CASE RECORDS
OF THE
MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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CASE 12-1995

PRESENTATION OF CASE

A 59-year-old man was admitted to the hospital because of possible pneumonia and acute renal failure.

He had a 17-year history of non-insulin-dependent diabetes mellitus that had been managed in recent years with glyburide, with reportedly good control; he was known to have retinopathy and had undergone laser treatments 5 years before admission. Two months before admission evaluation elsewhere showed that the 24-hour urinary excretion of protein was 3.7 g; the serum creatinine level ranged between 1.0 and 1.5 mg per deciliter (88 and 130 μmol per liter), and the creatinine clearance was 77 ml per minute. During the six months before admission he had recurrent ankle edema.

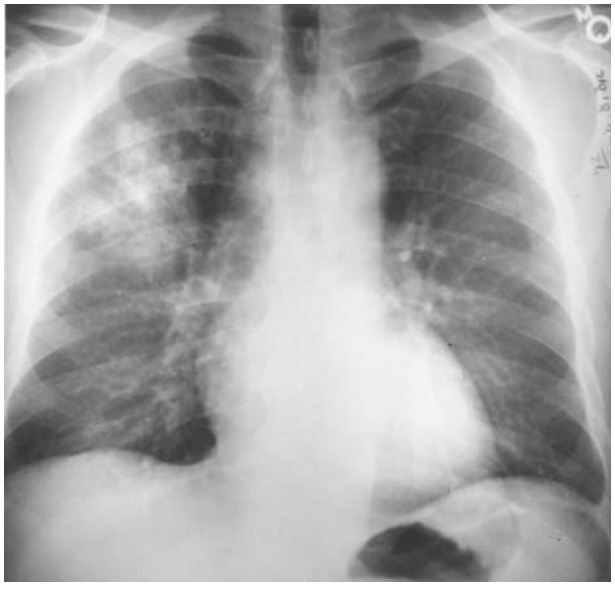

Figure 1. Posteroanterior Radiograph of the Chest, Showing a Patchy Air-Space Opacity in the Right Upper Lobe.
The other lung fields are clear, and the heart, mediastinum, and hilar areas are normal.

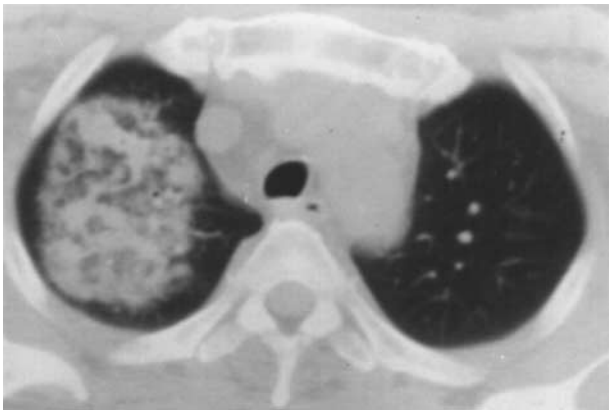

Figure 2. CT Image of the Chest, Showing a Right-Upper-Lobe Ground-Glass and Air-Space Opacity Involving the Central Lung Zone.

The patient was otherwise well until six days before admission, when he entered another hospital because of a dry cough, fever, chills, and sweats, with an infiltrate or mass in the right upper lobe (Fig. 1). He produced no sputum and was treated empirically with ceftriaxone, with resolution of the fever and cough after one day. At entry, the urea nitrogen level was 36 mg per deciliter (13 mmol per liter), and the creatinine level was 1.0 mg per deciliter; during the next six days the urea nitrogen level rose to 71 mg per deciliter (25 mmol per liter), and the creatinine level increased to 3.0 mg per deciliter (270 μmol per liter). The final five days at that hospital were marked by orthopnea, progressive edema, and oliguria despite increasing doses of diuretic agents. On the third hospital day a computed tomographic (CT) scan of the chest (Fig. 2) again showed a rounded area of air-space and ground-glass opacity. Three days later the patient was transferred to this hospital; he was receiving ceftriaxone, NPH insulin (isophane insulin suspension), furosemide, metolazone, and bumetanide.

