and hæmaturia and effected a symptomatic and often a permanent cure.

In the course of time, as exploratory incisions for pain and hæmaturia became more frequent, and as the kidneys were more closely observed, some slight pathological conditions were often found to account for the symptoms as well as for the cure of certain of these cases by exploratory incision. Thus, Tiffany found a cicatrix in the upper lobe of the kidney; Barker, oxalate of lime crystals; Abbe, gravel in a calyx, and Lauenstein, dilatation of pelvis and consequently retention.

In cases of the so-called hæmophilia of the kidney for which, since the celebrated case of Senator, the kidney has five times been extirpated, Albarran believes that a careful microscopic examination would often demonstrate the presence of nephritis. In chronic nephritis we may have unilateral hæmaturia, as in the infectious nephritis following *la grippe*.

To relieve the tension caused by pressure in some forms of albuminuria, probably due to non-surgical nephritis, Reginald Harrison advised, in 1896, exploratory operation with puncture or division of the albugineous capsule. With the same object in view, Le Dentu as early as 1881, and Lambret in 1897, found relief of symptoms due to division

of the capsule along the convex border of the kidney by the knife or Paquelin cautery.

To make exploratory incision complete as to its diagnostic value, which may go hand in hand with and be as important as its therapeutic value, it is essential to excise a small piece of kidney tissue for microscopic examination. This has been my custom for years. It is often impossible when we have the divided kidney in our hands to make a correct diagnosis of the apparently healthy kidney tissue with the naked eye. This has been well demonstrated by a series of seven cases operated upon by Oscar Bloch, four of which I will briefly mention:

CASE I. Diagnosis before operation; Stone, slight pyelitis, movable kidney or neoplasm.

Diagnosis during or after operation: Beginning diffuse sarcoma (malignant tumor.)

Diagnosis after microscopical examination of excised renal tissue: Slight nephritis with microbes.

CASE II. Right renal pains for eight years at intervals first of one month, later of a few days only.

Diagnosis before operation: Doubtful whether renal disease exists or not.

Diagnosis after nephrotomy and digital exploration of pelvis and calyces: Chronic, adhesive perinephritis; uncertain renal disease.

Diagnosis after microscopical examination: Parenchymatous and interstitial nephritis.

One year later the patient was suffering no pain and was in perfect health.

CASE III. Diagnosis before operation: Deep peritoneal or retroperitoneal abscess on right side.

Diagnosis after lumbar incision and evacuation of 1400 c. c. of pus: Uncertain as to location and nature of abscess.

Diagnosis after microscopical examination of piece of wall sac: Pyonephrosis (uriniferous canals and tubules found in wall of sac).

CASE IV. Diagnosis before operation but after puncture which evacuated old pus: Pyonephrosis of long standing with closed ureter.

Diagnosis after operation. Chronic nephritis; (yellowish cortical substance; indistinct border line between cortex and pyramids).

Diagnosis after microscopical examination: Normal kidney.

The tumor in this case was a cyst of the spleen.

Albarran reports a case of a man of fifty-one who had had nephritic colic for a year, after which hæmaturia appeared. Upon cystoscopic examination blood was found to issue from the right kidney. Diagnosis: Stone or neoplasm, (not tuberculosis).

Operation: Exploratory nephrotomy, kidney slightly enlarged, pelvis and calyces somewhat dilated and flaccid. Opening through kidney into the pelvis, digital exploration found no stone, "but the finger brings out some fragments resembling false membrane."

A bougie introduced through the kidney passed down freely into the ureter. Wound and kidney closed by catgut sutures and healed by first intention.

Microscopical examination: The false membrane showed carcinoma. The kidney was removed thirty-one days later and the patient recovered.

As regards the technique of exploratory incision it may be said that the kidney should be exposed by a lumbar incision, the condition of the adipose and fibrous capsules noted, the kidney liberated in the usual manner for palpation and inspection, needle puncture if stone is suspected, the fibrous capsule divided longitudinally along the free border of the kidney as far as is deemed necessary by the operator.

