Nephrectomy for a large aneurysm of the right renal artery : with a résumé of the twelve formerly reported cases of renal aneurysm / by W.W. Keen.

NEPHRECTOMY FOR A LARGE ANEURYSM OF THE RIGHT RENAL ARTERY, WITH A RÉSUMÉ OF THE TWELVE FORMERLY REPORTED CASES OF RENAL ANEURYSM.

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NEPHRECTOMY FOR A LARGE ANEURYSM OF THE RIGHT RENAL ARTERY, WITH A RESUME OF THE TWELVE FORMERLY REPORTED CASES OF RENAL ANEURYSM.[1]

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HAVING recently encountered the following case of a very rare surgical disorder—a very large aneurysm of the renal artery—I have taken occasion to gather together all the reported cases as a basis of a brief consideration of its symptoms, diagnosis, and treatment.

CASE 1.—*Large Aneurysm of the Right Renal Artery; Operation; Recovery.*—Miss A. B., aged 45, first consulted me January 27, 1900, at the instance of Dr. William H. Mercur, of Pittsburg, and Dr. de Schweinitz, of Philadelphia. Her menstruation has recently become irregular. She has never had any serious illness, excepting typhoid pneumonia, 8 years ago Her family history is good except that a paternal aunt died of tuberculosis. Her occupation, literature, is such that she has never been exposed to unusual physical strain nor has she ever had any accident. About 5 years ago, she noticed on the right side of the abdomen a sense of discomfort and had the first of the series of 10 or 15 attacks of the kind described below. Two of these were very severe; one lasting about 10 days, and another about 5 weeks, though she continued her public lectures in spite of them. The attacks began with chilly sensations, followed by nausea, but usually without vomiting. There was considerable fever, the temperature rising in one attack to 105°. They had usually been considered "bilious attacks," most of them passing off in two or three days. She has never been jaundiced and never noticed any gallstones in the stools. For several years, possibly more than four or five, she has noticed that the right side of the abdomen was apparently a little fuller than the left, but she thought that it was a normal condition. Her present illness began on January 14, yet in spite of her ill-

[1] Read before the American Surgical Association, in Washington, May 8, 1900.

ness, she has given three lectures Dr. Mercur states that her gall-bladder he thinks was enlarged at this time in addition to the presence of the tumor in the right abdomen which he discovered and judged to be cystic. She has noticed no blood in the urine until the morning of the day when I saw her, when there was a slight amount passed. She has had no pain in the tumor, nor is it tender. She thinks that very slight variation in the size of the tumor has occurred, but this has had no relation to the amount of urine that she passed.

I learned later from Dr. Wharton Sinkler, of Philadelphia, that he had been called to see her in a severe attack about five years ago when he made a careful examination of the abdomen, finding the right kidney movable and slightly enlarged.

Physical Examination.—The moment that the abdomen was uncovered the right side was noticed to be very much enlarged. Palpation showed a tumor which was tense, not nodulated, apparently cystic, at least toward the inner side, but firm externally. It was not tender, was somewhat freely movable though within narrow limits, lay in the right side of the abdomen filling the entire distance between the border of the ribs and the iliac crest. It extended from the right flank to about 5 cm. to the left of the middle line. (Fig. 1.) By palpation reciprocal pressure was felt anteriorly and posteriorly. The gall-bladder was not distended.

Diagnosis.—A partially cystic tumor of the right kidney, probably due to hydronephrosis, with a possibility of a sarcoma or other neoplasm. I advised exploratory operation which would probably involve a nephrectomy.

On entering my hospital, the amount of urine was small, 28 ounces, but under the use of Poland water it rose in the next 24 hours to 56 ounces, in addition to a small amount passed with one stool. Professor Coplin examined the urine and reported on January 30 that it was turbid, amber-colored, sp. gr. 1.020, acid, neither albumin nor sugur were present, urea 1.1%. By the microscope only a few leukocytes, squamous epithelial cells, granular debris, and an abundance of amorphous urates were present. No casts, crystals or blood were found, and no tubercle-bacilli could be demonstrated.

Operation February 1.—A vertical incision 6 cm. long was made over the center of the tumor. As soon as the tumor was reached it felt soft and almost fluctuating, yet did not have the appearance or the feel of a sac containing fluid. I punctured it with a pair of hemostatic forceps. Nothing escaped but blood. The descending colon lay to the left of its center and was adherent to it by the mesocolon. As soon as the outer layer of the mesocolon was torn through, the tumor was readily isolated and finally delivered through the incision which had now been prolonged to 17 cm. The

pedicle was so broad that it had to be secured in seven different sections, the arteries being numerous and large and the veins especially enormously distended. During the operation, as there was a possibility that the other kidney would not be equal to its work, Dr. J. Chalmers Da Costa, who with Dr William J. Taylor and Dr. George W. Spencer, was assisting me, transfused a quart of normal salt solution

