the size and much the shape of a small clenched fist. Like the right kidney, it was surrounded with fat. On section the kidney itself seemed perfectly normal, except that it was encroached upon in its upper part by the tumor, but separated sharply from it by a wall of connective tissue. This kidney was connected with the bladder by a normal ureter, and there is no reason to believe it in anything but a healthy condition. The cut section of the tumor showed that it was composed of various nodules, the center of each of which was in a more or less advanced stage of apparently fatty degeneration. In a few places masses apparently of old extravasated blood were to be found. The growing portions of the tumor were nodules the size of peas, and at the periphery of the tumor. The blood supply of the tumor seemed to be rich, and on carefully dissecting up the renal vein, the tumor was found to have invaded it so as to actually hang into its caliber.

Microscopic examination of this tumor showed that it was a typical struma suprarenalis aberrata of Grawitz. Microscopic examination of the tumors found in the lungs showed that they were of the same character.

A study of the literature of this subject may be summarized in the following conclusions:

1. Remnants of the adrenal body are found in various parts of the genito-urinary tract in a large per cent. of all postmortems (90 per cent.)

2. The suprarenal capsule or adrenal body is a ductless gland essential to life. It secretes a substance which slows the pulse, contracts the capillaries, and removes the pigment from the skin. When it is destroyed or removed, the patient dies, or if partially destroyed, he takes on the condition recognized in Addison's disease. When the adrenal body is greatly increased in its function, the skin is blanched, the heart's action is increased in power, but slowed, and the capillaries are contracted, and the whole vascular system undergoes the degeneration of arterio-sclerosis.

3. About one-third of all the tumors of the kidney appearing in adult life are of adrenal origin, but only a small proportion of these show a tendency to metastasis, and these metastatic foci are usually confined to the lungs or to the bones, and only rarely are they found in both places.

4. A few of the adrenal tumors produce the symptoms of poisoning with the adrenal extract. The poisoning does not always seem to be proportionate to the size of the tumor.

5. The removal of the tumor before metastasis takes place results in subsidence of the symptoms of poisoning. The tumors may be removed without loss of kidney substance, or by a complete nephrectomy.

CLINICAL RESULTS OBTAINED BY THE USE OF MY INSTRUMENT FOR COL- LECTING THE URINE SEPAR- ATELY FROM THE TWO KIDNEYS.

Presented to the Section on Surgery and Anatomy at the Forty-ninth Annual Meeting of the American Medical Association, held at Denver, Colo., June 7-10, 1898.

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A description of my instrument for obtaining the urine separately from the two kidneys was published first in the JOURNAL OF THE AMERICAN MEDICAL

ASSOCIATION, Jan. 29, 1898, and again in *Medicine* in April, 1898. The object of the present paper is to present a few clinical facts obtained by the use of the instrument, which demonstrate its advantages, applicability and reliability.

Case 1.—Mrs. D., age 31 years, American, without particular hereditary tendency. Except for present trouble she has always been a strong, active, healthy woman. About four years ago she began to have pain in the lumbar region. The pain was dull and intermittent and increased by violent exercise such as dancing, driving or riding in the cars. The attacks of pain increased in frequency and severity and in a year or two the urine after exercise, particularly dancing, was very dark in color and there would be a desire to urinate frequently. Twice she had attacks of severe pain in the left lumbar region followed by the passage of a small calculus. The pain in the back became almost constant and she was obliged to discontinue all exercise on account of the great increase of pain and hematuria excited thereby. The urine contained blood almost constantly, although, except following exercise, it was so slight in amount as to require the microscope for its detection.

On Feb. 14, 1898, by means of my instrument I collected the urine separately from the two kidneys. An analysis of the urine thus collected is as follows:

	Right kidney.	Left kidney.
Amount collected in 20 minutes...	12 c.c.	10 c.c.
Color.....	Clear amber.	Cloudy, very light brown.
Reaction.....	Neutral.	Strongly acid.
Urea.....	0.7 per cent.	1.2 per cent.
Albumin.....	Slightest possible trace.	Small amount.
Microscope.....	Negative.	Red blood cells abundant; numerous flat epithelial cells, singly and in masses of several hexagonal cells; few leucocytes.

