

nal pressure will be found to cause the obstruction (p. 486). While the operative technic must differ with each case, it may be said in general that—

1. The discovery and removal of the obstruction is the first object of the operation.

2. Until the ureteral catheter has been passed from the pelvis of the kidney down and into the bladder one cannot feel sure that the obstacle has been removed.

3. No matter how dilated the kidney, it is still of some service to the patient, and should not be extirpated unless nephrectomy is considered a less formidable procedure than the removal of the obstruction.

4. Operating to preserve the kidney does not imply the performance of any of the so-called conservative plastic operations for renal retention. Simple nephropexy, or even nephrotomy, is a far safer and, in all but the exceptional cases of ureteral valves and strictures, an equally certain procedure.

5. Yet to return to the original point, the ease with which certain cases may be cured is no excuse for overlooking the obstructive cause of the retention, since, unless this cause is known, we have no means of judging how much relief may be expected from the operation.

I have purposely consigned the description of the plastic operations upon the ureter to another chapter (p. 486) in order to emphasize the fact that they are rarely needed here. After what has been said it is scarcely necessary to repeat that nephrectomy for the relief of hydronephrosis is a last resort.

## CHAPTER XXXVIII

## ETIOLOGY, MORBID ANATOMY, AND GENERAL SYMPTOMATOLOGY OF SURGICAL INFLAMMATIONS OF THE KIDNEY

No common disease is so persistently and so comprehensively misunderstood as is pyelo-nephritis. The physician, encountering mild chronic cases, is contented with the diagnosis and treatment of chronic interstitial nephritis; while the surgeon is too apt only to see in the pyuria characterizing the severer inflammations an evidence of cystitis. Yet the only way to appreciate the frequency of the disease is to suspect of pyelo-nephritis every case of bacteriuria or pyuria that is not a urethritis. Investigation will show that almost every case of long-standing stricture or hypertrophied prostate, and many cases of stone and tumour of the bladder, show some pyelo-nephritis, while occasionally a case will be encountered in which the characteristic symptoms of cystitis—viz., frequent and painful passage of purulent urine—are the sole obvious indications of a suppurating kidney uncomplicated by cystitis.

**Varieties.**—The four varieties of pyelo-nephritis are—

Catarrhal pyelo-nephritis (pyelitis).

Suppurative pyelo-nephritis.

Pyonephrosis.

Abscess of the kidney.

These four conditions constitute the surgical inflammations of the kidney. They represent the various degrees and varieties of suppuration in the kidney and its pelvis. Hence it is convenient to group their etiology, morbid anatomy, and general symptoms all together, leaving the consideration of special symptoms, diagnosis, prognosis, and treatment for the next chapter.

The terms explain themselves. Catarrhal pyelo-nephritis is a light inflammation of the kidney and its pelvis productive of little pus. Suppurative pyelo-nephritis is a similar condition more severe in type, with much pus collected in the pelvis of the kidney and passed off with the urine. Pyonephrosis is suppurative pyelo-nephritis in a dilated kidney. Abscess of the kidney is suppuration within the organ uncomplicated by pyelitis.

## ETIOLOGY

The surgical inflammations of the kidney are microbic in origin, and may be caused by any pyogenic bacteria. It is to be remarked, however, that the milder forms of pyelo-nephritis are habitually caused by the bacillus coli, and are characterized by an acid urine.

The route of bacterial invasion has been noticed in a previous chapter (p. 357). An ascending invasion is accepted as the cause of the inflammation when it is secondary to some disorder of the bladder, prostate, or urethra. But when the renal inflammation is primary it is attributed to infection by microbes excreted through the kidneys—the so-called descending invasion.

**Predisposing Causes.**—The predisposing causes of pyelo-nephritis are all-important. Bacteria are always present. Every attack of constipation doubtless sends myriads of colon bacilli through the kidneys, and from every infected wound a sufficient number of staphylococci and streptococci doubtless enter the circulation and pass through the kidneys to cause suppuration ten times over in those organs, if only they are vulnerable; but they are not. Unless there is some trauma, irritant, or congestion, the bacteria are passed off without so much as multiplying in the urine. Thus the predisposing cause literally produces the inflammation—more than this, it often determines the quality of inflammation.

The chief predisposing causes are—

1. *Retention.*—Urethral retention, whether by stricture or prostate, is a common cause of catarrhal pyelo-nephritis, and may cause suppuration. Ureteral retention, which usually causes hydronephrosis, may cause pyonephrosis.