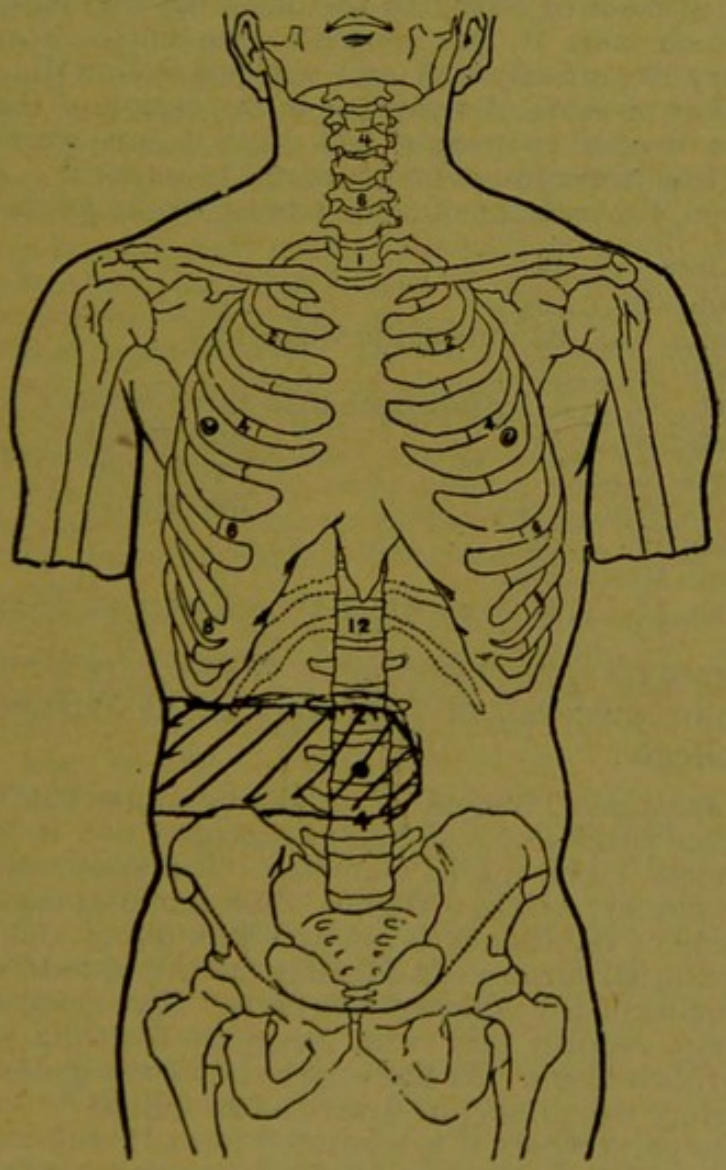

Fig. 1.

into the veins of the left arm. In spite of the injection of the salt-solution, and also the fact that not over 4 ounces of blood was lost, she was very profoundly shocked. Oxygen and chloroform were used as the anesthetic instead of ether on account of the possible effect of ether on the other kidney. The operation lasted less than 30 minutes. I had

intended prior to the nephrectomy to determine the presence of the other kidney, but the tumor was so large and the difficulty of introducing the hand beyond it into the abdominal cavity so great that I quite forgot to do so. The appendix was examined, found normal and was not disturbed. The wound was closed without drainage. After the operation, the temperature fell to 97.2°, by the fifth day it had reached 100.6,° by the ninth day had fallen to 99°, after which time it was normal. She left the hospital on February 19 perfectly well and without feeling the slightest discomfort or sense of weakness in the region of the tumor. She was directed to wear a belt until it was worn out, by which time it would not be necessary to renew it. After the operation, the amount of urine passed was as follows:

Date.	Oz.	
Feb. 2	39½.	
Feb. 3	32 plus urine with stool.	
Feb 4	21.	
Feb. 5	17½ plus urine with	three stools.
Feb. 6	4½ " " "	four stools.
Feb. 7	6 " " "	five stools.
Feb. 8	11½ " " "	one stool.
Feb. 9	22.	
Feb. 10	23½.	
Feb. 11	23, from which time it became normal.	