This analysis pointed very conclusively to the left kidney as the seat of the trouble, and taken in connection with the history made a diagnosis of renal calculus certain. One very interesting point shown by the analysis is the marked difference in the reaction of the urine of the two kidneys secreted at the same time. That from the right side being *neutral* while that from the left side was *strongly acid*. As the reaction was taken at once before secondary changes could take place an interesting point is thus brought up, namely, to what extent local conditions within the kidney may influence the reaction of the urine. It may be mentioned here, as adding to the interest and importance of this point, that the calculus found in the left kidney was composed of almost pure uric acid. As the patient had received prolonged medical treatment without benefit surgical measures were decided upon and on March 8, 1898, an incision parallel with and one centimeter below the twelfth rib was made, exposing the left kidney, which was cleared of its surrounding fat. Nothing abnormal could be detected by sight or palpation of the kidney. The pelvis of the kidney was then opened by an incision along the convex border. In passing through the substance of the kidney a small abscess containing six to eight cubic centimeters of thin light brown pus, was evacuated. A calculus was found lodged in one of the calyces and removed. It was only with considerable difficulty that the calculus was found and removed even after the finger had free access to the pelvis. The pelvis of the kidney was washed with hot sterilized water, the kidney sutured with catgut and the incision closed in layers, except at the angle, where a small iodoform gauze packing extended down to the kidney. This was removed on the second day. Healing followed *per primam* with perfect recovery.

Case 2.—Mr. H., American, age 37 years, family history good, never had any illness prior to present trouble, except gonorrhea, which he had had several times. About two years ago, following shortly after an acute attack of gonorrhea he

had a severe illness lasting about six weeks. It was attended by fever, pain in the right side of the abdomen and right lumbar region. During this illness there was a sudden discharge of a large quantity of pus with the urine. He has never been well since this acute attack although he has been around and able to do some work. He has suffered almost constantly from pain in the right lumbar region, frequent urination, which is better and worse at times, and occasionally has spells of fever with chills, sweats, etc. There is pus in the urine constantly. Is pale, anemic, considerably reduced in flesh, and quite weak. His temperature varies from 100 to 103.5 degrees F. He sleeps poorly and has frequent night sweats; appetite poor; no cough. He urinates frequently, without difficulty. The urine contains considerable pus, although he says it is now what he calls quite clear, not containing as much pus as it does at times. Upon examination a large, rather firm, quite fixed tumor is easily felt in the region of the right kidney. All other organs appear to be normal. A clinical diagnosis could be made of cystitis with pyonephrosis of right kidney, probably of gonorrheal origin.

The main questions to be determined were: Is the left kidney already involved, and is it able to do the work alone, provided the right kidney be removed? To determine these points, on Feb 19, 1898, I collected the urine with my instrument. Owing to the presence of the cystitis, the bladder was thoroughly irrigated with sterilized water after the instrument was introduced and fixed in position. The urine all came from the left side, not a drop was found to come from the right kidney. The analysis of the urine thus obtained showed: amount in twenty minutes 14 c.c.; perfectly clear, dark amber, acid; urea 2.3 per cent.; albumin, very slight trace; very few flat epithelial cells, scattering leucocytes and a few cylindroids. The value and efficiency of the instrument are clearly demonstrated in this case.

Notwithstanding the existence of cystitis and a large amount of pus in the urine, we were enabled, by the instrument to attain perfectly clear, practically normal urine from the left kidney. It demonstrated to us that the left kidney was normal and that it was doing all of the work. The amount collected, 14 c.c. in twenty minutes, is equivalent to 1008 c.c. in twenty-four hours. By actual measurement the amount passed in twenty-four hours was 1057 c.c. This again shows that the left kidney was doing all the work, and demonstrates how perfectly the septum is formed by the instrument in the bladder. It being satisfactorily shown that the left kidney was normal and able to carry on the work alone the patient was operated on Feb. 21, 1898. A long oblique incision was made beginning near the outer end of the twelfth rib and extending downward and forward internal to the anterior superior spine of the ileum. The kidney was found embedded in an immense mass of thickened, firm, connective and adipose tissue containing numerous foci of suppuration. One large perinephritic abscess containing from 100 to 200 c.c. of thick yellow pus was evacuated. It lay between the superior pole of the kidney and the inferior surface of the liver. The kidney was found to be a mass of innumerable small abscesses. There was no dilatation of the pelvis. The whole kidney was so involved in a dense connective tissue mass that no pedicle composing the vessels for ligation could be formed. Two large angular clamps were therefore applied to grasp the renal vessels, and the kidney with considerable of the connective adipose mass removed. The clamps were left in place and the wound packed with plain sterilized gauze. Considerable shock followed the operation and for forty-eight hours the patient was quite low. At the end of this time the clamps were removed. He

now began to improve rapidly, temperature became normal, and he left the hospital March 12, less than three weeks from the date of operation, with the wound almost healed. The cystitis improved remarkably, the urine, which he was passing freely, contained but very little pus when he was discharged.