2. *Stone.*—Renal calculus is the most common cause of suppurative pyelonephritis, and may, by obstructing the ureter, cause pyonephrosis.

3. *Tuberculosis or Neoplasm.*—Malignant or tubercular disease may occasion suppuration in the kidney by producing a tissue ill fitted to repel bacterial invasion, or by blocking the ureter.

4. *Trauma.*—If a contused or ruptured kidney becomes infected there results a suppurative pyelo-nephritis or abscess of the kidney, or both (Fig. 144).

5. *Other Causes.*—A number of exceptional causes of renal suppuration are occasionally encountered. Among these may be mentioned the pressure of pelvic growths, pregnancy (see Acute Pyelo-nephritis), decrease in the power of resistance, such as occurs in wasting diseases, and especially in tabetics and paralytics, and such

septicemias as overwhelm the kidneys by the multitude of microbes these organs are called upon to transmit.

## MORBID ANATOMY

It is customary to describe suppurative pyelitis and nephritis as though they were quite independent conditions, or at least often met with separately. Such is not the case. While doubtless the inflammation has its first beginning in the one or the other, it is impossible clinically to distinguish pyelitis without nephritis or nephritis without pyelitis, excepting only those rare cases of renal abscess which begin within the parenchyma of the kidney and do not implicate the pelvis. With this one exception, then, suppurative nephritis does not occur without pyelitis, nor does pyelitis, whether catarrhal or suppurative, occur without nephritis.

**The Renal Pelvis.**—**Catarrhal Pyelitis.**—When the pelvis of the kidney is acutely inflamed it is congested and may be covered with a layer of pus or false membrane. There may be petechiæ and spots of epithelial desquamation.

In chronic conditions the pelvis is thickened and its mucous membrane rough and bereft of its normal polish.

**Suppurative Pyelitis.**—Suppurative pyelitis is characterized by more important changes. Besides a considerable inflammatory thickening of its walls, and more or less ulceration of its surface, the very shape of the pelvis may be distorted. There is often sufficient pouching of its sides to allow the accumulation of pus and calculi in a sort of pocket which, like the *bas fond* of the bladder, is the microbic breeding-place—the source of the pus.

The ureter is usually inflamed throughout its length in severe or acute cases. Its congested vesical orifice may be observed through the cystoscope.

**Pyonephrosis.**—In pyonephrosis the pouching and dilatation of the kidney pelvis reach their limit. The pelvis is usually greatly thickened and dilated, and is often irregularly pouched, ulcerated, and filled with pus, calculi, or a magma of lime salts (Fig. 143). The ureteral orifice is usually stenosed or completely obstructed.

**The Kidney.**<sup>1</sup>—**Catarrhal Nephritis.**—A light bacterial infection does not necessarily provoke suppuration in the kidney. The bacteria (usually the bacillus coli) obtain a foothold, probably in the mucous membrane of the calices, and thence attack the whole kidney, not by suppuration, but by chronic interstitial sclerosis.

The kidneys become small and dense, slightly lobulated on the

<sup>1</sup> Cf. Albarran.

surface, with adherent capsule, and perhaps a few small cysts with serous or sero-purulent contents. On section the cortex is found chiefly affected. While the pyramids retain a normal appearance the cortex may be quite converted into a mass of fibrous tissue containing

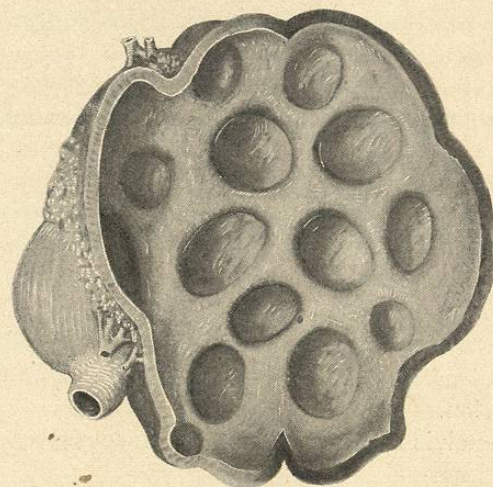


FIG. 143.—PYONEPHROSIS.  
The kidney is reduced to a multilocular suppurating cavity.

lobules of fat. The microscope reveals infiltration of the stroma with fibrous and fatty tissue compressing and obliterating tubules and glomeruli alike. The areas of sclerosis are unevenly distributed about the organ, and wherever there is no sclerosis the secreting epithelium undergoes hypertrophy.