The patient was a construction worker. He had contracted rheumatic fever at the age of 21 years, without residual cardiac damage. A left acoustic neuroma had been excised three years before admission. There was a history of insulin-dependent diabetes mellitus in his son and of non-insulin-dependent diabetes in both parents. There was no history of hematuria, urinary frequency, polyuria, nocturia, hemoptysis, pharyngitis, sinusitis, diarrhea, constipation, or use of alcohol or tobacco.

The temperature was 36.7°C, the pulse was 88, and the respirations were 20. The blood pressure was 170/65 mm Hg.

The patient breathed comfortably at an elevation of 45 degrees. No rash or lymphadenopathy was found. Moderate diabetic retinopathy was present; the oro-

pharynx was clear. The jugular venous pressure was 8 cm of water. The lungs were clear, and the heart and abdomen were normal. There was massive edema to the waist.

The prothrombin and partial-thromboplastin times were normal. The results of other hematologic tests and of blood chemical and urinary tests are presented in Tables 1, 2, and 3. An electrocardiogram showed a normal rhythm at a rate of 80, with nonspecific ST-segment and T-wave abnormalities. Radiographs of the chest revealed a patchy air-space opacity in the right upper lobe, with questionable thickening along the right paratracheal region; the heart appeared normal. Tests for antineutrophil cytoplasmic antibodies and anti–glomerular-basement-membrane antibodies were negative. The results of complement studies and a test for anti–deoxyribonuclease B antibodies were pending.

Table 1. Hematologic Findings on Admission.

VARIABLE	VALUE
Hematocrit (%)	35.7
Mean corpuscular volume (μm^3)	87
Erythrocyte sedimentation rate (mm/hr)	121
White-cell count (per mm^3)	12,000
Differential count (%)	
Neutrophils	85
Band forms	1
Metamyelocytes	3
Lymphocytes	8
Monocytes	2
Eosinophils	1
Platelet count (per mm^3)	349,000

Table 2. Blood Chemical Findings on Admission.*

VARIABLE	VALUE
Urea nitrogen (mg/dl)	74
Creatinine (mg/dl)	3.2
Glucose (mg/dl)	286
Bilirubin (mg/dl)	0.3
Triglyceride (mg/dl)	159
Cholesterol (mg/dl)	150
High-density lipoprotein	20
Low-density lipoprotein	98
Uric acid (mg/dl)	9.8
Protein (g/dl)	6.7
Albumin	2.0
Globulin	4.7
Sodium (mmol/liter)	128
Potassium (mmol/liter)	5.1
Chloride (mmol/liter)	94
Carbon dioxide (mmol/liter)	25.5
Magnesium (mmol/liter)	1.05
Calcium (mg/dl)	6.9
Phosphorus (mg/dl)	6.2
Aspartate aminotransferase (U/liter)	35
Lactate dehydrogenase (U/liter)	340
Alkaline phosphatase (U/liter)	400

*To convert the value for urea nitrogen to millimoles per liter, multiply by 0.357. To convert the value for creatinine to micromoles per liter, multiply by 88.4. To convert the value for glucose to millimoles per liter, multiply by 0.05551. To convert the values for bilirubin to micromoles per liter, multiply by 17.1. To convert the value for triglyceride to millimoles per liter, multiply by 0.01129. To convert the values for cholesterol to millimoles per liter, multiply by 0.02586. To convert the value for uric acid to micromoles per liter, multiply by 59.48. To convert the value for magnesium to milliequivalents per liter, multiply by 2. To convert the value for calcium to millimoles per liter, multiply by 0.25. To convert the value for phosphorus to millimoles per liter, multiply by 0.3229.

Table 3. Urinary Findings.

VARIABLE	VALUE
Protein	4+
Glucose	1+
Sediment (per high-power field)	
Red cells	35 (many dysmorphic)
Casts	
Granular	7
Red cell	0
Creatinine (g/liter)*	0.95
Sodium (mmol/liter)	42
Potassium (mmol/liter)	37.5
Chloride (mmol/liter)	72

*To convert the value for creatinine to millimoles per liter, multiply by 8.84.