Macroscopic Description of the Tumor, by Prof. W. M. L. Coplin, professor of pathology at the Jefferson Medical College:

The specimen consists of a kidney somewhat flattened out on the surface of a globular mass on which it lay. The whole mass is 14.5 cm. in diameter. The specimen, including the kidney, weighs 970 gms. The globular mass to the inner side of the kidney is soft and fluctuating and presents on its external surface considerable fat and shredded tissue, the remains of the adjacent soft parts. The color is for the most part reddish pink with irregular mottling of purple and purplish black. At the upper end of the globular mass is an artery which may be described as follows:

At the point where it is separated from its connection the lumen is 0.35 cm. Macroscopically it is quite normal. From the point of attachment to the tumor it is directed downward and outward. At a distance of 3.1 cm. it divides into two branches, the superior being the larger. Its position is such as to preclude absolutely accurate measurement, but its lumen is apparently 0.15 cm. It projected downward and outward and entered a cavity just above the point where the ureter comes off. The lower branch passes downward and toward the renal pelvis and 0.5 cm. from its origin divides into two branches. The smaller one was an extremely min-

ute vessel, not over 1 or 2 mm. in diameter. The larger branch passes downward toward the pelvis of the kidney, but could not be traced into that structure.

The kidney resting upon the surface of the globular mass already referred to, is a crescentic body with what appears to have been the pelvis flattened against the globular mass. The surface of the capsule is shredded, evidently the result of the separation of adhesions The kidney measures over its convexity 12.5 cm , and from the capsule to and including the pelvis, a little less than 3 cm.

An incision was made through the entire mass, extending from the convex surface of the kidney nearly through to the globular mass, permitting the separation into two almost equal parts (See colored plate) The tumor proper is found to consist of a large central mass of coagulum and a capsule. The latter is apparently continuous with or partly adherent to the pelvis and capsular tissues of the kidney, and varies in thickness from 0.15 to 0.35 cm. The density and resistance of the capsule varies In some areas it is intensely fibrous and cannot be torn or pinched through. At other points it is softer, cuts with little resistance, and can be broken through. At and near the kidney it contains small bloodvessels, but at the cut edge in other areas no bloodvessels are visible. At various points the wall contains fat which is on the outer surface and at no point does it penetrate the wall.

The larger part of the tumor (contained within the sac just described) is formed of laminated blood-clot. The different parts of the clot are evidently of different ages. On the side next to the pelvis of the kidney the clot is lighter in color than at the opposite side of the clot. From the lower portion of the sac nearest the pelvis (so far as can be determined the cavity containing the clot does not communicate with the pelvis) the laminae radiate from a single point, passing off as fan-like bands. From this center they commonly become broader and often separate as they pass toward the opposite side of the tumor. Between the laminae are more or less recent blood-clots, some of which are soft and jelly-like and at the upper portion of the kidney are still fluid. One-half of the clot was cautiously loosened and lifted out of the portion of the sac next to the pelvis of the kidney in order to determine, if possible, from within the sac the point of communication with the bloodvessel. The outer surface of the removed clot is irregular and resembles somewhat in appearance a half of the cerebrum. The base and that portion which would correspond to the occipital lobes are composed of rather recent coagula,while the area which would correspond to the motor area of the brain and slightly anteriorly is evidently older and almost completely decolorized fibrin. Running over this area from the base toward the superior surface is a Y shaped body, the appearance of which

strongly suggests that it is an artery, as a section shows a lumen filled with a clot. The lower arm of the Y is 2 cm. long and each of the upper arms about the same length. The long arm of the Y is probably 0.2 cm in diameter, the smaller arms are little over one-half that size. The lower branch of the renal artery already described passes into the cavity of the tumor at a point which corresponds approximately to the point at which the main branch of the Y-shaped artery ends (See plate.)

The capsule of the kidney strips off with its usual readiness. The cortical and medullary portions are a little darker in color than normal and the papillae are flattened and partially surrounded by the pelvic flap. The pelvis itself is small, the ureter was located with difficulty, but found to pass downward in its normal position. (See plate.) It was adherent to the globular sac already described, but easily separated from it.

Cubes of tissue from the kidney, aneurysm wall, and from the clot in the aneurysm were fixed in Heidenhain's solution, embedded in paraffin, sectioned and sections stained with hematoxylin and eosin, hematoxylin and picric acid, and toluidin-blue.

1. Microscopic examination of sections from the kidney. The capsule is thickened and shows a slight lymphoid-cell infiltration. Many of the Malpighian tufts are flattened, and show a slight lymphoid-cell infiltration and areas of hemorrhage. Its capsule shows little change. The tubules are normal in a few areas, but in the greater part of the section the epithelial cells have desquamated, and with the exception of a few which are dilated, their lumina are smaller than normal. In passing toward the pelvis these changes are more marked. In this area many of the tubules contain a material that takes the acid stain, is homogeneous and resembles hyaline material, and in all probability is necrotic and degenerated epithelium. In various areas throughout the whole section there is an increase of fibrous tissue. Near the pelvis are a number of cysts. The largest of these is 0.5 cm. in diameter, and with the exception of a few places the walls are formed by a connective tissue membrane not covered by epithelium. The few recognizable epithelial cells remaining attached to the wall are of the low columnar type Its lumen is empty. In the smaller cyst the epithelial cells, which are cylindrical in type, are still in situ,—at least most of them remain attached to the wall. Some of the cysts show papillomatous projections from one or more aspects of the cyst wall, and barring a few desquamated epithelial cells their lumina are unoccupied. One of the striking features of the sections is the extraordinary thickness of the bloodvessel walls, especially of the intima Most of the bloodvessels are empty, while a few contain some erythrocytes and leukocytes Scattered

throughout the section a small amount of blood-pigment is found.

