Preliminary Clinical Observations

Postoperative Enhancement of Urinary Output in Patients with Acute Renal Failure Using Continuous Furosemide Therapy*

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Three cardiac surgical patients with acute postoperative renal failure were treated with a constant infusion of furosemide (Lasix) after furosemide given in bolus proved ineffective. Furosemide given continuously brought about a prompt resolution of the oliguria and tended to hasten the resolution of acute renal failure.

Furosemide (Lasix) is frequently administered following cardiac surgery to facilitate diuresis. Following intravenous injection of a bolus, prompt diuresis often ensues; however, the effect on urinary output may be variable and often subsides within four to six hours. Recently, Copeland et al reported a more sustained diuresis with continuous infusion of furosemide. The patients in their study had normal renal function before and after surgery. In contrast, use of continuous therapy with furosemide in patients following cardiac surgery who develop acute renal failure with oliguria has not been previously reported. We present three case histories where this technique was used successfully in the face of acute renal failure.

CASE REPORTS

CASE 1

A 74-year-old woman presented with a dissecting thoracic aortic aneurysm and aortic insufficiency. She had no prior history of diabetes or renal disease, but she was hypertensive. Before surgery, she had normal results on studies of renal function. She underwent repair of her aortic aneurysm and did well with an adequate urinary output. Total cross-clamp time was 88 minutes, and pump time was two hours and 37 minutes.

On the first postoperative day, the patient’s urinary output decreased to below 40 ml/hr, and with indication of adequate fluid volume status and cardiac output, she was given furosemide in an intravenous bolus of 40 mg at least three times without an increase in her urinary output. A drip infusion of furosemide at 0.36 mg/kg/hr was begun, which was increased to 0.75 mg/kg/hr to maximize effect. The patient’s urinary output increased with the drip infusion, averaging 240 ml/hr. After four days of infusion of furosemide, she had demonstrated marked clinical improvement with normalization of her renal function.

CASE 2

A 70-year-old woman with coronary artery disease and aortic stenosis underwent aortic valve replacement and coronary artery bypass grafting. She had diabetes mellitus and hypertension but no history of renal disease. Total cross-clamp time was two hours and 20 minutes, and total pump time was five hours and three minutes.

On the fourth postoperative day, the patient’s urinary output decreased to less than 100 ml/hr, and there was a gradual rise in her pulmonary capillary wedge pressure despite an adequate cardiac output. Also, she had an increase in weight, and the blood urea nitrogen (BUN) and creatinine levels increased from 17 mg/dl and 0.9 mg/dl before surgery to 48 mg/dl and 1.4 mg/dl, respectively. The patient’s condition failed to respond to furosemide in an intravenous bolus of 40 mg at least three times, and a drip infusion of 0.38 mg/kg/hr was begun. With this therapy, her urinary output increased to 300 ml/hr, and she demonstrated marked clinical improvement, with a decrease in weight and normalization of her renal function (BUN and creatinine levels of 26 mg/dl and 0.8 mg/dl, respectively).

CASE 3

A 57-year-old man with aortic stenosis underwent aortic valvular replacement. He had no history of renal disease. Total cross-clamp time was 88 minutes, and pump time was 24 hours.

On the fourth postoperative day, a sudden drop in urinary output to less than 40 ml/hr was noted. Concomitant with this, there was a rise in his BUN and creatinine levels from 14 mg/dl and 1.5 mg/dl before surgery to 62 mg/dl and 2.9 mg/dl, respectively. Obstructive urethropy was ruled out, and the patient’s condition failed to respond to furosemide administered in a bolus. A drip infusion of furosemide at 0.4 mg/kg/hr was begun, with an almost immediate increase in his urinary output to over 200 ml/hr and with a resultant fall in his BUN and creatinine levels and his weight over the next 48 hours (BUN and creatinine levels of 42 mg/dl and 1.6 mg/dl, respectively).

DISCUSSION

The loop diuretic, furosemide, works by blocking uptake of chloride in the ascending loop of Henle. Its half-life is about 50 minutes, and its diuretic effect,
therefore, lasts approximately four to six hours after intravenous injection.

Copeland et al described the use of continuous intravenous infusion of furosemide at 0.05 mg/kg/hr for 12 hours in 18 cardiac surgical patients. These investigators noted a sustained diuresis with less hourly variation. Several reports in the literature suggest the use of intravenous infusion of furosemide for treating malignant ascites and refractory edema.

We recently had several postoperative open-heart patients with apparent acute oliguria whose condition no longer responded to fluid challenges or furosemide bolus or to therapy with ethacrynic acid (Edecrin). Our patients showed good clinical response to continuous intravenous infusion of furosemide. All patients were monitored with Swan-Ganz catheters and had cardiac outputs within normal range. Also, urinary outputs were monitored hourly. In no case was the drip infusion of furosemide started without first assuring adequate cardiac function and absence of any obstructing uropathy. Standard therapy with a bolus of furosemide was attempted first, and if not successful, a one-time dose of ethacrynic acid was given in an attempt to prompt diuresis. A drip infusion of furosemide was begun at a rate of 0.25 mg/kg/hr and was gradually increased until an adequate diuresis was forthcoming. Response to therapy was usually within minutes of starting the drip infusion. If not, the dosage was increased until an effect on urinary output was noted, and then the dosage was held at that level; however, we did not exceed 0.75 mg/kg/hr. The drip infusion was discontinued when there was evidence of normalization of renal function. A dose-response curve for continuous administration of furosemide has yet to be worked out, and obviously, many of the changes in dosage here were made on an empiric basis. In no case was any toxic effect of the furosemide administration appreciated.

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REFERENCES
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