Ceftriaxone and diuretic medications were discontinued. Insulin was administered, and a sodium polystyrene sulfonate resin was given by mouth; a low-sodium diet was provided. Daily doses of methylprednisolone (1000 mg) were injected intravenously. Severe oliguria persisted. During the first three hospital days the patient remained afebrile; the blood pressure was in the vicinity of 170/90 mm Hg on most occasions. The hematocrit declined to 33.7 percent, and the white-cell count fell to 10,400 per cubic millimeter; the urea nitrogen level rose to 140 mg per deciliter (50 mmol per liter), and the creatinine level increased to 5.1 mg per deciliter (450 μmol per liter).

A diagnostic procedure was performed.

DIFFERENTIAL DIAGNOSIS

DR. ROBERT M. BLACK*: This 59-year-old man with underlying renal disease and diabetes mellitus presented at another hospital with a respiratory tract illness complicated by renal failure. Ceftriaxone and, later, corticosteroids were administered. Before discussing the lung lesion, I shall review the underlying renal disorder.

Diabetic nephropathy is the most likely cause of the proteinuria detected two months before admission. Its presence is suggested by a long history of diabetes; proteinuria, which usually increases over time; a benign urinary sediment with few red cells or casts; slowly progressive renal failure; and usually diabetic retinopathy. In contrast to the frequency with which diabetic renal disease causes proteinuria and end-stage renal disease in adults, it is unusual for patients with uncomplicated diabetic nephropathy to have acute renal failure.[1] The

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most common cause of acute renal failure is prerenal disease — for example, a disorder due to the use of diuretic agents or exposure to radiocontrast material. In this patient, however, the presence of increasing edema and hematuria is evidence against diuretic-induced volume depletion, and apparently he did not receive radiocontrast medium at the time of the CT scan. May we review the radiologic findings?

DR. MEENAKSHI BHALLA: A posteroanterior radiograph of the chest (Fig. 1) shows an air-space opacity in the right upper lobe. The other lung fields are clear, and there is no pleural effusion. The hilar areas, mediastinum, and heart are normal. The CT scan (Fig. 2) shows a ground-glass and air-space opacity in the right upper lobe, with air bronchograms. The opacity involves the central lung zone, with sparing of the periphery. There is either dilatation of blood vessels or perivascular thickening in this region.

DR. BLACK: The differential diagnosis of the pulmonary abnormality in this patient is complex. Both lymphomas and carcinomas may be associated with acute renal failure.[2,3] Although a primary lung tumor, such as a bronchioloalveolar-cell carcinoma, might produce this radiologic picture, the patient presented with fever, chills, and a nonproductive cough after a brief prodrome. Most patients with bronchioloalveolar-cell carcinoma have at least some sputum production.[4] Other primary lung tumors are unlikely in view of the radiologic findings and the absence of a history of smoking. Lymphoma is improbable, since diffuse lymphadenopathy was not observed on the CT scan. The apparent change in the radiologic appearance of the lesion over a period of days is also evidence against an uncomplicated lung tumor but is compatible with both infection and hemorrhage. Hemoptysis was not documented, but I shall discuss the possibility that it occurred when I review the causes of acute renal failure. An accumulation of lung fluid can also be observed with unilateral pulmonary edema, but there was no evidence of cardiomegaly or valvular heart disease on the radiologic or physical examination. Consequently, I shall exclude that possibility. The possibility of a thromboembolus due to renal-vein thrombosis should be considered in any patient with the nephrotic syndrome and a pulmonary lesion. The fact that the pulmonary abnormality preceded the acute renal failure, however, is evidence against this diagnosis. Moreover, renal-vein thrombosis is more unusual in patients with diabetic nephropathy[5] than in those with the nephrotic syndrome caused by other disorders, such as membranous nephropathy. On the basis of this reasoning and the patient's presentation and course, I believe that the pulmonary process was probably an infection. The rapid suppression of the cough and fever after 24 hours of ceftriaxone therapy supports this diagnosis but also suggests that an atypical pneumonitis (due, for example, to mycoplasma) was not present. I cannot identify the cause of the lung infection, if present, from the case record alone.