The difference between the lesions just described and those of renal retention (*cf.* Hydronephrosis) must not be forgotten. Retention alone causes con-

gestion and edema first, later epithelial atrophy without any production of new interstitial tissue; while inflammation, whether catarrhal or suppurative, whether associated with retention or not, causes chronic interstitial nephritis with a temporary acute congestion if the onset of the nephritis is acute.

**Suppurative Nephritis.**—Inasmuch as no two suppurating kidneys present exactly the same lesions it is quite impracticable to give a detailed picture fitting the requirements of every case. In general it may be said that—

1. There is always more or less of the chronic interstitial change described above.
2. In chronic suppurative pyelo-nephritis the kidney is habitually enlarged and congested, while the sclerosis is marked and the suppuration may be confined to the surfaces of calices; or there may be one or more foci of suppuration within the kidney substance, or dense globular scars showing where abscesses have been.

In the more acute cases the whole kidney may be infiltrated with pus. The bacteria, and with them the suppuration, follow the tubules, so that the pyramids are traversed by radiating yellow streaks surrounded by zones of congestion (*néphrite rayonnante* of

Albarran). In other cases the purulent infiltration follows no defined lines, the kidney is simply riddled with small foci of suppuration. If the patient survives, these foci coalesce to form one or more large abscesses, which ultimately burst into the pelvis of the kidney or reach the perinephritic tissue by rupture or by lymphatic invasion.

3. In pyonephrosis the kidney is commonly reduced to a dense multilocular abscess cavity (Fig. 143) containing pus, perhaps urinous or cheesy, and usually calculi. The loculi may intercommunicate widely or may be quite shut off, forming separate abscesses. Albarran mentions the occurrence of large subcapsular abscesses. Yet, in spite of all this sclerosis and chronic suppuration, the pyonephrotic, like the hydronephrotic, kidney almost always retains some epithelial elements and some power of secretion. Yet, in discussing the treatment of this condition, we shall see that the conservatism with which this should inspire the surgeon is often more than outweighed by the dangers of leaving a suppurating kidney and the inconvenience of secondary nephrectomy.

4. True abscess of the kidney of haematogenous origin usually begins with one or more foci of suppuration in the cortex that grow and coalesce to form large abscesses (Fig. 144). These terminate by invading the pelvis or the perinephritic tissue, thus setting up pyelo-nephritis, pyonephrosis, or perinephritis, unless the patient dies before this stage is reached.

5. Albarran has described two hyperacute fatal forms of renal infection characterized only by an accumulation of bacteria and the evidences of an acute congestion of the kidneys.

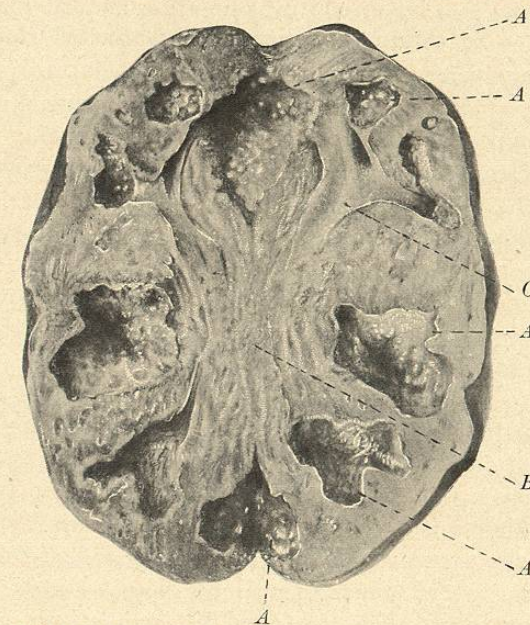


FIG. 144.—MULTIPLE ABSCESS OF THE KIDNEY DUE TO RUPTURE AND CICATRICIAL OBLITERATION OF THE PELVIS (Nephrectomy, by Dr. Chetwood).  
A, abscesses; B, pelvis replaced by scar; C, sole remaining calyx.

**The Urine.**—The urine excreted by an inflamed kidney is absolutely pathognomonic; and if there is any clinical confusion in determining the urinary signs of the surgical inflammations of the kidney, it is for one of three reasons:

1. Because the urine from the inflamed area (abscess of the kidney, closed pyonephrosis) is not passed off;
2. Because the products of vesical and prostatic inflammation (the vaginal mucus in the female) habitually mingle in the urine and obscure the products of renal inflammation; or
3. Because there is a superficial resemblance between the urinary signs of inflammation in any portion of the urinary tract.