2 Sections from the wall of the globular mass:—The outer margin of the wall is formed by an irregular layer of a rather dense fibrillated membrane frayed out externally and internally continuous with the mass of blood-clot In many places the blood is infiltrating the wall, and older areas of hemorrhage can be recognized by the presence of deposited pigment and the detritus resulting from the erythrocytolysis At a number of points the wall is apparently formed by blood clot in process of organization The adjacent clot contains nothing deserving of special mention; structurally it is composed of the cellular and fibrinous elements usually present in such masses

3 Sections from the clot show masses of fibrin arranged in lamellae; the superficial layers are evidently older, although in the deeper part of the section are to be recognized similar layers. The cavities formed by the layers and many spaces within them contain collections of red and white cells

Diagnosis.—False aneurysm of a branch of the renal artery. Pressure atrophy of the kidney.

Following this I give an abstract of all the cases that I have been able to discover in the Index Catalogue of the Surgeon-General's Office and also by the courtesy of Dr. J. C. Merrill, U. S. A.

Case 2.—*Traumatic Aneurysm of Left Renal Artery.*—D. Solomo Constantinus Titius De renum Vitiis, Aneurysmatis Arteriae Renalis Sinistrae Exemplum Vitebergae, 1798. The aneurysm resulted from the fall from a horse and proved fatal after four years. The patient was a doctor. No details of the case are given.

Case 3.—*Aneurysm of the Left Renal Artery Bursting into the Pelvis of the Kidney and Followed by Fatal Hemorrhage.*—Gossett (*Lancet*, 1829–30, i, 388.) A woman, aged 43, on September 9 had an attack of rheumatic fever. She recovered in a few days, but pain and tenderness over the left kidney persisted. On September 16 she had marked dysuria and then voided a considerable quantity of blood. September 20 a very large quantity of arterial blood was voided, so that she was at the point of death. The blood was first thought to come from the uterus. Examination by the rectum showed a pendulous body of a gelatinous consistence behind the uterus. The os uteri was contracted. This mass was found to be a flaccid bladder filled with blood. She died September 25. At the necropsy an aneurysm of the left renal artery was found. It had burst into the pelvis of the kidney. There was a coagulum of from 16 to 18 ounces in the bladder. The other viscera were healthy. No description of the aneurysm is given.

Case 4.—*Aneurysm of the Right Renal Artery.*—Leudet, *Compt-s rendus Société Biol.*, Paris, 1852 iv, 159, *Bull. Soc. Anat*, 1852, xxvii, 457, and *Gaz des Hôp*, 1852, 583. The three references are all to the same case. The aneurysm was found at the necropsy on the body of a woman, aged 62, dying of nephritis two days after admission Her illness had existed for two years, with general debility, but no edema of the legs or face. Two months before death there was marked aggravation of the dyspnea and cough, edema and finally coma appeared before death. The right kidney was less than one-half the size of the left, which was somewhat enlarged and in the renal artery, at its bifurcation, an aneurysm the size of a bean (haricot). Its interior was filled with semisoft, yellowish material, but no fibrin or blood. The arterial walls were calcareous.

Case 5.—*Small Aneurysm of the Right Renal Artery.*—Danner (*Bull. Soc. Anat.*, 1856, xxxi, 170). The patient was a gouty man, aged 66. In the right kidney the arteries were calcareous. At the bifurcation was an aneurysm the size of a nut (noisette). The contents were of a blackish color and somewhat adherent.

Case 6.—*Small Aneurysm of a Renal Artery.*—(*Catalog Museum St. Barth. Hosp*, London, 1882, i, 234, specimen No. 1536.) "Portion of a renal artery with a small aneurysm. Earthy matter is distributed in the coats of the sac and the adjacent walls of the artery appear thickened and indurated."

Case 7.—*Large Aneurysm of the Right Renal Artery.*—Armstrong (*Am. Jour Med. Sci.*, October, 1885, 435). Armstrong believed the case to be unique. A man, aged 50, was admitted to the hospital comatose and died a few hours later. Necropsy. Free blood (300 cc.) was found in the abdomen and a large clot under the liver. The right kidney was enlarged and there was a circumscribed peritonitis around it. The capsule was ruptured posteriorly, and this was the source of the hemorrhage into the abdomen. On incision, the enlargement of the kidney was found to be due to a black, easily disintegrated clot, within which lay the kidney. The clot consisted of 900 cc. of blood. "The kidney was slightly eroded on its surface, and in the external border was a small spherical cavity, about 1 mm. in diameter The tubules were pressed away, not destroyed, and there was a well-organized fibrinous clot. This was the *fons et origo* of the hemorrhage; and as it contained the only well-formed fibrin that existed in the exudate, and from its shape, I considered it an aneurysm of an interlobular artery." The left kidney showed chronic nephritis.

