

ACUTE UNILATERAL NEPHRITIS, WITH REPORT OF A CASE *

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Synopsis of Authors' Case.—Woman, aged 22 years, seized with sudden pain in the left loin, radiating forward into the left hypochondrium; rigidity of lumbar muscles with tenderness in costovertebral angle; fever, rapid pulse; leukocytosis; in urine albumin, hyaline and granular casts, red blood-cells and pus-cells. Patient moderately septic; nephrectomy; kidney the seat of disseminated, suppurative nephritis. Patient made a good recovery although some weeks later it was necessary to remove the submaxillary gland for calculous inflammation.

Pathological and clinical studies have caused the belief to prevail that acute hematogenous inflammation of the kidney is always bilateral. This is, however, not the case; but exceptions to the rule are so rare and so little understood that reports of single instances are not without value. Acute unilateral inflammations differ from the commoner types of acute nephritis in that they are of an interstitial character; rather inflammatory than degenerative, and with a strong tendency to the formation of abscesses. Acute bilateral interstitial inflammation has long been known. It was found by Councilman¹ in scarlet fever, and has been seen in erysipelas, osteomyelitis, endocarditis, and pyemia. The infection in these cases is conveyed to the kidney by the blood-stream. Suppurative inflammation, pyelitis and pyelonephritis, is of course common in association with stone and tuberculosis. It is usually considered to be due to ascending inflammation, although this is by no means clearly established. In addition, there is a group of borderline cases, as, for instance, the pyelitis and pyelonephritis of pregnancy and the puerperium, in which it is difficult to say how the inflammation reaches the kidney. We are inclined to believe that even in these it is more likely to be hematogenous than an extension from below upward.

The particular type of unilateral nephritis to which we wish to refer in this communication is that which attacks a person apparently well, often without warning and with an unusually acute onset. In some patients the progress of the disease may be so rapid that in a few hours extreme prostration is observed, while in others the course may be protracted so that several days elapse before marked septic symptoms are noted. The patient complains of tense, throbbing pain in the loin, often radiating into the anterior aspect of the abdomen. There is tenderness

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1. Councilman: Trans. Assn. Am. Phys., 1898, xiii.

over the same area, but most marked at the costovertebral angle, and this is accompanied by rigidity of all the muscles of the loin and of the oblique muscles of the abdominal wall. There is fever of variable degree with a correspondingly rapid pulse and a moderate leukocytosis. The urine is rather scanty in amount, of high color and turbid in appearance. It contains a considerable amount of albumin, and the sediment consists largely of casts, red blood-corpuscles and pus cells. Certain general manifestations such as headache, nausea and vomiting, delirium and even symptoms of uremia may appear and the patient looks and is extremely toxic.

In 1895, Weir² and Woodward³ each reported cases of nephrectomy for unilateral suppurative nephritis, but the present surgical treatment of this affection is mostly due to the able teachings of Brewer,⁴ who has persistently called attention to the subject, and in his latest contribution reports an experience of fourteen cases of the acute type and about a dozen of the mild type. Cobb⁵ collected eight cases from the surgical wards of the Massachusetts General Hospital, all of them operated on since 1902. There are a few other instances recorded in the literature, and the number is increasing so that we shall soon become familiar with the affection and approach its diagnosis and treatment with more certainty and confidence.

CASE REPORT

The case that we have observed and of which we have given an epitome at the beginning of this article is as follows:

History.—Mrs. R. A. K., aged 22, had measles, mumps and scarlet fever when a child; in 1909 she had a severe attack of typhoid fever complicated with hemorrhages, but convalescence was not otherwise interrupted; she was quite well during the summer of 1910. Later she was married. During the early part of December, 1910, she suffered for two weeks from general aches and pains supposedly influenzal in origin, after which a vague pain persisted in the left loin, and she herself believed that some swelling was present, but her physician did not notice anything. December 23, she rode fourteen miles into the country in an automobile, the day being exceedingly cold. At 3 a. m. on December 24 she awakened nauseated and had an attack of vomiting; some hours later moderate pain in the left loin set in, and there was tenderness and rigidity; the temperature rose to 102 F. and the pulse to 120; the leukocytes on this day were counted and found to be 7,000, but two days later they had risen to 13,000. Daily examinations of the urine were made and showed it to be highly colored and to contain albumin and casts but no pus-cells. The attack gradually subsided, the pain and tenderness disappeared, but some rigidity persisted. December 30 she insisted on getting out of bed, following which all the symptoms recurred, and about this time it was noticed that pus was present in the urine. We saw her first on Dec. 31, 1910, at her home in the country.

