

## Pre-Operative Assessment Of The Patient With Renal Insufficiency

Patricia Zuniga, MD

Surgery imposes a significant stress on the body. Physiologic stresses during surgery include fluid shifting, hormonal alterations and hemodynamic changes, especially during open- heart surgery. During the first 24 hrs there is an increase in catecholamines, cortisol, corticotropin and glucagon levels. Exposure to toxins is not unusual since many procedures such as heart catheterizations, require the use of contrast dye. All of these factors have a significant impact on the body as a whole and the nephron in particular. They may either cause or worsen renal dysfunction -temporally or permanently. In this brief review we will outline the most common problems a general internist should consider when asked to evaluate a patient with renal insufficiency before undergoing surgery, what basic work up should be done and what preventive or therapeutic measures should she/he recommend.

Acute renal failure or worsening of an already established renal dysfunction is common during the peri-operative period. The renal damage is usually the result of multiple factors, but more frequently it is the result of an ischemic injury in a susceptible individual. A typical scenario is a patient who is undergoing a high- risk procedure, such as heart/vascular surgery and is diabetic or has atherosclerotic disease. In addition, patients may require a nephrotoxic substance such as contrast dye or an aminoglycoside. These patients may also go through hypotensive periods during or after surgery, increasing the likelihood of renal injury and complications. In a study of 834 patients from a VA hospital who underwent either heart valve surgery alone or in combination with CABG, a retrospective analysis demonstrated an increased frequency of poor outcome among patients with a baseline creatinine above 1.5 mg/dL. Furthermore these patients also had a higher incidence of bleeding, respiratory and cardiac complications.<sup>1</sup>

It is therefore important to identify individuals at risk for renal complications early in order to start appropriate measures to decrease the likelihood of renal disease. This task is easily done with a complete history and physical examination paying special attention to volume status: symptoms and signs of volume overload or dehydration. A complete past medical history should include a history of prior renal insufficiency, prior BUN and creatinine levels,

prior urinalysis and degree of proteinuria if any. Current basic laboratory work completes the process. This should include electrolytes, BUN and creatinine, complete blood count and urinalysis. A normal serum creatinine and a normal urinalysis usually rule out significant renal disease except in two groups of patients: the elderly and patients with cirrhosis. In these two patient populations the serum creatinine does not correlate well with the GFR making it necessary to do a 24-hr. urine collection for creatinine clearance to assess renal function.<sup>2,3</sup>

There are several clues gathered during the history and physical examination that helps us identify patients likely to develop worsening renal failure.

- Pre-existing renal disease is the single most important factor that predisposes individuals to worsening injury during the peri-operative period.
- Patients with medical conditions associated with decreased renal blood flow and low GFR, such as diabetes mellitus, hypovolemia, dehydration and sepsis.
- Individuals with impaired cardiac function. In cardiomyopathy, decreased left ventricular function, low ejection fraction and congestive heart failure cause decreased cardiac output. This in turn decreases renal blood flow and causes vasoconstriction rendering the kidney more susceptible to ischemia and nephrotoxins.
- Patients with cholestatic jaundice have a higher incidence of renal failure and post-op mortality. This may be due to a predisposition to hypotension due to low peripheral vascular resistance in cirrhotic patients, accompanying sepsis and associated disseminated intravascular coagulation. Predictive factors in these patients are the degree of bilirubin elevation and the degree of creatinine elevation.<sup>4</sup>

### Peri-operative measures to minimize renal dysfunction

1) Ensure adequate volume and normal osmolar status: This can be assessed clinically. It is important to avoid both volume overload and dehydration. If possible a euvolemic state should be achieved prior to surgery. Because of the fluid shifts during surgery diuretics for the management of hypertension should be avoided or held. Most

experts recommend stopping diuretics on the day of surgery or the day before.<sup>5,6</sup> This approach seems reasonable because it is unpredictable how much fluid loss/gain will occur during surgery and any volume overload can easily be corrected with intravenous diuretics. Sodium balance should also be carefully monitored since water and sodium usually go hand in hand.

2) Monitor electrolytes and correct abnormalities.

3) Avoid hypotension: As discussed above, renal ischemia during surgery or the immediate post op period is one of the most common causes of increased creatinine. Ensuring adequate hydration is the best way to avoid intra-operative hypotension. Moreover, patients with hypovolemia are more susceptible to the vasodilating effects of anesthetic drugs and more likely to develop intra-operative hypotension.

