Acute Water Intoxication during Transurethral Resection of the Prostate, Using Glycine Solution for Irrigation

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Water intoxication has long been recognized as a complication of transurethral resection of the prostate gland (TURP) when distilled water was used for irrigation.[1, 2] Desmond,[2] however, reported that no toxic symptoms occurred in more than 400 cases when glycine solutions were used, even though the plasma levels of sodium decreased.[2] The following is a report of a patient who developed cerebral symptoms of water intoxication when 1.2 per cent glycine was used for irrigation during TURP.

REPORT OF A CASE

A 75-year-old man with a history remarkable only for mild hypertension was admitted to the Veterans Administration Hospital in Gainesville. Physical examination revealed moderate obesity, inguinal hernia, and an enlarged prostate. Preoperative laboratory studies showed a hematocrit of 43 per cent, normal serum electrolytes, and nonspecific ST-T changes on the EKG. A diagnosis of benign prostatic hypertrophy was made and the patient was scheduled for a TURP.

The patient was given diazepam, 10 mg, im. An hour later, he received spinal anesthesia consisting of tetracaine, 12 mg, 1.2 ml of 10 per cent dextrose solution, and 0.2 mg epinephrine. Analgesia to a sensory level of T10 was achieved. The blood pressure initially decreased from 120 to 90 torr, but responded promptly to 12.5 mg ephedrine, iv. The TURP proceeded without incident for an hour and 15 minutes, after which time the patient began to complain of vague discomfort and was given diazepam, 5 mg, iv. He became progressively more irritable, confused, and disoriented, and finally became lethargic. The blood pressure did not exceed preoperative values during the procedure, which lasted 2 hours and 15 minutes. The patient received 1,450 ml of Ringer's lactate solution intraoperatively. Irrigation fluid used for the TURP was 1.2 per cent glycine solution.

The patient was moved to the recovery room. Depression of consciousness seemed to increase. His pupils were equal in size, but dilated and only slightly reactive to light. Analysis of blood with the Auto-Analyzer showed: serum sodium less than 110 mEq/l, serum chloride 73 mEq/l, serum potassium 4.4 mEq/l, CO_2 content 19 mEq/l, BUN 12 mg/100 ml, hematocrit 40 per cent. Blood–gas analyses showed Pa_{O_2} 65 torr, Pa_{CO_2} 33 torr, *p*H, 7.38, and HCO_3^- 20.5 mEq/l. The serum showed no gross hemolysis.

The patient was treated initially by fluid restriction and supplemental oxygen. No diuretic was given because spontaneous diuresis of 300–500 ml/hour was maintained throughout the first postoperative day. Six hours after the operation, serum sodium had increased to 123 mEq/l; arterial blood–gas tensions and *p*H were normal while the patient breathed room air. His sensorium remained depressed and left-sided facial seizures developed 3 to 4 hours postoperatively. The patient was then given 200 ml of 3 per cent saline solution iv in a 3-hour period; clearing of the sensorium, cessation of seizure activity, and increased diuresis resulted.

The following day, the patient was alert and well oriented. Urinary output was 200 ml/hour, and analysis of serum showed sodium 140 mEq/l, chloride 100 mEq/l, and BUN 20 mg/100 ml. Total fluid intake postoperatively for 30 hours was 1,430 ml; urinary output was 7,765 ml. The remainder of the postoperative period was uneventful, and the patient recovered fully.

DISCUSSION

The classic picture of water intoxication after use of distilled water for irrigation during TURP, including restlessness, confusion, nausea, cyanosis, tachypnea, increases in blood and pulse pressures, progressing to coma, convulsions, pulmonary edema, and cardiovascular collapse, has been well described. Hemolysis of erythrocytes, acute hypervolemia, and dilutional hyponatremia are the major etiologic factors.[1]

Use of glycine solution for irrigation during TURP has not previously been associated with significant hemolysis, even though the com-

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monly used 1.2 per cent solution is hypotonic. Glycine can be absorbed from open venous sinuses, causing hyponatremia. The amount of absorption is dependent upon the size and congestion of the gland to be resected, infection, pressure of the irrigating fluid, duration of the resection, the number of open sinuses, and the experience of the surgeon.[2]

Desmond,[2] in a study of 72 patients undergoing TURP with glycine as the irrigating fluid, found that 54 patients had serum sodium levels within 10 mEq/l of normal. Serum sodium decreased 12–16 mEq/l in ten patients and 26–54 mEq/l in eight others. Only two of Desmond's patients, who had decreases in serum sodium of 27 and 30 mEq/l, respectively, developed symptoms. In both the serum osmolalities decreased and the patients developed cerebral and pulmonary edema. In neither case was the duration of operation stated.

Although the Pa_{O_2} of the patient in this report decreased approximately 25 torr, which may have reflected increased intrapulmonary water, he did not develop signs of overt pulmonary edema. His cerebral status, however, strongly suggested that acute cerebral edema was induced after only an hour and 15 minutes of resection time. To our knowledge, no other case of acute cerebral changes without concomitant clinical signs of water intoxication during TURP with glycine irrigation has been reported. Certainly, the negative water balance of 6,335 ml for the first 30 hours postoperatively suggests that our patient absorbed a significant quantity of glycine solution. The dilution of serum electrolytes further supports this possibility. Although the hematocrit decreased only 3.0 vol per cent, it has been shown that even with distilled water the hematocrit may not accurately reflect the degree of acute hemodilution, since some erythrocytes swell without rupturing, thereby occupying more space.[3]

In the review of this subject by Marx and Orkin,[1] it is suggested that TURP's less than an hour in duration may be safe if the dissection is not carried into the sinuses deep within the capsule. Fillman *et al.*[4] reported that absorption and hemolysis are not significant when distilled water is used for irrigation and when the resection time is 60 minutes or less. It might be expected, therefore, that the safe period would be longer with glycine, and we were surprised to see symptoms of water intoxication after only 75 minutes of irrigation with glycine.

Thus, cerebral edema can occur when glycine is used for irrigation during TURP. The classic syndrome of water intoxication may not occur simultaneously. Since 1.2 per cent glycine does not cause significant hemolysis when absorbed, its safety record is reasonable compared with that of distilled water. However, the anesthesiologist must be alert for the signs and symptoms of water intoxication during TURP, even when glycine solution is used.

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