Hæmorrhage is controlled by digital compression of the hilus by an assistant or by a clamp. The cortical substance is divided by the knife or cautery, the knife being preferable as it gives a natural view of the cut surface; if it is considered necessary, the division may be prolonged through the pyramids into the pelvis which is then examined by digital exploration. If it is deemed necessary to expose the pelvis to ocular inspection, incision is prolonged through

both poles so that finally the kidney is completely bisected. (Sektionschnitt of the Germans.)

The hæmorrhage which usually recurs as soon as compression of the hilus vessels is released is best stopped by reuniting the bisected kidney by deep and superficial sutures. In an aseptic kidney this can always be done; but when there is suppuration in the pelvis and calyces and the kidney is, consequently, infected, it is wiser to stop the hæmorrhage by packing with sterile gauze after only partial union of the bisected kidney.

There is no question that exploratory incision and bisection of the kidney, and microscopic examination of a piece of its tissue, is the court of ultimate appeal in diagnosis. The question naturally arises whether there is any danger following division of a healthy or only slightly diseased kidney. The danger of infection from without seems to be minimal with our present operative technique, and in fact, so high an authority as Albarran does not hesitate to aver that the operation is devoid of danger, ("ne presente aucun danger").

While I believe that the danger is minimal, still there are two cases on record, and these are, as far as I know, the only ones of the large number of exploratory incisions made, which have presented a peculiarly dangerous consequence; namely, gangrene of the kidney tissue.

CASE I. *Nephrolithotomy—Stone in Pelvis—Primary Suture of Kidney—Hæmorrhage Eighth Day—Local Gangrene of Kidney—Nephrectomy—Death.*—A. B., male, 44 years of age, was admitted to the hospital in my service on May 25th, 1893. Family history negative. Patient's general health was fair until the present trouble began three years before. In August, 1890, after prolonged driving over rough roads, he was seized with severe pain in the right testicle accompanied by vomiting. The pain gradually disappeared and was entirely gone in about two days. Toward the close of the attack he felt slight pain in the region of the kidney. During the next two years he had several attacks usually occurring after severe or prolonged exercise. Following April, 1893, he had almost constant pain, localized in the re-

gion of the right kidney, the pain extending at times down the right leg as far as the foot. No apparent hæmaturia. Under the microscope the urine was found to contain some blood corpuscles and pus cells, but no albumin. The patient had lost about twenty-five pounds in weight during the last year.

*Examination.*—The patient looked reasonably healthy and well-nourished, the color of his face being neither rosy nor extremely pale; no tumor can be felt, slight tenderness upon pressure in the lumbar region; no tenderness on rectal examination of the ureter.

*Operation.*—Under ether narcosis an incision was made from three-quarters-of-an-inch below and parallel to the twelfth rib through the skin, latissimus dorsi and abdominal muscles. After dividing the tendon of the transversalis a mass of paraperitoneal adipose tissue the size of a goose egg bulged out in the wound. After pressing this aside by piercing it with dissecting forceps I reached the retroperitoneal thin fascia covering the adipose capsule of the kidney.

At first I could not feel the kidney and as the operating space was small I divided the quadratus lumborum transversely back to the extensor dorsi and finally reached the lower end of the kidney.

The adipose capsule was thick and so adherent in places that it was necessary to prolong the incision so as to insert the entire left hand. The kidney was then brought down into the wound but nothing abnormal could be seen or felt on its surface, nor could any stones be felt in the pelvis.

Exploration from the convex surface of the kidney by a needle inserted upward, inward and downward was negative as to stone, cavity or urine. A piece of the cortex was excised for microscopic examination.

I next made an incision two inches long on the convex surface of the kidney; the incision was followed by considerable hæmorrhage. It was so difficult to find the cavity of the pelvis that I lifted up the kidney and there saw the ureter on the posterior surface, not dilated, and with no stones in its upper portion. I then succeeded in reaching

the pelvis from the convex surface of the kidney. Examination of the pelvis with a steel urethral sound disclosed no stone, nor could any stone be found on digital examination, but I could feel grating after a flexible lead catheter had been passed in various directions in the lower end of the kidney.

I then extracted the stone which was oval, flat, with a roughened crystalized surface and was one and a half cm. in diameter and one half cm. thick. No more stones could be found on exploration.

