Radiology Associates LLP

Renovascular Interventions

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INTRODUCTION

Once the diagnosis of renal artery stenosis (RAS) has been established, two questions are raised: "Who should under go revascularization?" and "What benefit will revascularization provide?"

INCIDENCE OF RENAL ARTERY STENOSIS

Renal artery stenosis greater than or equal to 50% is seen in approximately 20% of patients aged 65 years or older, and in 40% of patients aged 75 years or more. Angiography for peripheral vascular disease (PVD) or coronary artery disease finds approximately 25% of patients have greater than or equal to 50% stenosis. Over time, nearly half of the patients examined will show significant progression of the disease over a 4-5 year period, with close to 20% becoming occlusive, contributing to renal failure. Over this same time span, new contralateral lesions will be seen in nearly half of the patients. For the record, significant renal artery stenosis is defined as either a cross sectional narrowing of the artery greater than or equal to 60%, or any naarrowing with a measured intra-arterial blood pressure difference greater than 5 mm of mercury.

ISCHEMIC NEPHROPATHY AND RENOVASCULAR HYPERTENSION

Ischemic nephropathy is defined as critical main renal artery stenosis or occlusion in combination with excretory renal insufficiency. It is the etiology for end stage renal disease (ESRD) in approximately 15% of patients beginning dialysis. A clear relationship has been established between worsening renal artery stenosis and an elevation in BUN, serum creatinine and a decrease in creatinine clearance. This can occur despite adequate control of the patient's blood pressure. Studies have also clearly demonstrated that vascular intervention with restoration of blood flow has an impact in stabilizing renal function, often preventing the otherwise inevitable deterioration. It bears reminding that renal artery occlusion is a silent disease. It does not manifest itself as other organs do. There is no equivalent "acute attack" scenario, as is the case with cardiac or carotid disease. It is all too often discovered only when the patient's doctor informs them that they need dialysis.

While the incidence of true renovascular hypertension (RV-HTN) in the general population is only about 4-5%, the prevalence of combined atherosclerotic vascular disease (ASVD) and hypertension (HTN) is much greater. Therefore a significant number of patients with combined ASVD and HTN will not have pure RV-HTN.

INDICATIONS FOR INTERVENTION

With this in mind, the literature proposes the following as clear-cut indications for percutaneous revascularization procedures (i.e., renal angioplasty or stent placement): (1) bilateral RAS (2) unilateral kidney with RAS (3) unilateral or bilateral RAS with renal insufficiency (4) "flash" pulmonary edema (5) extremely labile or non-controlled hypertension (6) fibromuscular dysplasia (angioplasty alone) It has also been shown that patients with CHF or unstable angina in association with RAS can have a significant cardiovascular benefit from renal intervention. Only considered as a relative indication is the patient with moderate to severe hypertension fairly well controlled on medicines.

While the leading indication for renal intervention is hypertension, the expected results when treating exclusively for HTN are less than ideal. Only 8-10% will achieve a true cure. This probably is due to the low prevalence of pure RV-HTN in the population. Fifty to 60% will show improvement, seen as a reduction in medicines necessary to control their HTN. A full 30% will see no change in their HTN despite a technically successful procedure.

RESULTS

The technical success for a percutaneous procedure (defined as revascularization of the main renal artery with less than 30% residual stenosis, or a pressure gradient of less than 5 mmHg across the stenosis) is achieved in greater than 95% of patients. Stenting of most lesions/stenoses has been shown to yield better initial success rates than angioplasty alone. This is due to the fact that angioplasty alone leads to undesirable result in a fair number of cases,

which are then stented for salvage. Angioplasty alone is often successful and adequate for treatment, and reserves stenting for cases of re-stenosis. Primary stenting should be used for ostial stenosis, which are extensions of calcified aortic plaques around the renal ostium. Densely calcified and eccentrically located stenoses in the main renal artery should also be strongly considered for primary stenting. For cases of fibromuscular dysplasia, a less common but very treatable etiology of renovascular hypertension, angioplasty alone is recommended, with stenting reserved only for severe, flow-limiting injury during the angioplasty. Results of angioplasty for fibromuscular dysplasia are generally very good and longer lasting.

RECURRENCE

Restenosis rates are on the order of 15-20% per year. The most important factor leading to restenosis is the renal artery diameter. Vessels dilated to 6mm or more have lower restenosis rates. Vessels only dilated to 5 mm or less have higher restenosis rates. This is primarily due to the fact that all stents and angioplastied vessels undergo intimal repair, akin to a scar formation. Epithelial tissue will grow over the stent or angioplastied site, ultimately narrowing the lumen. The larger the Luminal diameter at the outset, the greater the resulting diameter will be after the healing process has finished. Another factor that leads to rapid restenosis is continued smoking by the patient. White females also tend to have higher restenosis rates, at least in part due to their inherently smaller vessels.

Since the natural history of a stented vessel is that if incorporation of the stent into the vessel wall, restenosis may often be treated as just another stenosis. Repeat angioplasty can be performed, and stenting utilized for lesions that recoil after angioplasty alone. There is a large body of new research in the area of preventing vascular re-stenosis, with some of the new anti-platelet agents showing some promise in this area.

COMPLICATIONS

Treating a difficult renal artery stenosis remains one of the more challenging procedures for a vascular radiologist. The usual complications associated with routine angiography are magnified in the renal patient. Bleeding risks are greater (5-10%), since generous use of anticoagulants and anti-platelet agents are combined with the larger sheaths used to facilitate passage of catheters and stents. Contrast load is a particular concern in this patient population. The end result of contrast nephrotoxicity is variable, with most patients returning to normal after a period of decreased renal function. Cholesterol emboli can occur as the angioplasty balloon fractures atherosclerotic plaque and squeezes out microscopic particles of cholesterol. These particles shower to the tiny end arterioles of the kidney, setting up an inflammatory cascade that doesn't manifest itself until days later when the patient's renal function significantly and irreversibly deteriorates. This process is invisible to the angiographer during the procedure. The end result appears no different than usual. Injury to the renal artery leading to thrombosis can often be treated percutaneously, but at considerable discomfort to the treating physician. The dreaded arterial rupture (1-2%) can only occasionally be salvageable percutaneously. Usually it requires emergency surgery for repair. Often it ends up with renal loss, and in the worse circumstances can be fatal. Some new "covered" stents are now available and these have an application for this serious problem. However, they are not FDA approved for use in the vascular system (but did you know that the FDA hasn't approved any stent for use in a renal artery!).

Studies analyzing 30-day mortality have shown rates of 2-7% in patients undergoing percutaneous renal revascularization, with the majority of deaths being related to co-morbid conditions. This underscores the generally ill nature of these patients. Mortality from the percutaneous procedure itself is on the order of 1%, still making it one of the highest risk procedures undertaken between a vascular radiologist and a patient. Thirty day mortality rates for surgical revascularization are also on the order of 2-7%. But this number increases to 9% in patients with ASVD (which is approximately 50% of the pool), and 22% for patients with serum creatinine of >1.4. The numbers are slightly lower for large centers with extensive experience. There have been no studies which have definitely shown a better long term outcome between surgical versus percutaneous revascularization, although the restenosis rate for surgical intervention is lower, approximately 10% at one year.

SUMMARY

It is worth mention that most patients with significant renal artery stenosis have multiple co-morbid conditions, including CAD, PVD, DM, HTN, cerebral vascular disease and COPD. The life expectancy for most patients with 3 or more of these conditions requiring vascular intervention, surgical or otherwise, is approximately 50% at 2 years. Weighing the potential benefit versus risk of any procedure is paramount in the ultimate decision of whether or not to perform an intervention.