2. Weir: *Med. Rec.*, New York, 1895, xlv, 325.

3. Woodward: *Ann. Surg.*, 1895, xxi, 588.

4. Brewer: *Surg., Gynec. and Obst.*, 1906, ii, 485; *Ibid.*, 1908, vii, 699; *Jour. Med. Soc. New Jersey*, 1909, vi, 61; *Yale Med. Jour.*, 1911, xvii, 237.

5. Cobb: *Ann. Surg.*, 1908, xlviii, 680.

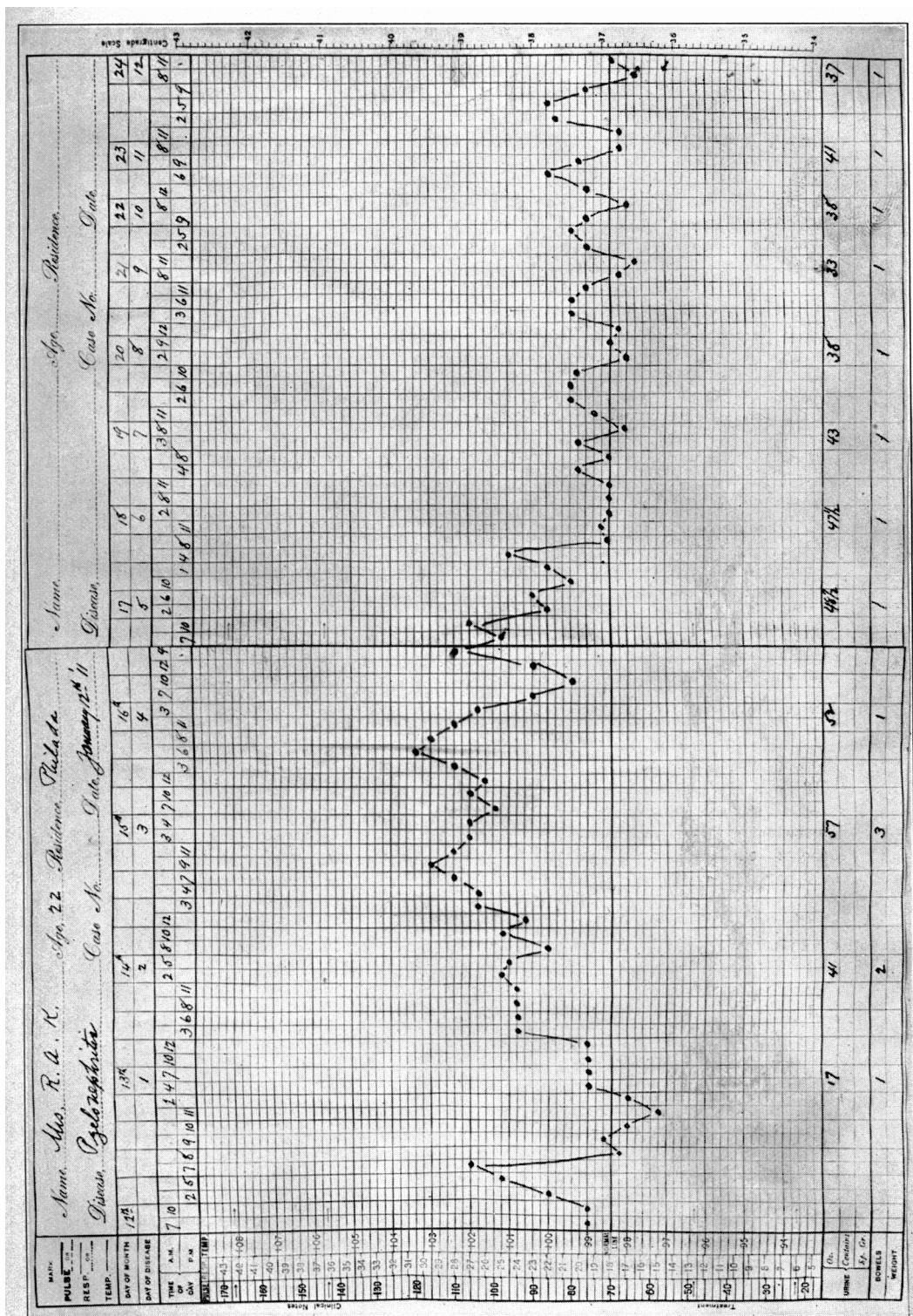


Fig. 1.—Temperature chart after operation.

Examination.—We found a well-nourished, rather pale young woman, complaining of pain in the left loin and left hypochondrium, radiating at times down to the groin and sometimes to the back. Tenderness to pressure existed at the costovertebral angle and extended forward to the crest of the ilium. There was distinct rigidity of the muscles in the loin and a sense of fulness to palpation although no tumor could be detected. There was fever and a rapid pulse and a moderate leukocytosis, and urine analysis showed albumin, with hyaline and granular casts, erythrocytes and pus-cells in the sediment. The patient was not particularly prostrated, although she looked somewhat septic. We made a positive diagnosis of unilateral infection of the kidney. As she was a woman with abundant vitality and energy, we believed it would be safe to temporize a few days and await developments. Accordingly, hot fomentations were ordered for the kidney region, and hexamethylenamin (urotropin) and an abundance of water, liquid diet and purgation were prescribed. During the next ten days the patient varied in her condition, sometimes being on the verge of marked improvement, again having a relapse to the condition just mentioned. Finally, as the temperature continued around 102 F., and as her general appearance indicated an increasingly septic state, and as some delirium was manifested, an operation was deemed advisable. The symptoms were always unilateral and always located in the region of the left kidney. She was admitted to St. Agnes' Hospital January 11, 1911. During the few hours before operation the temperature ranged from 100 to 102 F.; the pulse from 84 to 100.