In view of these confusing elements it will be useful to consider consecutively how to obtain the kidney urine uncontaminated by vesical, prostatic, or vaginal pus, what the characteristics of such a urine are, and how renal inflammation may be diagnosed therefrom.

**To obtain the urine uncontaminated from the kidneys,** it is not necessary—current opinion to the contrary, notwithstanding—to employ the ureteral catheter or the urine segregator. Any one who depends entirely upon these instruments will certainly blunt his diagnostic acumen by his inability to discover renal inflammation in that very large class of every-day patients upon whom their use is impracticable or impossible. But there are many other methods that serve for all practical purposes. To be satisfactory the method employed must always obtain the renal urine uncontaminated by bladder pus, and it must sometimes determine from which kidney such urine is derived.

When a patient comes complaining of any inflammation of the urinary tract, it is customary to have him urinate into two glasses (p. 83). This test may suffice. The second flow of urine may show the characteristics of kidney urine plainly enough. But the diagnosis is often not so easy. If there is still a doubt this may usually be solved by washing the bladder gently and repeatedly with boric-acid solution until the wash returns clear. The urine previously passed is preserved for comparison, and the patient dismissed for an hour. At the end of that time he returns and passes the urine meanwhile accumulated in his bladder. If this is as cloudy as the second flow before washing, the diagnosis of pyelo-nephritis may at once be made and will be confirmed by testing the urine last passed.

But another question may arise. If the kidney urine thus obtained shows evidences of pyelo-nephritis, it may still be necessary to determine—especially if an operation is contemplated—which kidney is inflamed, or whether both are implicated. If, on the other hand, the kidney urine is clear, the surgeon may still suspect renal

suppuration—e. g., closed pyonephrosis or abscess of the kidney, the evidences of which do not escape down the ureter. To decide these questions it is rarely necessary to appeal to the ureteral catheter. A closed pyonephrosis or a parenchymatous abscess declares itself plainly by the local signs and general symptoms; while to determine from which kidney the pus comes there are four criteria: (1) The lumbar tumour and tenderness, (2) observation by the cystoscope of the congested ureteral orifice, (3) segregation or ureter-catheterism, and (4) exploratory nephrotomy. I confess that, except in tuberculosis, I prefer double nephrotomy to ureteral catheterization.

**The Urinary Signs of Pyelo-nephritis.**<sup>1</sup>—Since the lesions of pyelo-nephritis are catarrhal or suppurative inflammation of the kidney and its pelvis, combined with a chronic interstitial nephritis, *we always find in the urine excreted from such a kidney pus, bacteria, albumin, and renal casts.* Each of these has its special characteristics.

The *pus* may be present in great quantity, or it may be possible to obtain only a slight deposit by the centrifuge. Yet some pus is always present, varying in quantity from time to time. If the case is closely watched it will often be found that the urine remains for days almost clear of pus, during which period the patient's general and local symptoms become progressively more marked. Then, suddenly, and without any assignable cause, the urine becomes loaded with thick creamy pus and immediately the symptoms are relieved—only to recur gradually as the pus pocket in the renal pelvis refills. This symptom-complex, of *markedly remittent pyuria with increasing symptoms while the pus collects and relief when it is poured out,* is almost pathognomonic of pyelo-nephritis. The seminal vesicle may give similar gushes, but the symptoms and the local and urinary signs of the two conditions differ so widely that an error of diagnosis is hardly possible.

But these gushes of pus are not constant, and to distinguish them may require long and careful observation. Yet if there is at any time a quantity of renal pus in a given specimen its characteristics are usually quite distinctive. If the urine is allowed to stand an hour or so in a glass vessel, it will be found that *the pus sinks to the bottom of the glass and lies flat and solid like a bed of sand, while the supernatant fluid remains hazy with bacteria* (Plate IX). The pus has often a sallow greenish hue, or it may be creamy; but these signs are of little moment. It is the flatness and solidity of the de-

<sup>1</sup> I advisedly employ the term pyelo-nephritis, since the urinary signs in pyonephrosis or abscess of the kidney are not to be depended upon.

posit that are characteristic. Bladder pus never settles in this way. However intense the cystitis, however deep the layer of pus at the bottom of the glass, it is always capped by a fluffy, rolling mucocloud (like the thunderheads on the horizon of a summer sunset) if the pus comes from any part of the urinary tract except the kidney (Plates V, VI).

But this distinctive pyuria is only encountered in the suppurative forms of pyelo-nephritis. When the lesion is mild and catarrhal we must look further for our diagnosis.