Case 8.—*Traumatic Aneurysm of the Right Renal Artery.*—Turner (*Trans. Path. Soc. of London*, 1885, xxxvi, 277). A male, aged 19 years, was thrown from a cart on May 13. Hematuria was present from the sixth day after admis-

Dr. W. W. KEEN'S CASE OF ANEURYSM OF THE RENAL ARTERY. (Natural Size.)

Right and left are the two halves of the Kidney; the whole central mass is the Aneurysm, filled chiefly with a laminated clot. A is a probe showing where the Renal Artery communicates with the Sac of the Aneurysm. B is a probe in the Pelvis of the Kidney and the Ureter.

sion. There was pain in the right side with vomiting. On June 10, a swelling appeared in the right renal region, with symptoms of peritonitis and hectic fever. He died June 13. Necropsy. General peritonitis. A large cavity surrounding the right kidney was filled with a disintegrating blood-clot. The central part of the kidney was entirely disorganized. On its posterior surface, near the hilum, was a "well-defined encapsulated blood-clot of round outline and of the size of a large cherry attached to the central branch of the renal artery, about half an inch from the point of division of the arterial trunk." The upper end of the kidney also was disorganized; the lower alone being normal. The calyces were ulcerated and filled with puriform fluid. The pelvis of the

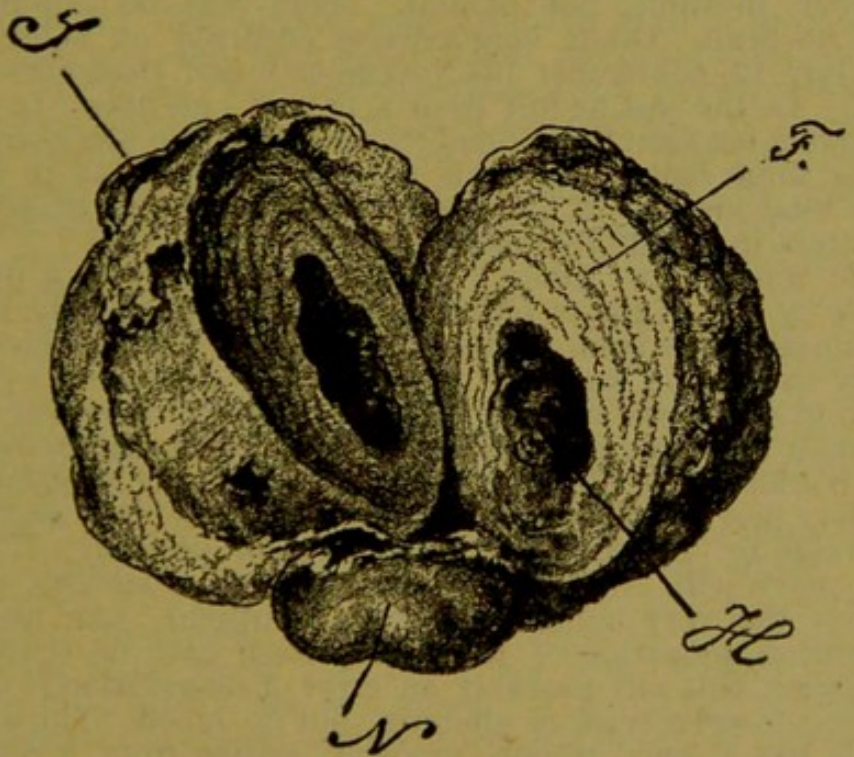

FIG. 2.—The specimen removed by Albert in Case 9. *N*, the kidney; *S*, capsule; *F*, fibrinous contents of aneurysm in laminae; *H*, hollow space filled with fresh coagulum.

kidney communicated with the perinephric cavity. The seventh and eighth right ribs were fractured.