Operation.—The operation was performed Jan. 11, 1911, under ether anesthesia. The patient was placed in the usual lateral position over a kidney pillow and a curved incision was made downward and inward from near the costovertebral angle. On opening the deep fascia, the perinephric fat was found infiltrated and inflamed, bleeding with great readiness. On further exploration of the fat in the region of the kidney, an abscess was encountered containing 3 or 4 ounces of thick pus. The kidney was exposed and delivered with some difficulty and was found to be the seat of a diffuse, suppurative process. Accordingly, nephrectomy was performed and the wound packed with gauze and drained with a rubber tube. Partial closure of the wound was effected.

Examination of the specimen was made by Dr. Aller G. Ellis, Dr. John Speese, and ourselves, and the examination of the pus by Dr. Randle C. Rosenberger. The reports are as follows:

Macroscopic Description.—The kidney was about one and one-half times the normal size, intensely red and congested, with purple blotches of hemorrhage beneath the capsule. Near the lower pole a ragged opening existed with evidence of necrosis at its edges. In three other places rents were found, evidently caused by trauma during operation. It was afterward discovered that at the places hemorrhagic infarction existed. On section of the kidney the entire organ was seen to be intensely congested, especially the cortical portion, and to be the seat of numerous miliary abscesses. In the lower half, a large wedge-shaped yellow area communicated with the opening before mentioned and which had probably been made at the operation. The apex of the wedge represented the apex of a pyramid. One other such area, but somewhat smaller in size, was present. At the upper pole a round, orange-colored mass about 4 mm. in diameter was discovered; it was thought to be tuberculosis but was found on microscopic examination to be a hypernephroma.