Although I shall consider a number of possible causes of the acute renal failure, only one explains all the findings in this case. The renal disease was characterized by a decline in renal function that began about 10 days after the onset of the respiratory symptoms, with oliguria and massive edema. Examination of the urinary sediment revealed ++++ protein and 35 red cells per high-power field, as well as granular casts. Although no red-cell casts were observed, many of the free red cells in the urine were dysmorphic.

The morphologic pattern of the red cells may help to determine the cause of renal involvement in a patient with hematuria. The red cells are typically uniform and round in patients with extrarenal bleeding but often appear dysmorphic in patients with renal lesions, especially lesions associated with glomerular diseases.[6] This morphologic change is manifested by blebs, budding, and segmental loss of cell membrane, resulting in marked variability in the shape of the red cells and a reduction in their mean size in the urine.[7] Red-cell injury in this setting may be due to both mechanical trauma, as the cells traverse the glomerular basement membrane, and osmotic trauma, as the cells move through the tubules.[8] The value of the red-cell morphologic pattern in the diagnosis of hematuria, however, remains to be proved. One problem is the limited experience of most examiners in assessing this abnormality. The diagnostic yield is likely to be greatest when almost all the red cells are dysmorphic. If both monomorphic and dysmorphic red cells are present, however, the origin of the hematuria may be uncertain unless red-cell casts are also seen.[9] With the understanding that the dysmorphic appearance of the red cells alone may not indicate glomerular involvement, is there a nonglomerular disorder associated with hematuria that could have caused acute renal failure in this case?

Acute interstitial nephritis is induced most often by drug therapy, although sarcoidosis, legionella infection, leptospirosis, streptococcal infection, and even viral infections are also possible causes.[10] Most patients present with acute renal failure; fever, which may be accompanied by a rash; and white cells, white-cell casts, and free red cells in the urinary sediment. Eosinophilia or eosinophiluria is present in more than 75 percent of the cases. The absence of many of these findings in this case leads me to dismiss acute interstitial nephritis as improbable. On the basis of the urinary sediment and the clinical course, therefore, I believe that the patient under discussion had an acute glomerular lesion superimposed on diabetic nephropathy.

Glomerular disorders can be divided into two categories: those that are nephrotic, with proteinuria as the primary finding, such as diabetic nephropathy, membranous nephropathy, minimal-change disease, focal segmental sclerosis, and amyloidosis, and those that are nephritic, manifested by red cells and red-cell casts in the urine. When nephrotic disorders cause progressive renal insufficiency, the course is insidious; acute renal failure is unusual, and when it does occur, minimal-change disease is almost always the cause of the nephrotic syndrome.[11] Thus, although I believe that

this patient had diabetic nephropathy, I shall rule out a nephrotic disorder as the cause of his acute renal failure. Unlike nephrotic disorders, nephritic forms of glomerulonephritis frequently cause acute renal failure. I shall now discuss the five principal nephritic disorders that should be considered in this patient with pulmonary infiltrates.

The clinical diagnosis of lupus nephritis is usually based on the characteristic multisystem involvement and the serologic abnormalities — an elevated titer of antinuclear antibodies, circulating antibodies to native (double-stranded) DNA, and low plasma C3 and C4 levels. When the renal disease develops in the absence of typical extrarenal manifestations, the most common disorder is membranous nephropathy,[12] which is unlikely in this patient with hematuria and acute renal failure. The clinical presentation is atypical of lupus nephritis, although the results of serologic studies were pending.