A flexible bougie was next introduced into the ureter and passed down into the bladder without obstruction.

I now proceeded to close the wound in the kidney. The hæmorrhage was so profuse that it was necessary to continuously compress the lips of the kidney wound, as every time the compression was removed the blood welled up. I then attempted, without success, to compress the vessels in the hilus. The hæmorrhage was finally checked by the insertion of four deep sutures and the closure of the kidney wound was completed by inserting two surface sutures. The adipose capsule was then drawn over the kidney and drains inserted, down to the kidney surface. The divided muscles were next united in inverse order and the skin sutured down to the point of insertion of the drainage tube and the usual dressings applied. The patient did well for six days when hæmaturia and rise in temperature appeared. After this condition had increased for three days I reopened the lumbar wound and the wound in the kidney and packed the latter down to the pelvis. This checked the hæmorrhage but the temperature continued to rise and in two or three days reached one hundred and four degrees. As a last resort I made nephrectomy. The operation occupied only a few minutes but the patient died ten minutes later.

In the removed kidney was found a cuneiform, gangrenous infarction; about one cubic inch of the kidney tissue was gangrenous and was beginning to separate, thus giving rise to the secondary hæmorrhage.

In the second case the whole kidney was gangrenous and the patient survived.

CASE VII. (Bloch.) Diagnosis before operation: Acute suppurative pyelonephritis of two months' standing, renal tumor, pyuria, fever, probably stone in kidney.

Operation: Nephrotomy; incision in kidney two-and-a-half inches long. No stone found on digital exploration of pelvis. Hæmorrhage profuse, stopped by packing but returned when packing was removed. A pack of gauze was therefore left in the kidney wound.

Microscopic examination of the excised tissue revealed infiltration of leucocytes, interstitial nephritis and parenchymatous degeneration of the epithelium.

Two days after the operation the tampon was removed and serious hæmorrhage followed, necessitating reopening of the outer wound. Ten days later gangrene of the whole kidney, which came away in shreds during the following two weeks and the patient recovered.

In my case of gangrene the supposedly healthy kidney tissue was sutured closely. I attributed the gangrene to the deep sutures, and intended in future cases to abandon deep suturing and substitute packing. Now, however, as shown in Bloch's case, as gangrene may set in after either packing or suturing of slightly diseased kidney tissue, and as greatly diseased kidney tissue, as in pyonephrosis of all degrees, may be divided without gangrene, we may conclude that the cause of gangrene is unknown. These rare cases surely do not contraindicate exploratory operations on the kidney in general.

#### NARCOSIS.

The position of the patient, who is placed on the left side with a pad under the costo-iliac space, causes some embarrassment of the respiratory movements of the thorax and some difficulty to the anæsthetizer, because the face rests with one side on the table, thus making it difficult to watch the pupils and to manage the tongue.

As regards the choice of anæsthetics as between ether and chloroform, after the use of both of which albuminuria and cylinders or cylindroids have sometimes been found in the urine, the investigations of Wood and others seem to

favor the use of ether. Albuminuria followed the use of chloroform in 11.5 per cent. of the cases and of ether in 6.9 per cent. Cylinders were found after the use of chloroform in 34.8 per cent. and after ether in 24.6 per cent. of the cases.

Repeated narcoses at intervals of a few days should be avoided. An examination in narcosis for diagnostic purposes should not be made therefore a few days before operation.

#### TREATMENT OF THE OPERATION WOUND.

Solutions of sublimate and carbolic acid should never be used in these cases as they have a destructive effect on the kidney tissue, causing albuminuria and hæmoglobinuria respectively. When irrigation is required, sterilized water or boric acid or physiological salt solution should be used. The avoidance of the use of iodoform either for dusting over the wound or iodoform gauze for packing or dressing is equally important. The experiments of Stubenrauch have proved that even small quantities of iodoform applied locally to kidney tissue cause extensive fatty and parenchymatous degeneration of the renal epithelial cells. In general iodoform intoxication similar extensive degeneration is found in both kidneys and liver. Fatal iodoform poisoning following nephrectomy has been reported by Isreal and others. In these cases the wound cavity had been packed with iodoform gauze and the autopsy showed fatty degeneration of the remaining kidney.







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