Inoculations made from the perinephritic abscess on blood serum agar developed a diplococcus resembling the gonococcus, which died out in the second generation. The kidney upon examination was found to be tuberculous and the secreting portion practically destroyed.

Case 3.—Mrs. S., age 39 years, American, has been suffering many years with what was supposed to be cystitis. She had painful and frequent urination with pyuria, the frequency becoming so great that she was obliged to wear a urinal constantly. She also suffered with a burning pain in the sacral region, which frequently extended into the thighs. She had some pain in the lumbar region, which was always referred to the left side and no pain on the right side. She was treated for years for bladder trouble, receiving all manner of irrigations, local application, etc., without benefit. She then came into Dr. J. Frank's hands, who, upon cystoscopic examination, decided for the first time that her trouble was not located in the bladder. Dr. Frank tried cauterization of the ureters, after Kelly's method, and, although he succeeded repeatedly in catheterizing the left side could never succeed on the right side. There was no tumor to be felt in the region of the kidney on either side, but some pain was always referred to the left side. Through the kindness of Dr. Frank I was asked to examine her with my instrument. This was done, March 10, 1898, with the following result:

	Right.	Left.
Amount collected in 20 minutes.	8 c.c.	10 c.c.
Color	Pale, milky, cloudy.	Clear, light amber.
Reaction	Neutral.	Acid.
Urea	0.05 per cent.	1.05 per cent.
Albumin	Well marked quantity.	Small amount.
Microscopic	Pus-scattered cells and in large clumps or masses. Few red blood cells.	Few flat cells and an occasional leucocyte.

No bacteriologic examination was made.

The examination demonstrated conclusively that the disease was located in the kidney and in the right one alone; the left kidney was secreting practically normal, healthy urine notwithstanding the fact that the pain had always been referred to the left side. The character of the fluid obtained from the right side, thin, purulent, albuminous, neutral, 0.05 per cent. urea, showed that the secreting portion of the kidneys must be almost entirely destroyed with little else than a pyocystic condition remaining.

Upon the results of this examination Dr. Frank removed the right kidney March 19, 1898. He found the kidney practically destroyed, nothing but a multiple, cystic, purulent, tuberculous mass remaining. The ureter was much thickened and dilated. The patient recovered. This case illustrates a very important point which has been observed before, namely, the pain is not always referred to the diseased side. This patient never complained of pain in the right kidney, the diseased one, but always in the left kidney, the apparently healthy one.

Case 4.—Mr. S., age 30 years, decorator, good family history, never seriously ill and no sequelae to the usual diseases of childhood. States he had a serious and continuous hematuria eight years ago, which persisted for eighteen months, then ceased. Four years ago he had a severe fall on the walk, but noticed no trouble from it. Two years since he again noticed the hematuria for which he consulted an eminent specialist who made a cystoscopic examination, thought he saw a papilloma of the bladder and advised exploration. The patient drifted away and after two years consulted Dr. Whitfield who referred him to Dr. L. L. McArthur for diagnosis.

Examination revealed a somewhat anemic condition of a

young man of good physical development without a subjective complaint. Blood examination showed lowered blood count, relative proportion normal. No plasmodium. The urine was constantly bloody, although the amount of blood present varied somewhat from time to time. It was always intimately mixed and unaccompanied by clots of any dimension. The amount of urine in twenty-four hours was 543, sp. gr. 1020, and albumin; no sugar; no pus. Microscopic examination showed no elements except the blood and an occasional blood cast.

Through the kindness of Dr. McArthur, I had an opportunity to use my instrument on the patient. The result was most satisfactory and very striking. The urine from the right kidney was perfectly clear, and normal in every respect while that from the left kidney contained all of the blood, demonstrating absolutely the left kidney as the source of the hematuria.

These four cases are by no means all that have been examined as I have made now some forty examinations. Each of the four cases mentioned, however, illustrates some particular point and taken together they demonstrate the wide range of applicability of the instrument.

Case 4 is an absolute demonstration of the completeness and perfectness of the septum or watershed formed in the bladder. A more beautiful demonstration could scarcely be imagined; in one vial the red, bloody urine, while in the other perfectly clear, normal urine.