Antibodies to the glomerular basement membrane and lungs are present in patients with Goodpasture's syndrome, a disorder characterized by both pulmonary hemorrhage and glomerulonephritis. The variable presence of clinically evident pulmonary disease seems to reflect a general lack of access of circulating glomerular-basement-membrane antibodies to the alveolar basement membrane. Thus, patients with pulmonary involvement usually have underlying pulmonary disease due to smoking or, less frequently, infection or exposure to hydrocarbons.[13-15] In addition to circulating antibodies to the glomerular basement membrane, linear deposition of IgG can be seen on immunofluorescence staining of renal-biopsy specimens. The only other disorders with this pattern of linear immunofluorescence are diabetic nephropathy and fibrillary glomerulonephritis,[16,17] but a renal biopsy can almost always distinguish these disorders from disease involving anti–glomerular-basement-membrane antibodies. Since this patient had no hemoptysis and since the test for anti–glomerular-basement-membrane antibodies was negative, the diagnosis of Goodpasture's syndrome is unlikely. I should add that the method of detecting anti–glomerular-basement-membrane antibodies is important. Immunoassays are highly sensitive, whereas indirect immunofluorescence tests, which can be performed much more rapidly, give false negative results in up to 40 percent of cases.[18] Thus, a negative test by indirect immunofluorescence does not rule out glomerulonephritis associated with anti–glomerular-basement-membrane antibodies.

IgA nephropathy (Berger's disease) is the most common cause of glomerular hematuria.[19,20] The diagnosis can be established by the presence of prominent globular mesangial IgA deposits on immunofluorescence staining of a renal-biopsy specimen. There is often an increase in hematuria in patients with IgA nephropathy within one to three days after the onset of a respiratory tract infection. The glomerular filtration rate is generally normal or only slightly reduced during the acute episodes, but acute renal failure, which is usually reversible, can occur and may be associated with glomerular crescent formation.[21] The delay of more than one week in the onset of acute renal failure and the absence of a history of hematuria make IgA nephropathy a less likely diagnosis in this case.

I shall turn now to the possibility that this patient's course can be attributed to a systemic vasculitis. Wegener's granulomatosis is the most common form of necrotizing vasculitis involving both the kidneys and the respiratory tract. The renal lesion is a necrotizing glomerulonephritis, often with crescent formation. Immune deposits are usually absent in the glomeruli and the renal vessels, and necrotizing granulomas, which are frequently present in the upper and lower respiratory tracts, are rarely found in renal-biopsy specimens.[22] Lung involvement in Wegener's granulomatosis is variable and may be characterized by infiltrates, cavitary lesions, or hemorrhage. Except for hemorrhage, which can lead to life-threatening hemoptysis, the pulmonary lesions in this disorder are unlikely to change rapidly during a period of several days. Furthermore, peripheral edema occurs in a minority of patients with Wegener's granulomatosis, and massive edema is uncommon. Most of the patients in whom edema develops with concurrent nephrotic proteinuria have a more protracted course and a better preserved glomerular filtration rate, which permits continued urinary protein losses.[23] Antineutrophil cytoplasmic antibodies can be detected in the serum in more than 90 percent of patients with Wegener's granulomatosis.[24,25] Antineutrophil cytoplasmic antibodies directed against proteinase 3, which is one of three serine proteinases located in the azurophilic granules of neutrophils, are the most specific antibodies detected in patients with this disorder.[25] The negative test in the patient under discussion is evidence against the diagnosis of Wegener's granulomatosis.

Before dismissing the possibility of systemic vasculitis, however, I should mention the importance of the high sedimentation rate. The sedimentation rate is elevated in almost all patients with the nephrotic syndrome and advanced renal failure.[26] A third of them have a sedimentation rate that is more than 100 mm per hour, a value usually associated with cancer, connective-tissue disorders such as lupus, and vasculitis.[27] The frequent elevation of the sedimentation rate in patients with renal disease is clinically important, because that finding alone is not an indication to search for an underlying systemic disorder.

The disease that I believe caused this patient's acute renal failure is postinfectious glomerulonephritis. A variety of bacterial, viral, and parasitic infections can lead to a proliferative glomerulonephritis.[28-30] The prototype for this disorder is poststreptococcal glomerulonephritis.