Microscopic Description.—Sections show a hemorrhagic fibrinocellular exudate on the surface of the renal capsule. At several points a large amount of hemorrhage is present and exists as an infarct. The capsular vessels are dilated and a diffuse leukocytic infiltration begins beneath the capsule and extends downward through the cortex and medulla. Many of the leukocytes are of the polynuclear form. The renal epithelium shows degenerative changes and cloudy swelling with numerous casts. The stroma in some areas is decidedly fibrous.

There was no evidence of tuberculosis in any of the sections examined by Dr. Speese, Dr. Ellis or ourselves. In the specimen submitted to Dr. Ellis a small hypernephroma was discovered, with extensive connective tissue formation.

Postoperative History.—The patient reacted from the shock in a few hours; afterward the temperature gradually rose until on the fourth day it was 103 F.; then it slowly declined to the normal, which was reached on the sixth day after operation. The pulse remained high, rapid and weak for several days. The patient commenced to pass urine shortly after the operation and during the first twenty-four hours 17 ounces were excreted. During the second twenty-four hours 41 ounces and during the third 57 ounces were voided. The amount of urine during the first ten days after operation varied from 33 to 57 ounces, and averaged 44 ounces, and during the last ten days of her stay in the hospital, it varied from 31 to 46 ounces, and averaged 39 ounces. At first there was abundant albumin with casts, pus-cells and erythrocytes, but the sediment gradually lessened and for the last week examination was negative for albumin, casts and pus. The last urinalysis showed a specific gravity of 1.010. The gauze packing was removed from the wound during the second week, but con-

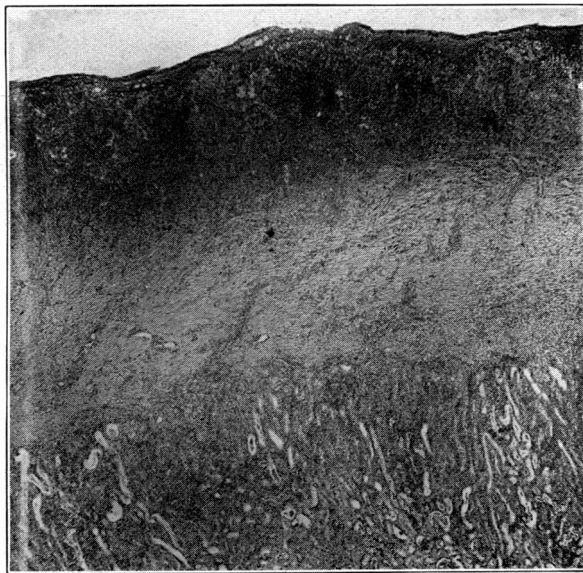


Fig. 2.—Section through capsule and cortex, showing great thickening of the former, with fibroid change, hemorrhage, and round cell infiltration; pronounced cellular infiltration of superficial layers of cortex.

siderable wound trouble was experienced which protracted convalescence. A bacteriologic examination of the pus in the kidney removed at operation, and later of the wound discharge, revealed the *Micrococcus pyogenes aureus* and from the culture a vaccine was made by Dr. Rosenberger and administered several times to the patient. The examination of the blood showed hemoglobin 38 per cent. on the day after operation and from this it hardly varied until February 14, when it began to rise steadily. The first count of red blood-cells made four days after operation revealed 3,200,000 and the count varied but little from this until February 14, when it showed 3,940,000, after which continued improvement took place. The leukocytes varied, depending on the condition of the wound, but averaged about 13,000 during her stay in the hospital.

The patient was discharged February 25, 1911, forty-four days after admission, with a small sinus rapidly closing. Her general health was excellent, although some weakness persisted. The sinus healed entirely in one week. About six weeks later, the patient complained of swelling, pain and tenderness beneath the right lower jaw and noticed some salivation with a foul odor and salty taste in the mouth. An examination revealed a swelling of the right submaxillary salivary gland, densely hard in character, not acutely inflammatory but somewhat tender to pressure. Pressure caused pus to exude from the duct of Wharton into the mouth. A radiograph made by Dr. Pancoast showed the presence of a calculus.

