DIAGNOSIS AND MANAGEMENT OF PYELONEPHRITIS

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OF the four common nephropathies, glomerulonephritis, nephrosclerosis, intercapillary glomerulosclerosis and pyelonephritis, at present only pyelonephritis, the most familiar of these, offers the possibility of arrest or cure. It has been strangely neglected, possibly because it is a nosologic stepchild, half surgical and half medical. Volhard and Fahr in 1914[1] did not list it among medical diseases of the kidney nor did Addis in 1925.[2] Apart from the pediatric, obstetric and urologic aspects, little of general interest was written about it until 1939 when Weiss and Parker[3] explored its relationship to hypertensive disease. In 1948 Raaschau[4] of Copenhagen published an excellent monograph on the subject with extensive pathologic and clinical studies. His most striking observation concerns its incidence. Among 3607 routine autopsies he found histopathologic evidence of pyelonephritis in 5.6 per cent. One half of these persons had died of renal failure but in only 1 out of 6 was the condition recognized ante mortem. Undoubtedly, if a disease is both common and remediable, its diagnosis and treatment are of general interest.

Etiology and Pathology

The most common organisms in pyelonephritis are colon bacilli and hemolytic streptococci. In some cases the infection is secondary to lesions which prevent free urinary drainage. In this group surgical correction of the causes of urinary stasis usually permits eradication of infection. Among the remaining patients the process is primary with no demonstrable anatomic abnormality. The organisms apparently reach the kidney substance through the blood stream. The pelvis and lower urinary tract become involved by contamination with infected urine.

Following infection, a focal or diffuse inflammatory process develops which involves all types of renal tissue, glomerular, tubular, interstitial and vascular. If the condition is unchecked the result is progressive scar formation with destruction of kidney substance which leads to hyalinization of the glomeruli and eventual atrophic kidney. The arterioles show proliferative endarteritis which Weiss and Parker suggest may account for the arterial hypertension occasionally noted in patients with pyelonephritis. The end stage closely resembles, and is even indistinguishable from terminal glomerulonephritis.

Diagnosis

In the group of patients with surgical lesions of the urinary tract, history, urinalysis and cultures, cystoscopy and pyelography establish diagnosis with little difficulty. Patients with primary pyelonephritis who give a history of recurrent chills and fever with dysuria accompanied by tenderness or pain in the kidney region will have pyuria and bacilluria during active phases. However, some are free of symptoms until they reach advanced stages of renal insufficiency and exhibit the evidences of early uremia and anemia. Frequently, recurrent attacks of pyelonephritis have been attributed by patient and physician to influenza because of backache and fever; sometimes they have been so slight as to be ignored and only recalled on questioning. These cases can be discovered only when pyelonephritis is suspected as a cause of obscure fever or chronic illness characterized by indefinite abdominal or lumbar distress.

Patients showing persistent or recurrent albuminuria, pyuria or cystitis should be examined for upper urinary tract infection. Urograms or retrograde pyelograms occasionally show blunting of the calices or distortion of the renal pelvis. When such changes are present they tend to confirm the diagnosis. However, more often than not, these studies show no abnormality and the diagnosis is made from repeated urine cultures and examinations of the urinary sediment.

Unfortunately, pyelonephritis can be moderately active and reveal slight or sporadic pyuria and proteinuria. Sterile urine cultures are notoriously frequent among patients who have active infection in the kidney substance. When these conditions prevail only repeated examinations and the demonstration of diminished renal function will lead to a proper diagnosis.

Appraisal of renal function is best made by the Addis test and urea clearance. The Addis test reflects tubular function in terms of ability to concentrate urine and defines the degree of proteinuria in grams per 24 hours. The Addis count detects and quantitates pyuria and hematuria not always apparent on routine examinations. Furthermore, if the leukocytes are examined with vital stains, or under the phase microscope, the degree of protoplasmic motion can be estimated. If extensive, active infection may be assumed. The urea clearance is a reliable measure of filtration rate.