Although poststreptococcal glomerulonephritis usually follows impetigo or a streptococcal throat infection, similar histologic findings may follow a number of nonstreptococcal infections.[31-33] Furthermore, although poststreptococcal glomerulonephritis is more common in younger people, both streptococcal glomerulonephritis and nonstreptococcal postinfectious glomerulone-

phritis have been reported in older people.[34-36] In a study of 803 nondiabetic patients in New Zealand with biopsy-proved glomerulonephritis, only IgA nephropathy, membranous nephropathy, and focal segmental glomerulosclerosis were more common than postinfectious glomerulonephritis.[37]

In addition to nephritogenic strains of group A streptococci, acute postinfectious glomerulonephritis has been reported after several other viral, fungal, and bacterial infections, including bacterial pneumonias.[32,35,38-40] In the case under discussion the clinical presentation and apparent response to antibiotic therapy favor a bacterial infection as the cause of the pulmonary infiltrate. The latent period between the onset of infection and the clinical evidence of renal disease in postinfectious glomerulonephritis varies, averaging between 10 and 21 days,[41] in contrast to the shorter latent period characteristic of IgA nephropathy. The former time frame is compatible with the interval of approximately 10 days between the onset of symptoms and the development of renal insufficiency in this patient. When the disease is symptomatic, the characteristic findings at presentation include hematuria, oliguria, edema, and hypertension. Although the symptoms are typically more mild in patients with nonstreptococcal postinfectious glomerulonephritis,[29] they can be severe.[35-37] Pulmonary congestion may occur, mainly because of sodium and water retention induced by the low glomerular filtration rate.[42] Such congestion could explain the orthopnea and estimated central venous pressure of 8 cm of water in this patient, as well as the severe edema, which seems to have been disproportionate to the degree of renal insufficiency. A low plasma C3 level occurs during the first week in most children and adults with poststreptococcal glomerulonephritis[36] but is less common in patients with nonstreptococcal postinfectious glomerulonephritis[31]; in this case the complement results were pending.

Postinfectious glomerulonephritis is typically acute, with spontaneous recovery in almost all patients, even those in whom renal insufficiency develops during the acute episode.[43,44] A diuresis usually begins within one to two weeks, and the renal function falls to base line within a month in most patients.[43] On the other hand, the urinary abnormalities, such as hematuria, tend to disappear much more slowly,[45] and some patients have residual damage, which may be manifested years later as hypertension, proteinuria, or progressive renal failure.[46]

The diagnosis of postinfectious glomerulonephritis is suggested by its clinical presentation and usually by hypocomplementemia. In the absence of a streptococcal infection the disorder may not be considered seriously in the differential diagnosis, particularly in older patients.[35] When the cause of renal failure is uncertain, a definitive diagnosis can be made only by renal biopsy, which will reveal a diffuse proliferative glomerulonephritis with characteristic subepithelial deposits ("humps")[47]; crescent formation may also be observed.

The treatment of postinfectious glomerulonephritis is largely supportive. According to most studies, antibiotic therapy does not appear to prevent the development of glomerulonephritis in patients with streptococcal disease, particularly if the therapy is initiated after 36 hours of infection.[48] Furthermore, there is little evidence that immunosuppressive therapy with corticosteroids accelerates recovery or improves the long-term outcome.

I believe that the diagnostic procedure was a renal biopsy and that the findings were most consistent with an acute postinfectious glomerulonephritis superimposed on diabetic nephropathy.

DR. EUGENE J. MARK: Dr. Niles, will you give us your impressions before the diagnostic procedure?

DR. JOHN L. NILES: Initially, we were most concerned about a disease related to antineutrophil cytoplasmic antibodies. When the tests for antineutrophil cytoplasmic antibodies and anti–glomerular-basement-membrane antibodies were reported as negative, however, we favored the diagnosis of postinfectious glomerulonephritis or possibly interstitial nephritis, for which the patient was treated with corticosteroids transiently.

DR. CECIL H. COGGINS: There has been a remarkable change in the prevalence of various types of glomerular disease. Poststreptococcal glomerulonephritis was once the most common form of nephritis, but now it is less than 1/10 as common as Wegener's granulomatosis in our adult population.