Under ether anesthesia a 2-inch incision was made beneath the jaw and the submaxillary salivary gland removed. It contained an oval calculus about 12 mm. in length. Since this time, the patient has been perfectly well, gaining in weight and strength and frequent urinalyses have shown nothing abnormal. Later she became pregnant; nothing unusual happened until October 27, when a miscarriage occurred. The patient suffered no ill effects from this, however. On November 1, she was passing 40 ounces of urine in the twenty-four hours, with a specific gravity of 1.015 and showing nothing abnormal to chemical or microscopic examination.

ETIOLOGY

The kidney in unilateral nephritis may become infected in one of three ways:

1. *By an Ascending or Urogenous Infection.*—This is much less common than was once held, and Sampson's⁶ well-known paper, published in 1903, states the case correctly in the following words:

The reflux of urine from the bladder into the ureters may be considered an etiologic factor in the causation and maintenance of renal infection only when the intravesical portion of the ureter is diseased, thus impairing its function, or when some ureteral abnormality exists.

It is thus seen that the kidney is protected from ascending invasion by the downward current of urine and the physical condition of the healthy ureteral orifice. Of course, infection may be transmitted to the pelvis of the kidney by an unclean ureteral catheterization.

2. *Lymphatic Infection.*—A local spread of infection from the intestinal tract or from the lower urinary organs by way of the lymphatics is not common, but does sometimes occur. Some interesting experimental work has been published recently by Kunita,⁷ showing the way in which the lymphatics of the ureter communicate with those of the perinephric tissue and kidney, and by Franke,⁸ who found that the ascending colon and cecum were connected by a chain of lymphatics with the right kidney but was unable to find such connection in the case of the left kidney.

3. *Hematogenous Infection.*—This is the common mode. It is well known that micro-organisms frequently pass through the kidney without injuring it in so far as we know. The urine swarms with typhoid bacilli in many cases of typhoid fever and one frequently observes a colon bacil-

6. Sampson: Bull. Johns Hopkins Hosp., 1903, xiv, 334.

7. Quoted by Stewart: Univ. Penna. Med. Bull., 1910, xxiii, 233.

8. Franke: Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1911, xxii, 623.

luria; although in neither case are symptoms of kidney infection necessarily present. There has been some experimental work published indicating that the passage of micro-organisms through the kidney is always attended by damage histologically, although clinically no trouble may be appreciable. It has also long been known that by experimentally tying the ureter, bruising the kidney and injecting cultures of staphylococci into the veins, the kidneys will become infected. These infections point the way to an understanding of the workings of well-known clinical conditions as factors in the etiology of pyelonephritis. Most cases of pyelonephritis are probably unilateral in the beginning. Theoretically, a source of infection must exist somewhere in the body, although it



Fig. 3.—Section through cortical portion of kidney showing intense inter-tubular and periglomerular round cell infiltration.

is not always easy to ascertain the source. In view of the fact that the colon bacillus is the most frequent cause of urinary infections, we may reasonably infer that intestinal stasis, intestinal ulceration and severe and long-continued constipation act as predisposing factors. Previous infections, such as furuncle, tonsillitis, tooth abscesses or any form of peripheral suppuration may predispose to pyelonephritis. The bladder, the prostate gland and the uterus and its appendages may also act as portals of entry, and certain general conditions of which typhoid fever and influenza are the most prominent examples may contribute to haematogenous infection of the kidney.