*Bacteria* appear in the pyelo-nephritic urine in a characteristic manner. When there is a notable pyuria the bacteria need not be especially noted. They befof the supernatant urine, but that is all. Yet there are many phases of mild catarrhal pyelitis, acute as well as chronic, in which pus is present in so small a quantity that the urine is clouded by the bacterial swarm rather than by pus—i. e., there is *bacteriuria* with all its characteristics, already studied at length (p. 363). We need not repeat them here.

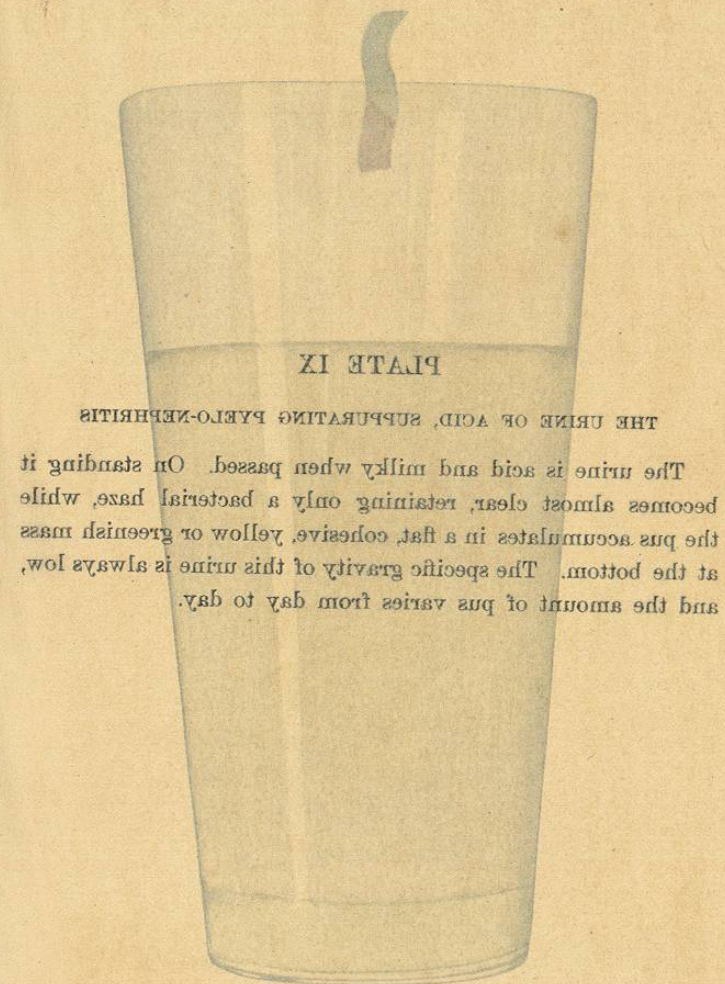
*Albumin* is always present in the urine of pyelo-nephritis. In the catarrhal (*bacteriuria*) cases there is habitually not enough albumin present to give Heller's ring; but careful acidulation and boiling after filtration will produce the characteristic light albuminous cloud. In the graver or more acute cases albumin may be present in great quantities, whether from renal exudation or from the presence of blood.

The *casts* are characteristic of the grade of kidney lesion. They often contain blood, pus, and epithelial cells.

Certain other characteristics of the urine of pyelo-nephritis are its *light colour and low specific gravity*, attributable to the deficient excretion of solids, and its *acidity*. The urine is always acid in catarrhal and almost always so in suppurative cases, and this is the more striking when the urine is so malodorous and purulent as to suggest ammoniacal cystitis.

To sum up: A characteristic pyelo-nephritic urine is light in colour and acid in reaction. It is hazy with bacteria, and if it contains pus in any quantity, this deposits in a solid flat mass, green or yellow. (Compare Plates V, VI, and IX.) Albumin may be discovered in the filtered urine, and the microscope reveals casts unless their presence is obscured by pus.

**The Perinephritic Tissue.**—Fibro-lipomatous perinephritis (p. 540), characterized by condensation of the perirenal fat into a dense fibro-lipomatous envelope, is constantly met with in severe cases of long standing, while some fibro-lipomatous masses are found about the pelvis in almost all cases.



THE URINE OF ACID SUPPURATING PYELO-NEPHRITIS

The urine is acid and milky when passed. On standing it becomes almost clear, retaining only a bacterial haze, while the pus accumulates in a flat cohesive yellow or greenish mass at the bottom. The specific gravity of this urine is always low, and the amount of pus varies from day to day.