CLINICAL DIAGNOSIS

Acute postinfectious glomerulonephritis.

DR. ROBERT M. BLACK'S DIAGNOSIS

Acute postinfectious glomerulonephritis superimposed on diabetic nephropathy.

PATHOLOGICAL DISCUSSION

DR. SHANE M. MEEHAN: The diagnostic procedure was a percutaneous renal biopsy. The specimen contained eight glomeruli, which were enlarged and hypercellular, with partial narrowing of the capillary loops. Neutrophils were present within the capillaries and extended into the mesangium (Fig. 3). The glomerular basement membranes were shown to be diffusely thickened by periodic acid–Schiff staining, without evidence of duplication, and there was a moderate-to-severe, diffuse, global increase of the mesangial matrix, which is typical of diabetic glomerulosclerosis. The arterioles were hyalinized (Fig. 3). There was no evidence of interstitial nephritis.

Direct immunofluorescence revealed discrete granular deposits of IgG and C3 in the peripheral capillary walls and the mesangium (Fig. 4). IgA and IgM deposits had a similar distribution, with less intensity. Electron-microscopical examination of one sclerotic glomerulus revealed diffuse thickening of its basement membrane, an increase in the mesangial matrix, neutrophils and dense deposits in the mesangium, and focal subepithelial humps. Microscopical examination also revealed an acute arteritis with fibrinoid necrosis of the media and adventitia and an infiltrate of mononuclear cells and occasional neutrophils (Fig. 5). Fi-

brin-related antigens and C3 were observed in small arteries on immunofluorescence examination.

These findings provide evidence of an acute immune-complex–mediated glomerulonephritis superimposed on chronically injured glomeruli. The acute glomerular injury was typical of postinfectious glomerulonephritis. High titers of streptococcal protein anti–deoxyribonuclease B antibodies (1360 U [normal value, less than 85 U]) were detected nine days after the biopsy, suggesting that group A β-hemolytic streptococcal infection had triggered the immune-complex formation. The diagnosis is therefore acute postinfectious glomerulonephritis, with arteritis, superimposed on diabetic nephropathy.

Postinfectious glomerulonephritis has been reported only rarely in association with diabetic nephropathy, and no cases involving arteritis have been documented. In 13 reported cases of postinfectious glomerulonephritis with diabetic nephropathy,[49-51] streptococcal infection (principally of the respiratory tract) or staphylococcal skin infection preceded the glomerulonephritis. The patients had had diabetes for a mean period of 15 years (range, 8 to 35), and many had retinopathy at the time of the diagnosis. Typical presenting features were acute deterioration of renal function, hematuria, and an abrupt increase in proteinuria. Diffuse glomerulosclerosis was usually present in biopsy specimens, with superimposed acute proliferative and exudative changes. Follow-up periods ranged from two months to seven years. Four patients recovered completely from the acute episode, three required long-term hemodialysis, and one died during the acute phase of the disease; no follow-up information was available for the other five.

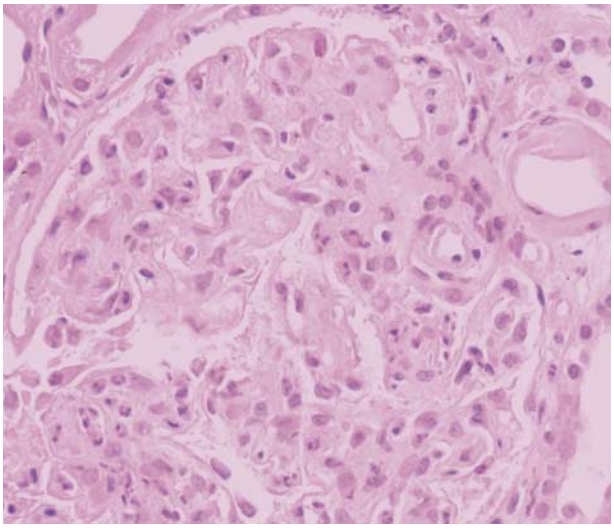

Figure 3. Renal-Biopsy Specimen, Showing Proliferative Glomerulonephritis with Neutrophils in the Capillaries and Mesangium (×95).
A hyalinized arteriole is also shown (top).