In addition to the entrance of infection, there must be some cause, traumatic or otherwise, operating to reduce the resistance of the renal tissue. This, likewise, is not always easily determined. Many of the cases reported as acute unilateral pyelonephritis with suppuration have occurred suddenly in an apparently normal kidney of persons previously well, and the infecting agent was usually the colon bacillus or the *Staphylococcus aureus*. It may be that these organisms were highly virulent or in excessive number, or it may be that some unrecognized abnormality of the kidney was present. A few years ago, Kidd⁹ suggested that as the majority of cases occur in women and involve the right kidney, undue mobility of the organ may be a predisposing factor, and Cotton¹⁰ reports two cases in which there was a definite displacement of the infected (right) kidney. The micro-organisms usually found in pyelonephritis are the *Bacillus coli communis*, *Micrococcus aureus*, *Streptococcus*, and the typhoid bacillus. The great majority of cases have occurred in women, and the only explanation would seem to be the more frequent displacement of the right kidney and the greater tendency to intestinal stasis in that sex.

Recently unilateral renal hemorrhage of apparently unknown origin and sometimes called essential hematuria, has been placed in the group which we are discussing and considered to be of bacterial origin. Thus, Gaudiana¹¹ concludes that with the exception of early tuberculosis, lithiasis, neoplasms, torsion of the pedicle or Bright's disease, all cases described as hemorrhagic nephralgia are cases of unilateral nephritis and are the result of bacterial invasion of the kidney. Acute hematogenous infection is also of interest in connection with the pyelitis of pregnancy, but any discussion of this disease would occupy more space than the limit of our paper permits. Louria,¹² in a recent paper has given some consideration to the subject. Brewer's¹³ conclusions regarding the etiology are important and may be quoted:

During the progress of any infectious disease a certain number of micro-organisms find their way into the blood current: many of these organisms are excreted through the kidneys. If their number is comparatively small, if their virulence is low, and if the kidneys are in a healthy condition, the transit of these organisms through the renal apparatus gives rise to no demonstrable lesion. If, on the other hand, the number of the organisms is large, if their virulence is high, or if one or both kidneys are diseased, lesions are produced which may at the onset cause an overwhelming and fatal toxemia, or may proceed more slowly to the development of any of the classical types of renal infection or suppuration. While the disease may be bilateral, in a large number of instances it is unilateral and its unilateral character is due to the fact that

9. Kidd: Urinary Surgery, 1910.

10. Cotton: Ann. Surg., 1911, liv, 577.

11. Gaudiana: Folia urologica, 1908-1909, iii, 570.

12. Louria: New York Med. Jour., 1911, xciii, 1073.

13. Brewer: Jour. Am. Med. Assn., 1911, lvii, 187.

the affected kidney has lost to some extent its normal resistance to infection, by reason of trauma, abnormal mobility, previous disease, calculous irritation, anemia, passive hyperemia, complete, incomplete or intermittent hydronephrosis. The presence in the body of a kidney damaged by trauma or disease to such an extent as to lower its normal resistance to infection is a distinct menace to the individual, in that it possesses a potential susceptibility toward even the mildest forms of blood infection. While it is possible to produce renal lesions in animals by means of the *Bacillus coli*, the *Streptococcus pyogenes*, the *Staphylococcus pyogenes aureus*, the *Bacillus typhosus*, the pneumococcus, and the pyocyaneus, in clinical cases only the first four of these organisms have been isolated.

PATHOLOGY

The macroscopic appearance of the kidney varies with the stage of advancement of the morbid process. At first the kidney is swollen, tense

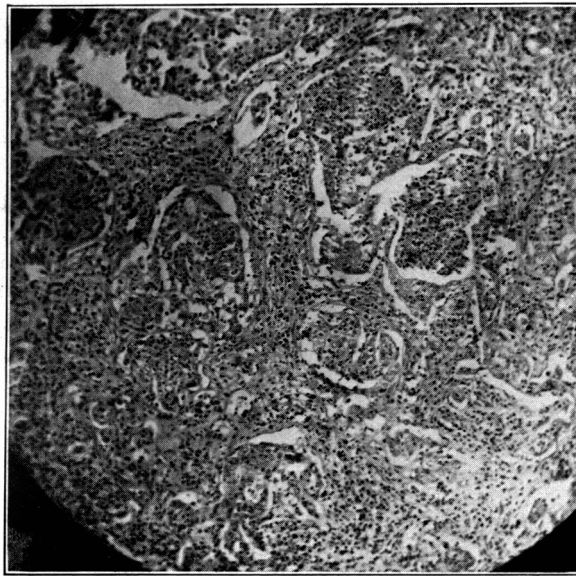


Fig. 4.—Section through cortical portion of kidney showing moderate amount of cell infiltration, edema, degenerative changes in glomeruli and tubules.