Case 2 demonstrates the fact that clear normal urine can be obtained from the kidney notwithstanding the presence of a purulent cystitis.

In Case 3 the use of the instrument led at once to a correct localization of the disease and the side involved, when the symptoms all pointed to the opposite side as the one probably diseased. This much for the clinical aspect of the subject. Concerning the mechanical use of the instrument it may be said that this is not difficult. A few simple rules that have been sufficiently detailed elsewhere are all that are necessary to follow. Most of these are such as would naturally suggest themselves to any intelligent physician attempting to use such an instrument. Some may appear trivial but all of them have been found by actual experience to be necessary in order to guard against a possible error or to facilitate the use of the instrument. By following these simple rules I feel certain the results will be most gratifying and the necessity of laying both kidneys free on the back to determine the presence and extent of disease in them as recently recommended by Edebohls (*Annals of Surg.*, 1898, xxvii, 425) will no longer exist.

DISCUSSION.

Dr. McARTHUR of Chicago—I have used this instrument and bear willing testimony to the excellent results. Very few of us who have attempted ureteral catheterization have done so without experiencing great difficulty, but it is now easy to obtain the urine in two separate bottles, and I have been charmed with the result. Take the case of a man who has passed bloody urine for years without any symptoms clinically or any evidence microscopically of a disease, and you have a case that will at first puzzle you. In such a case, to have two bottles of urine side by side will convince you that the blood is coming from above, and that the trouble is in the kidneys. In the same way an enormous tumor of the right side, which needs to be diagnosed from a cyst of the gall-bladder or a cystic kidney of the right side, will be proven—although previous examination of the urine has shown nothing of interest—to be a cystic kidney, and not a cyst of the gall-bladder, by the total absence of any urine from that side. An incision can be made and the diagnosis confirmed.

INJURY TO PERIPHERAL NERVES AND THEIR SURGICAL TREATMENT.

Presented to the Section on Surgery and Anatomy at the Forty-ninth Annual Meeting of the American Medical Association, held at Denver, Colo., June 7-10, 1898.

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MILWAUKEE.

It may be stated without fear of successful contradiction that the subject of injury to peripheral nerves is one which has not received any very extensive consideration from surgeons. It is indeed true that the frequency of nerve injury is not great when compared with injury to bone, muscle, artery or vein, but when such an injury does occur, especially if to a principal nerve, the importance of the injury is unquestioned. If a motor nerve be divided, its function throughout the area of its distribution is at once arrested, and this loss of function, excepting some slight restoration which may come from anastomosing branches, remains until the continuity of the nerve fibers has been re-established.

The opinion almost universally held by pathologists and surgeons is that certain characteristic changes occur in a peripheral nerve after division, these changes being more pronounced in the terminal than in the central portion of the divided nerve. The changes consist in the breaking up of the medullary sheath into fat drops, and their absorption with a disappearance of the axis cylinder, the neurilemma sheaths alone remaining. It is also generally accepted that following the section of a nerve, if it be properly sutured, regeneration commences in the central end by a splitting up and growth of the axis cylinders which are projected to and through the neurilemma sheaths to the very peripheral portion of the nerve; following this medullary sheaths are formed around the axis cylinders. Some hold that regeneration is effected through the nuclei of the neurilemma.

It was for the purpose of determining, as far as possible the extent of nerve degeneration after section, and the manner of the regenerative changes, as well as the best method of surgical procedure in divided nerves, that I undertook a large number of experiments upon the sciatic nerve of different animals. Eighty-five sections of the sciatic were made, and seventy specimens were taken and examined, both macroscopically and microscopically. So far as my experimental work goes it seems to demonstrate that the presence or absence of degenerative changes in a divided nerve depends very largely upon the treatment instituted, and also, to some extent, upon the state of health of the animal operated upon.

If a divided nerve be immediately sutured, or if a gap caused by resection be immediately bridged with some suitable material, and the work be done aseptically and properly, but slight degenerative changes will take place either in the distal or proximal portion of the nerve; and the nerve's function will, in the great majority of cases, be quickly re-established.

On the other hand, if the nerve ends be not approximated, if an interval caused by resection be not bridged, or if suppuration occur in the wound, then pronounced degenerative changes will occur in the nerve, more especially in the terminal portion, and a restoration of function will not occur. In opposition to the oft-repeated statement that "a divided nerve will first degenerate throughout its entire peripheral extent, and be absorbed and following this, regenera-