DR. ROBERT T. MCCLUSKEY: Arteritis is an unusual feature of postinfectious glomerulonephritis. Renal or cutaneous vasculitis and immune deposits in splenic vessels have been described in a few patients with reasonably well documented poststreptococcal glomerulonephritis,[40,52] providing evidence for a pathogenic role of circulating immune complexes in this disease. Although it has been proposed that the antigens are streptococcal products, evidence of their presence in circulating complexes or glomerular immune deposits is not compelling.[40] It is possible that the most important pathogenic complexes contain autologous antigens — in particular, IgG in cryoglobulins.

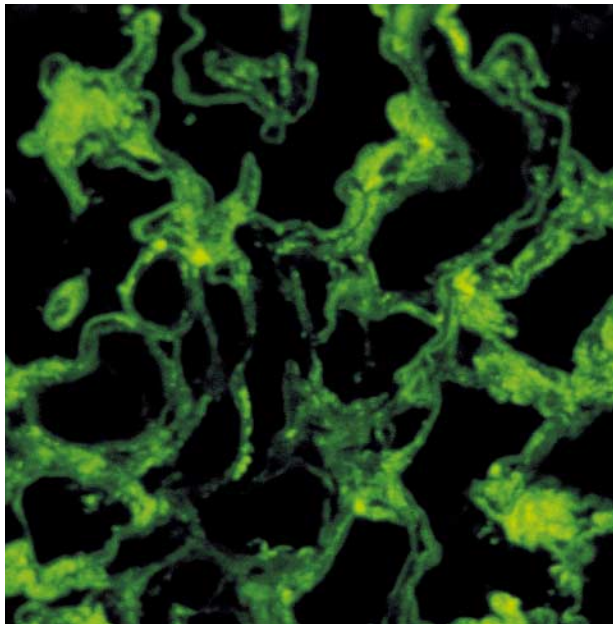

Figure 4. Direct Immunofluorescence Staining of Granular IgG along the Glomerular Basement Membrane and in the Mesangium (×352).

DR. NILES: The C3 level, which was reported after the renal biopsy, was 25 mg per deciliter, and the C4

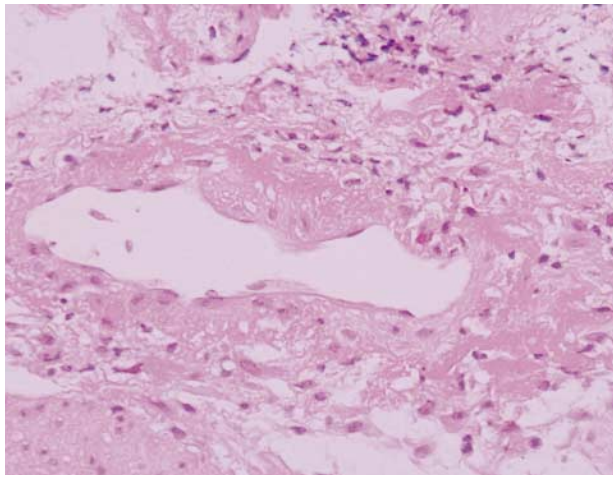

Figure 5. Small Artery with Fibrinoid Necrosis and an Infiltrate of Mononuclear Cells (×87).

level was normal. After the administration of steroids, the urinary output increased, and the creatinine level fell to 3.0 mg per deciliter (260 μmol per liter). When the biopsy results became available, the steroids were discontinued. The creatinine level rose slightly, to 3.1 mg per deciliter, and remained at that level for two days. Steroids were then restarted, the diuresis increased, and the creatinine level fell to 2.6 mg per deciliter (230 μmol per liter) before the patient's discharge and to 1.3 mg per deciliter (110 μmol per liter) three months later. The abnormal findings on the x-ray films of the chest disappeared over a period of several days.

Anatomical Diagnosis

Acute postinfectious glomerulonephritis with arteritis superimposed on diabetic nephropathy.

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