In pyelonephritis, as compared with glomerulonephritis, the concentrating ability of the kidney is usually fairly well preserved. Unless the damage has been extensive the specific gravity of urine collected for the Addis test will exceed 1.018. Proteinuria is most pronounced during active infection but it is rarely extreme and ranges from 0.5 to 2 Gm. per 24 hours, while patients with glomerulonephritis and intercapillary glomerulosclerosis often excrete 3 to 10 Gm. per day. Pyuria is nearly always present when pyelonephritis is active and can reach 20 to 30 million white blood cells per 12 hours. During periods of quiescence the count may range from 1 to 5 million. Hematuria is occasionally gross during acute infection but usually it is slight or absent and never is observed constantly as in glomerulonephritis. Excessive cylindruria is an

uncommon finding save during severe attacks of inflammation. When casts are present they are granular and cellular in appearance.

The urea clearance is depressed in proportion to the concentrating power, in contrast to the proportionately greater decrease in filtration rate which characterizes glomerulonephritis and intercapillary glomerulosclerosis.

Nephrosclerosis of essential hypertension and arteriosclerosis cause renal functional changes similar to those of chronic pyelonephritis. Moreover, pyelonephritis at times induces arterial hypertension. To differentiate these cases one must depend upon history of recurrent urinary tract infection, pyelographic demonstration of ureteral or pelvic distortion, or the demonstration of bacteria in the urine. A strong family history of hypertensive disease or arteriosclerosis will encourage the diagnosis of primary vascular disease and conversely, if there is no such history, the evidence will favor infection as the cause of an obscure condition characterized by slight proteinuria, pyuria and diminished renal function.

Treatment

Once the diagnosis is made and the offending organism is known and maintained in culture, treatment with sulfadiazine or one of the proprietary preparations which furnish sulfadiazine, sulfamerazine and sulfathiazine in a single tablet, can be started. These drugs are preferred because they can be effective against both coccal and bacillary organisms and are infinitely less expensive than aureomycin, streptomycin or chloromycetin. They can be taken orally for months if necessary. Initial dosages should be sufficient to obtain concentration of 6 to 8 mg. per 100 cc. of blood. Four Gm. at the onset and 1 Gm. every 4 hours thereafter with equal parts of sodium bicarbonate are usually adequate. Fluid intake of 3000 cc. or more per day promotes satisfactory urinary drainage and discourages crystal formation. Inasmuch as many of these patients excrete the sulfonamides poorly because of renal damage, the blood concentration should be measured daily during intensive therapy.

At the same time, the sensitivity of the culture to sulfadiazine and to the antibiotics should be determined in vitro. If its growth is not inhibited by the sulfonamide, a more desirable drug can be substituted. Should the sulfonamide be effective, it may be continued until the patient is afebrile for 48 hours. Thereafter, dosages of 0.25 to 0.5 Gm. four times daily maintain urinary concentrations of 50 to 100 mg. per 100 cc. These are usually effective against recurrence and reinfection. In most cases it is wise to prolong this schedule for 6 to 8 weeks after all signs of infection are gone.

Patients who have pyelonephritis have a chronic disease, or at least are vulnerable to a recurrence with any subsequent illness, operation or pregnancy. If they are aware of the early signs of urinary tract infection and seek treatment at the first suggestion of recurrence, much distress and kidney damage can be prevented. For those who have measurable loss of renal reserve and recognized long-standing infection, an Addis examination and urine

culture at intervals of 3 to 6 months may detect recurrences that are devoid of symptoms.

Summary

Pyelonephritis is the most common of the nephropathies (5.6 per cent of 3607 routine autopsies), and is the only one that is remediable. In cases in which urinary stasis is due to a surgical lesion, diagnosis is relatively simple by cystoscopy, pyelography and urine cultures. Correction of the surgical lesion usually makes eradication of the infection comparatively easy.

In primary pyelonephritis, diagnosis depends upon adequate investigation of the patient's history, Addis examinations, urea clearance and repeated urine cultures. When the organism is identified, treatment with sulfonamides should be started, and the sensitivity of the organism to antibiotics can be determined simultaneously. If growth of the culture is not inhibited by sulfonamide, a more effective drug may be substituted.

Pyelonephritis is a chronic or recurrent disease and measures should be taken to prevent further kidney damage.

References

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