CASE 9.—*Large Traumatic Aneurysm of the Right Renal Artery; Operation; Recovery.*—Hochenegg (*Wien. klin. Wochenschrift*, 1891, iv, 512); Illich (*Rif. Med*, May 28, 1891, 481). These two reports relate to the same case, which was operated on by Albert, of Vienna. Hochenegg's report is the fuller of the two. A man, aged 51, on April 19, 1889, fell a distance of three meters, striking on the right lumbar region on the upright part of a ladder. Dr. Kunz, who saw him within half an hour, found a fracture of the right rib. The right lumbar region was very

tender and painful. The urine passed an hour after his fall was bloody and the next morning he lost a liter of pure blood. The hemorrhage lasted for three days and it was estimated that he lost three liters in all. After three weeks he was out of bed The middle of May another copious hemorrhage (4 liters) was followed by collapse and cystitis He was then in bed till the end of June In the autumn he was in apparently perfect health. On November 10 a renewed profuse hematuria occurred for three days, during which he lost three liters of blood Up to this time repeated examinations had shown no tumor, but after this hemorrhage, a tumor the size of two fists appeared in the right lumbar region It was elastic, slightly movable, not painful. There was no pulsation and no bruit. Other hemorrhages occurred on February 21, July 12, September 19, November 8 and December 17, 1890 In the last he lost from a half to one liter. In the intervals between these hemorrhages the urine was normal. After these hemorrhages his general health began to fail. The total amount of blood lost was estimated to be about 13 liters in all (13.78 quarts).

He was sent to Albert's clinic in Vienna with a diagnosis by Dr. Kunz of either a lesion of the kidney or a traumatic aneurysm of the renal artery On admission early in 1891 he was very neurasthenic, wasted and weak; even to speak was an effort In the right lumbar region was a tumor the borders of which were two finger-breadths below the border of the ribs, 3 cm to the inside of the right mammillary line. The tumor was larger than a fist; was slightly movable by pressure and on change of position It did not move with respiration. Its surface was smooth, pulsation was very indistinct (sehr undeutlich) (As at the operation, palpation of the kidney itself gave no sense of pulsation, this was probably an error of observation) The urine showed a trace of albumin, but no blood The diagnosis was a renal tumor, probably arising from a hematoma, and nephrectomy was advised and accepted. Operation was by Albert, March 8, 1891, lasting an hour and a half. When the tumor was exposed no pulsation could be discovered. The tumor was extensively adherent to neighboring structures. On separating the loose adhesions, severe hemorrhage occurred from laceration of the renal artery. This was arrested by iodoform gauze and a pair of hemostatic forceps, which were left in place for five days. The patient left the hospital in good condition 48 days after the operation The tumor (Fig 2) measured 15 by 10 cm. A small portion of renal tissue was found The remainder of the tumor consisted of stratified fibrin in a capsule. In the center of the tumor was a cavity 3 by 4.5 cm., communicating with the renal artery and filled with fresh red blood-clot. Kundrat's examination showed an aneurysm

of the renal artery, probably the result of a laceration followed by hematoma. Hochenegg believes that by the fall the entire kidney was suddenly displaced downward and forward and was compressed in its upper half, producing a tear in the artery inside the capsule, which produced the aneurysm

CASE 10.—*Large Aneurysm of the Left Renal Artery, possibly Traumatic.*—Oestreich (*Berl. klin. Woch.*, 1891, xxviii, 1042). A woman, aged 50, in February, 1891, suffered from apoplexy and fell on a stairway unconscious. On April 23 there was a hemorrhage from the genitalia with pain in the abdomen. The hemorrhages became daily worse and finally were excessively fetid. On admission, May 25, the bleeding was found to be from the left kidney, in which region was a large tumor. The bladder was distended with a large decomposed clot and fluid blood; death occurred three days later. Necropsy: Left ventricle dilated and hypertrophied. The aorta showed many patches of endarteritis. A hemorrhage had taken place in the left thalamus; the left retroperitoneal tissues were distended and infiltrated with blood, especially around the left kidney and descending colon. At the lower end of the left kidney, partly in the renal tissue and partly in the surrounding tissues, was a great mass of blood communicating with the pelvis of the kidney. The outer layers were fresh hemorrhages; the inner partly laminated. The branches of the renal artery next the clot were markedly dilated and tortuous. The renal substance was unaltered. Diagnosis, rupture of sacciform aneurysm of the left renal artery with chronic endarteritis.

CASE 11.—*Aneurysm of the right renal artery the size of an apple.*—Oestreich (*Berl. klin. Woch.*, 1891, xxviii, 1042) A young man who died from multiple embolism, the result of malignant endocarditis. At the necropsy an aneurysm of the right renal artery the size of an apple, almost completely filled with clots, was found. It developed between the adrenal, the kidney and the aorta and extended upwards behind the liver. No symptoms had been observed during life. Whether it arose within or without the kidney was uncertain.

