3.13 Renovascular Hypertension and Ischemic Nephropathy

Effects of medical therapy and surgery or angioplasty on serum creatinine levels. This figure describes eight patients hospitalized because of severe hypertension and renal insufficiency. With medical management of the hypertension (antihypertensive drug therapy), four of the eight patients developed substantial worsening of their renal function as measured by serum creatinine; three of these four patients demonstrated improvement following surgery or angioplasty. The other four patients (patients one to four) did not demonstrate a worsening serum creatinine level with medical therapy; but three of these four patients showed improved renal function following surgery or angioplasty. (Adapted from Ying and coworkers [9]; with permission.)

FIGURE 3-22

Improved renal function demonstrated by intravenous pyelography following left renal revascularization. A, preoperative IVP (5-minute film) in a 65-year-old white man with a 15-year history of hypertension; serum creatinine 2.6 mg/dL. Note poorly functioning left kidney, which measured 11.5 cm in height. B, post operative IVP (5-minute film) obtained following left aortorenal saphenous vein bypass grafting to the left kidney. Note the prompt function and increased height (14.0 cm) of the revascularized left kidney versus the preoperative IVP. (From Novick and Pohl [10]; with permission.)

The clinical story of the patient in Figure 3-21, the benefits of surgical renal revascularization or percutaneous transluminal renal angioplasty (Fig. 3-22), and the radiographic evidence of improved renal function after renal revascularization (Fig. 3-23) are examples of ischemic nephropathy. Two definitions of ischemic nephropathy are suggested herein: 1) clinically significant reduction in renal function due to compromise of the renal circulation; and 2) clinically significant reduction in glomerular filtration rate due to hemodynamically significant obstruction to renal blood flow, or renal failure due to renal artery occlusive disease.
Hypertension and the Kidney

**Clinical Presentations of Ischemic Renal Disease**

- Acute renal failure, frequently precipitated by a reduction in blood pressure (i.e., angiotensin-converting enzyme inhibitors plus diuretics)
- Progressive azotemia in a hypertensive patient with known renal artery stenosis treated medically
- Progressive azotemia in a patient (usually elderly) with refractory hypertension
- Unexplained progressive azotemia in an elderly patient
- Hypertension and azotemia in a renal transplant patient

**Figure 3-24**

Atherosclerotic renal artery stenosis in patients with generalized atherosclerosis obliterans and in patients with coronary artery disease (CAD). Atherosclerotic renal artery stenosis is common in older patients with and without hypertension simply as a consequence of generalized atherosclerosis obliterans. Approximately 40% of consecutively studied patients undergoing arteriography for routine evaluation of abdominal aortic aneurysm, aorto-occlusive disease, or lower extremity occlusive disease have associated renal artery stenosis (more than 50% unilateral renal artery stenosis) and nearly 30% of patients undergoing coronary angiography may have incidentally detected unilateral renal artery stenosis. Approximately 4% to 13% of patients with CAD or peripheral vascular disease have more than 75% bilateral renal artery stenosis. Correlations of hypercholesterolemia and cigarette smoking with renal artery atherosclerosis are not unequivocally clear, but they probably represent risk factors for renal artery atherosclerosis just as they represent risk factors for atherosclerosis in other vascular beds.

(Adapted from Olin and coworkers [11]; with permission.)

**Figure 3-25**

Clinical presentations of ischemic renal disease. The clinical presentation of a patient likely to develop renal failure from atherosclerotic ischemic renal disease is that of an older (more than 50 years) individual demonstrating progressive azotemia in conjunction with antihypertensive drug therapy, risk factors for generalized atherosclerosis obliterans, known renal artery disease, refractory hypertension, and generalized atherosclerosis. A cute renal failure precipitated by a reduction in blood pressure below a "critical perfusion pressure," and particularly with the use of angiotensin converting-enzyme inhibitors (ACEI) or angiotensin II receptor blockers plus diuretics, strongly suggests severe intrarenal ischemia from arteriolar nephrosclerosis and/or severe main renal artery stenosis.

Unexplained progressive azotemia in an elderly patient with clinical signs of vascular disease with minimal proteinuria and a bland urinary sediment also suggest ischemic nephropathy. (Adapted from Jacobson [14]; with permission.)

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**Atherosclerotic Renal Artery Stenosis in 395 Patients with Generalized Atherosclerosis Obliterans and in Patients with Coronary Artery Disease**

<table>
<thead>
<tr>
<th>Patients, n</th>
<th>Percent of patients with &gt;50% stenosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal aortic aneurysm</td>
<td>109</td>
</tr>
<tr>
<td>Aorto-occlusive disease</td>
<td>21</td>
</tr>
<tr>
<td>Lower extremity disease</td>
<td>189</td>
</tr>
<tr>
<td>Suspected renal artery stenosis</td>
<td>76</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>817</td>
</tr>
</tbody>
</table>

*50% in diabetic patients.
†Data from Vetrovec and coworkers [12].
‡Data from Harding [13].
Mild stenosis (less than 50%) due to atherosclerotic disease of the left main renal artery (panel A) that has progressed to high-grade (75% to 99%) stenosis on a later arteriogram (panel B). Underlying the concept of renal revascularization for preservation of renal function is the notion that atherosclerotic renal artery disease (ASO-RAD) is a progressive disorder. The sequential angiograms in Figures 3-26 and 3-27 show angiographic progression of ASO-RAD over time. In patients demonstrating progressive renal artery stenosis by serial angiography, a decrease in kidney function as measured by serum creatinine and a decrease in ipsilateral kidney size correlate significantly with progressive occlusive disease. Patients demonstrating more than 75% stenosis of a renal artery are at highest risk for progression to complete occlusion. (From Novick [15]; with permission.)

FIGURE 3-26

A, Normal right main renal artery and minimal atherosclerotic irregularity of left main renal artery on initial (1974) aortogram. B, Repeat aortography (1978) showed progression to moderate stenosis of the right main renal artery (arrow) and total occlusion of left main renal artery (arrow). (From Schreiber and coworkers [16]; with permission.)