4) Avoid nephrotoxins whenever possible: Common offenders include contrast dye, antibiotics such as aminoglycosides and amphotericin B and non-steroidal anti-inflammatory drugs. A radiological test and dye load precedes several surgical procedures: Patients often have several CT-Scans with contrast, angiograms, IVP, etc., before a decision for a surgical intervention is made. The potential nephrotoxicity of contrast dye is well known. Patients should have a follow up creatinine at least 24 hrs after the procedure to assess renal function. Measures to avoid nephrotoxicity when radiological test with contrast is needed include:

a) Ensure adequate hydration prior to the procedure by administering intravenous normal saline 12 hours before and 12 hours after.

b) Use of anionic high-osmolality contrast versus non-anionic low-osmolality solutions: Low osmolality contrast agents are more expensive but were thought to cause less nephrotoxicity. However clinical studies comparing all types of patients have failed to show a statistically significant difference in the incidence of contrast nephropathy using low versus high osmolality agents. But when doing a sub-group analysis, the same studies revealed that patients with diabetes had a lower incidence of contrast nephropathy when a low-osmolality solution was used.<sup>2,5</sup> It seems therefore that diabetics are more susceptible to the deleterious effects of high osmolality agents. Thus, it is reasonable to recommend the more expensive low osmolality agents for diabetics and for patients with an

established renal dysfunction in order to avoid both further nephropathy and further expense that an emergency dialysis or chronic renal failure would represent.

c) Use of Antioxidant acetylcysteine: In a recent small study, Tepel et al demonstrated that 600 mg of oral acetylcysteine given prior and after a contrast infusion, decreased the incidence of contrast nephropathy in a group of high risk patients.<sup>7</sup> Acetylcysteine is an antioxidant that functions as a free-radical scavenger increasing the cells' reducing capabilities. Although more studies may be necessary, this seems to be a promising prophylactic measure, especially for the diabetic with coronary artery disease in need of an emergency coronary angiogram.

d) Spacing out contrast infusions: Contrast nephropathy is dose-dependent.<sup>8</sup> The longer the procedure and the larger the contrast dose, the higher the chances of nephrotoxicity. It is important to remember that not all pending tests must be done during one single hospital admission. If the test is not necessary for the management of the current medical problem, spacing out contrast infusions may preserve valuable renal function in the long run .

### **Infections**

Patients with ESRD have a higher incidence of peri-operative infections.<sup>9</sup> The risk is even higher considering that a significant proportion of these patients have other co-morbidities that predispose them to infections and poor healing including diabetes, vascular insufficiency and tissue hypoxia.<sup>10</sup> Infection in individuals with renal disease stems from two sources: decreased host defenses and increased exposure to pathogens.

Patients with chronic renal failure frequently have vitamin deficiencies, malnutrition, and impaired lymphocyte and granulocyte function secondary to uremia toxins. All this hinders the host's ability to fight infections. They also have an increased need for surgical interventions for vascular and peritoneal dialysis, increasing the likelihood of contamination, abscess formation and sepsis. Appropriate cultures should be obtained and empiric antibiotic therapy should be started early whenever indicated.

### **Increased Risk of Bleeding**

Patients with chronic renal insufficiency, especially the uremic patient on dialysis, have a greater likelihood of serious bleeding complications from surgery as well as gastrointestinal bleeding from

peptic ulcer disease or stress –induced gastritis. This increased risk seems to be related to both the anemia of chronic renal insufficiency and platelet dysfunction. Although the total platelet count is usually normal the bleeding time is prolonged reflecting platelet dysfunction. This abnormality is secondary to an impaired endothelial release of a macromolecular complex of factor VIII. The factor VIII complex is necessary for platelet binding, activation and aggregation. An attempt to reverse platelet dysfunction should be done if the patient is to undergo a major surgery and there are clinical signs of thrombocytopeny such as petechiae or a bleeding time greater than 15 min.

Transfusions are ineffective because the new platelets will not function properly in a uremic environment. DDAVP stimulates the release of factor VIII complex from the endothelium and has a relatively small vasodilator effect. Intravenous DDAVP can be given at a dose of 0.3 µg/Kg. in 50 ml of normal saline over 30 minutes. There is improved platelet function after 1 to 2 hours and the effects last for up to 6-12 hours. It can also be given intra-nasally: 1.5 mg/ml solution, 1 spray per nostril every 24 hours. Cryoprecipitate contains factor VIII but is not always effective. It is recommended particularly for patients who have already received DDAVP and are on vasopressors. However each preparation contains the blood of 10 donors increasing the risk of transfusion related infections. Another alternative is the use of conjugated estrogens: 0.6 mg/Kg IV daily for 5 days.

### Summary

Renal disease presents special issues in surgical patients.<sup>11-14</sup> When consulted for a preoperative evaluation of a patient with renal insufficiency, mild-moderate or ESRD, or a patient with high risk for renal insufficiency it is important to remember the following points:

Ensure hydration and avoid hypotension. Evaluate volume status clinically and correct any imbalance, check electrolytes including magnesium level and replace them if necessary. Hold medications that cause volume shifting such as diuretics. Avoid nephrotoxins when possible and if they cannot be avoided, minimize renal injury by ensuring hydration. When appropriate, use low -osmolality agents and try to space out procedures. Evaluate for anemia and platelet dysfunction. Consider the need for transfusion and DDAVP if risk of bleeding is high. Remember the high risk for infections, obtain cultures soon, start appropriate empiric treatment if signs of infection are present.

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