CASE 12.—*Large Traumatic False Aneurysm Originating from a True Aneurysm of the Left Renal Artery.*—Gruber (*Wien. med. Woch*, 1891, xli, 1646). A man, aged 39, eight months previously fell from a height of 2 meters, striking his back on a chest. In spite of severe pain in the left loin and great dyspnea, he walked to his house, 30 paces away. There was no vomiting. Half an hour later his urine was bloody and in it were clots of uncertain shape for two days For three months there was no bleeding, but he was very weak and suffered much pain in the loin. Then, without known cause, hemorrhages recurred on several occasions. On admission, in the left hypochondrium was a tumor extending

two finger-breadths beyond the middle line and into the false pelvis. The tumor was soft, smooth, solid, not adherent to the abdominal wall. On percussion it was dull. There were no pulsation and no auscultatory signs; hepatic dulness was absent; left lumbar region was tender; slight edema of the legs, and albuminuria. Blood appeared in his urine, especially after exercise. He was obliged to pass his urine every 30 to 50 minutes, and this frequent urination and the blood in his urine were the chief symptoms. A renal origin of the hemorrhage was diagnosticated from the history and the tumor. Splenic tumor, floating kidney, and malignant disease were excluded. The cachexia which was present was deemed to be the result of his hemorrhages.

The diagnosis was a lesion of the kidney from his fall, with retroperitoneal hemorrhage and clot. He died in February with paraplegic symptoms.

Necropsy.—Left renal artery at the hilum showed a sac 20 by 12 cm. Where the artery entered the sac it was dilated to the size of a child's fist. Both microscopically and macroscopically it was demonstrated to be a false aneurysm originating from a true aneurysm of the renal artery, probably as a result of the trauma.

Case 13.—*Large Traumatic Aneurysm of the Left Renal Artery; Operation; Recovery* — Hahn (*Deut. med. Woch.*, August 9, 1894, 637). Woman, aged 49, always healthy, married, labors normal. She had had a right inguinal hernia for 20 years. Early in March, 1893, she fell several steps. This produced a sudden feeling as if there were a movable ball in the abdomen and she felt a tumor under the left border of the ribs. She has never been well since, suffering from indigestion, loss of appetite and a sense of weight. From time to time, especially on sitting, she suffered from severe pain in the sacral region. She was admitted to the surgical ward May 2, 1893. A tumor the size of a child's head, elastic, smooth, dull on percussion and sharply delineated, was found in the left side of the abdomen. Upward it extended to the border of the ribs; downward a hand-breadth below the navel; inward to within three finger-breadths of the middle line. There were no adhesions to the abdominal wall; the tumor was not very movable, there being no change with change of posture nor with respiration. There was no pulsation. On bimanual examination ballottement was present Her arteries showed slight sclerosis. Urine, sp. gr. 1.012, no albumin or sugar. Diagnosis, hydronephrosis, or a soft, renal tumor. Operation, May 8. An oblique incision over the loin exposed the kidney, which was found normal in size and appearance. Puncture of the tumor revealed only blood. On attempting to loosen the inferior pole of the tumor a sudden profuse hemorrhage occurred. The wound was then packed, the patient turned on her back and an anterior incision made. The tumor and

the kidney lay included in a common capsule to the left of the descending colon. Puncture showed no fluid contents; the colon was displaced inward. On tearing the capsule a dark brown friable tissue was discovered, but only a little blood escaped. The tumor was removed after ligature of the pedicle. The peritoneum was closed by continuous suture, and the anterior wall was sutured. The operation lasted an hour and a half. The lumbar wound was allowed to close by granulation. In the fifth week the ligature on the pedicle came away. She made a smooth recovery. Examination of the specimen showed that the aneurysm was entirely separate from the kidney, but in the same capsule. The upper portion of the kidney was normal, the lower end flattened and atrophic. A branch of the renal artery was traced into the sac.

Remarks.

Aneurysm of the renal artery is one of the rarest of all the varieties of aneurysm. In the very careful search that I have made I have found only 12 cases, which with my own above reported make in all 13. Of these 7 were right-sided, 5 left-sided, and one is uncertain.

Cause.—The cause of such aneurysm in 6 of the 13 cases seems to have been an injury; thus Case 2 resulted from a fall from a horse: Case 8 was the result of being thrown from a cart; Case 9 followed a fall of 3 meters; Case 12 a fall of 2 meters; in Case 13 the patient fell several steps. In Case 10 it is a question whether the fall down a stairway was the cause of the aneurysm or not, but I think in view of the 6 other cases of almost undoubted traumatic origin the fall may be assigned as the probable cause in this case. Nephritis seems to have been present in Cases 4 and 7; calcareous degeneration in Cases 5 and 6; chronic endarteritis in Case 10; but in most of the cases no such disease of the arterial system appears to have been present. Among those in which there was no apparent cause are Case 3, in which fever and rheumatism are noticed on September 9; the patient recovered in a few days, hematuria appeared on the 16th, and death on the 25th. As the postmortem showed an aneurysm bursting into the pelvis of the kidney, the aneurysm probably had existed for some time without any known cause. In Case 11, the patient died from multiple embolism, the result of malignant endocarditis. An aneurysm of the

renal artery as large as an apple existed, and was almost entirely filled with clots. Whether it arose within or without the artery was uncertain, but no cause is assigned. In my own case, absolutely no cause could be assigned. The patient's arteries were not calcareous, there had been no injury, and no other assignable cause. Her age, about 45 years, was not such as to presuppose any sclerosis, nor did the radial arteries show any such condition.