and engorged with blood, and distinct infarcts may be seen. Later, numerous yellow nodules appear beneath the capsule surrounded by a zone of intense congestion. On section, these nodules are found to be the bases of wedge-shaped areas of suppuration in the cortex. Long linear yellow streaks may indicate suppuration in the tubules. The microscopic changes consist of a diffuse congestion and leukocytic infiltration with numerous foci of suppuration; there is often much hemorrhage beneath the capsule, and throughout the cortex triangular infarcts, hemorrhage and suppuration may be present. Large bacterial masses looking like emboli are often seen. In the later stages the foci of suppuration coalesce

and gross abscesses may be formed. The Malpighian tufts are congested and usually surrounded by leukocytic infiltration. The pelvis is congested and covered with exudate.

SYMPTOMS

The clinical picture of hematogenous pyelonephritis varies considerably with the virulence of the process. Brewer describes three types: 1. The severe type, in which the local symptoms are obscured by an intense toxemia, and a fatal result occurs unless the infected kidney is removed. 2. The intermediary type, with severe initial symptoms, but without grave toxemia. Renal abscess, perinephritic abscess, pyelonephritis or pyonephrosis develops in neglected cases. The symptoms may simulate appendicitis, cholecystitis, or abscess of the liver, and, if the renal disturbance is not marked, may resemble typhoid fever or pneumonia. 3. The mild type, with tenderness over the costovertebral angle as the only symptom, suggesting subacute appendicitis or cholecystitis. Brewer believes that this type accounts for certain irregular periods of temperature occurring during convalescence from some surgical conditions or infectious diseases. 4. To these we will add a fourth type, that in which the chief and perhaps the only symptom is hematuria. We have referred to the observations of Gaudiani and would also add those of Eshner,¹⁴ Billings,¹⁵ Elliott,¹⁶ and White¹⁷ for additional support of the view that some of the so-called "essential hematurias" are due to bacterial invasion of the kidney.

The "severe" type of Brewer or the fulminating type of other writers is of sudden onset in a person apparently well. There is severe abdominal pain, tenderness, rigidity, nausea and vomiting. While the pain at times is characteristic of renal disease, it generally suggests some intra-peritoneal process on the side affected, usually of the stomach, gall-bladder or appendix. A number of the cases reported in the literature were operated on for appendicitis, cholecystitis or perforated duodenal ulcer before the true condition was recognized. The temperature rises sharply, even as high as 106 F., and there may be a chill or succession of chills. Septic symptoms develop and sometimes death may ensue before any distinctive renal or urinary signs are observed. As a rule, however, an indication of the true condition of affairs is given by the shifting of the pain to the flank and the finding of a point of more or less severe tenderness at the costovertebral angle. It is rare that the enlarged kidney can be palpated owing to the rigidity present, although some resistance may be felt by bimanual examination. The urinary findings

14. Eshner: *Am. Jour. Med. Sc.*, April, 1903.

15. Billings: *Am. Jour. Med. Sc.*, 1910, p. 625.

16. Elliott: *Internat. Clinics*, IV, 1906, 16th series, p. 122.

17. White: *Quart. Jour. Med.*, 1911.

during the early hours are inconclusive and do not differ from those in any other severe septic infection, but later the urine becomes scanty and contains albumin, casts, blood and pus cells and the pathogenic micro-organism in pure or mixed culture. There is usually a high degree of leukocytosis and headache, muscular twitchings, convulsions or delirium may be present. The fatal termination is due to a combination of sepsis and uremia.