Symptoms.—In many of the cases, especially those of small true aneurysm, undoubtedly no symptoms will be present. If the patient dies of some other disorder, as in Cases 4, 5, 6, and 11, the aneurysm is only discovered at the necropsy.

First, a Recognized Tumor.—This was present in Cases 1, 8, 9, 10, 12, and 13, and varied from the size of two fists to one and one-half heads. Surgically speaking, these are the only cases to be considered; only three of these, 1, 9, and 12, have been operated on and all of them with recovery. In my own case, the tumor was as large as any reported. The tumor as a rule is smooth, not bosselated, elastic. It may be differentiated from rupture following an ordinary laceration of the kidney or its artery, resulting in a hematoma, by the fact that it grows less rapidly than such a hematoma, which would be an acute instead of a chronic disorder. On the other hand, the tumor will grow more rapidly than an ordinary sarcoma. If such a tumor is present, and especially if the arteries are sclerosed, if there is no fever nor marked pain, we might possibly suspect an aneurysm. In only one case of the whole series was the diagnosis of aneurysm made, and that by a very shrewd general practitioner (Case 9).

Second, Pulsation.—The chief reason why the diagnosis has not been made is that the artery is relatively small and the sac very large, hence the impulse of the blood is not sufficient to distend the large sac and produce pulsation. In only one case (9) very indistinct pulsation was believed to have been observed prior to operation, but palpation of the tumor itself during operation showed the absence of pulsation. In my own case, not the slightest pulsation was observed, nor was it even suggested to my mind that it was desirable to look for it.

Third, Auscultation.—The same might be said of auscultation to detect a bruit. A thrill of course would be absent if there were no pulsation. In only one case was auscultation employed, and in that the result was negative.

Fourth, Hematuria.—One of the most important symptoms is hematuria. If the aneurysm is outside of the kidney and does not communicate with the pelvis of the kidney, there will be of course no hematuria. Eventually, however, the sac will probably burst into the pelvis of the kidney, and so produce a very profuse and probably fatal hemorrhage. Strange enough in Case 3 at least, the hemorrhage was supposed to be uterine until a careful examination showed it to come from the bladder, which formed a pendulous body of gelatinous consistence, apparently back of the uterus. In Case 9 the aneurysm evidently developed within the kidney and therefore there was hemorrhage from the very beginning. So profuse was it that the man was believed to have lost over 13 liters of blood in a period of time extending from April 19. 1889, when he met with his accident, to December 17, 1890.

Differential Diagnosis.—Practically the only disorders which one might possibly confuse with it if the tumor is small, would be renal calculus. In this the sudden accession of pain, its intense severity, its sudden cessation, the presence of microscopical blood, and the recurrence of the attacks would all favor renal calculus rather than a possibly developing aneurysm. A much more needful differential diagnosis is between renal tumor, ruptured kidney or renal hemophilia on the one hand, and aneurysm on the other. In renal tumors, which are malignant, the metastasis in other organs, the general wasting, the pain and tenderness, the family history, all would point toward a renal tumor proper rather than an aneurysm. In hydronephrosis, the variation in size and coincidentally the variations in the amount of urine passed, the possible entire disappearance of the tumor, coincident with the passage of a large amount of urine (the "flush-tank" symptom) and the very elastic nature of the tumor, would help us in the diagnosis. In the present case, the elasticity due

to fluid blood and the relative solidity of the rest of the tumor, together with the other symptoms and absence of symptoms, I think may afford a reasonable excuse for the error in diagnosis. In rupture of the kidney, as I have already pointed out, there would be a much more rapidly growing tumor, if the blood escaped around the kidney and the tumor would be smaller and the hematuria very great if it were intrarenal alone. In renal hemophilia, there would of course be no tumor; excessive hemorrhages would be the only symptom.

Treatment.—In 1891, Oestreich, in entire ignorance that that very year would see his advice followed, strongly advocated extirpation of the kidney with the aneurysm. He made the prophecy, which was well verified in my own case, "It may easily happen that we will find an aneurysm when we operate with the intention of removing a tumor." But three cases have been operated on thus far: Case 9 by Albert, in 1891, Case 13 by Hahn, in 1893, since which time no case has been reported until the present Case 1, which is reported in this paper. There is nothing peculiar about any of the three operations other than the danger of hemorrhage especially from the pedicle. In my own case, the pedicle was broader than I have ever encountered in any prior case of nephrectomy, so that I had to tie it in seven different sections. All three of the operative cases have terminated in recovery, a most encouraging outlook for the future.