The second type, the *forme aigue* of Albarran, resembles the foregoing except that the intense septic symptoms are absent. More time is given in which to make a diagnosis, and the costovertebral tenderness and the urinary findings may be supplemented by ureteral catheterization. The bladder is seen to be intensely inflamed about the ureteral orifice,

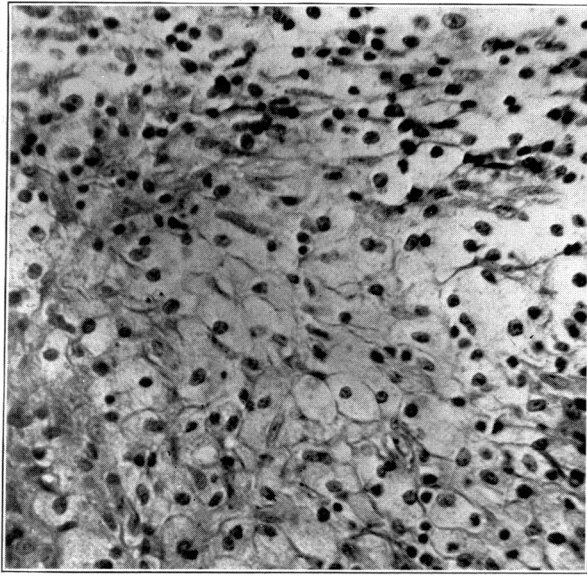


Fig. 5.—Section through small white nodule in cortex of kidney, showing character of the so-called hypernephroma.

from which pus may be seen exuding, and the lips of the orifice are edematous and pouting, and often ulcerated. The cystoscopic examination should not be undertaken during the acute attack, unless nephrectomy is contemplated. An x-ray examination should be made to determine the presence or absence of calculus.

The mild type which Brewer also terms “idiopathic pyelitis” has but few symptoms except moderate pain (backache) and costovertebral tenderness. A trace of albumin and a few casts, blood-cells and pus cells will be found in the urine. Some of these cases have no doubt been operated on for subacute appendicitis or cholecystitis; on the other hand,

they may account for "certain irregular periods of temperature occurring during convalescence from some surgical condition or infectious disease" (Brewer). The fourth type is characterized by persistent hematuria, which cystoscopy shows to come from one kidney, and the cause of which is revealed only at operation.

Treatment.—The acute fulminating form should be operated on as soon as the diagnosis can be made, with the intention of performing nephrectomy, unless nephrotomy with drainage will suffice. In 1911, Brewer reported that he had encountered fourteen cases of the severe type; two patients were untreated, and in four nephrotomy and drainage was done; they all died. Eight were treated by early nephrectomy and all recovered. The general statistics on the subject are not yet susceptible of analysis. It is quite true that the fulminating type sometimes subsides without operation; but just as in acute appendicitis, we never know which cases will recover and which will not. Of greater importance is the question of whether to do a nephrectomy or a nephrotomy. Brewer and Cobb have obtained splendid results from nephrectomy, but there is much to be said for the less radical procedure, chiefly because of the uncertainty as to the condition or even the presence of the other kidney, since there is rarely time for a cystoscopic examination. The objections that have been urged against nephrotomy are the inability to drain the whole organ by splitting it and the subsequent uselessness or even the menace of a kidney riddled with abscesses. Cases are on record in which the symptoms recurred after nephrotomy, necessitating a subsequent nephrectomy. In the subacute types, more time is given for investigation of the other kidney and the diseased organ can be more successfully treated. In the case herein reported we adopted a conservative plan of treatment for nearly three weeks, and when forced to operate we did a nephrectomy, because the friable, disorganized state of the kidney forbade a nephrotomy. Of course, in the mild cases operation is not to be thought of; rest in bed, a milk diet, urinary antiseptics, purgatives and plenty of water will usually bring about a cure. In refractory cases, bacterins should be used, and in persistent pyelitis it may be necessary to irrigate the renal pelvis through a ureteral catheter with a solution of one of the silver salts or with a 2 per cent. solution of aluminium acetate. If still resistant, it is advisable to operate — to split the capsule and drain the renal pelvis. In all such cases the existence of pressure on the ureter or of movable kidney should be investigated.