rable, self-calibrating analyzer, which measures all of the gases of interest.

This newly available range of gas monitoring instrumentation is reliable, relatively cost-effective, and provides anesthesiologists with continuous on-line data. By alerting anesthesiologists to potentially adverse events during an operation at an early stage, these new technologies offer the hope of improved care and decreased morbidity and mortality.

KELLY W. SMITH, MD
Salt Lake City

REFERENCES

Gravenstein JS, Gravenstein N, van der Aa JJ, et al: Pitfalls with mass spectrometry in clinical anesthesia. Int J Clin Monit Comput 1984; 1:27-34

Keenan RL, Boynan CP: Cardiac arrest due to anesthesia—A study of incidence and causes. JAMA 1985; 253:2373-2377

Westenskow DR, Smith KW, Coleman DL, et al: First clinical evaluation of a Raman scattering gas analyzer (Abstr). Anesthesiology 1987; 67(3A):A642

Chemical Basis for the TURP Syndrome

AN ARRAY OF hemodynamic and central nervous system (CNS) abnormalities has been described in some patients following transurethral resection of the prostate (TURP). The hemodynamic abnormalities include cardiac arrhythmias, hypotension, and even cardiovascular collapse, while the CNS abnormalities include confusion, transient blindness, seizures, and even coma. In the past these manifestations have been collectively called the "TURP syndrome" and have been generally attributed to dilutional hyponatremia and water intoxication from absorbing an excessive amount of irrigating solution during the surgical resection of the prostate gland. Absorption of 4 to 8 liters of sodium-free irrigating solution has been documented with dilution of the plasma sodium level down to nearly 100 mEq per liter. Because the sodium ion is necessary for depolarizing cells and for maintaining extracellular osmolality, hyponatremia is obviously presumed to be the cause of abnormal electrophysiologic responses of the CNS and the heart. Recent data suggest, however, that the absorption of glycine, the osmolar substance in the irrigating solution commonly used during TURP, may contribute to the TURP syndrome.

Glycine 1.5% is the most widely used irrigant because it is thought to be an effective osmotic replacement for sodium ions and to be nontoxic to the body. Glycine 1.5%, however, is slightly hypo-osmolar, being about 200 mosm per liter. Glycine is a nonessential amino acid with a normal plasma level of 13 to 17 mg per liter. It readily crosses the blood-brain barrier and is an inhibitory transmitter in the spinal cord and in the synapses of the medulla, pons, tectum, and retina. Glycine has been shown to suppress the waveforms of both the electroretinogram and visual evoked potentials in rabbits.

More recently we have found that glycine, in quantities capable of being absorbed clinically—about 9,000 μmol per liter—can alter both the amplitude and the latency of visual evoked potential waves in anesthetized dogs. Cardiac output and mean arterial blood pressure were also depressed by glycine in this laboratory model. Ammonia, a biotransformed metabolite of glycine, has been suggested as another potential neural toxic agent. Although the vast majority of patients subjected to a transurethral resection of the prostate do not manifest significant CNS abnormalities, we have shown in patients who complained of visual and other CNS disturbances the presence of hyponatremia, hyperglycinemia, and hyperammonemia. The administration of hypertonic saline in patients with adequate renal function remains the treatment of choice for patients exhibiting the TURP syndrome. As yet, there has been no report of permanent visual disturbance, but clinicians should be aware of a chemical basis for the TURP syndrome in addition to hyponatremia and water intoxication.

K. C. WONG, MD, PhD
Salt Lake City

REFERENCES

Creel DJ, Wang JM, Wong KC: Transient blindness associated with transurethral resection of the prostate. Arch Ophthalmol 1987; 105:1537-1539

Pycock CJ, Kerwin RW: The status of glycine as a supraspinal neurotransmitter. Life Sci 1981; 28:2679-2686

Wang JM, Wong KC, Creel DJ, et al: Effects of glycine on hemodynamic responses and visual evoked potentials in the dog. Anesth Analg 1985; 64:1071-1077

ADVISORY PANEL TO THE SECTION ON ANESTHESIOLOGY

C. PHILIP LARSON, MD
Advisory Panel Chair
CMA Scientific Board Representative
Stanford

ARTHUR O. MCGOWAN III, MD
CMA Section Chair
Lakewood

THOMAS JOAS, MD
CMA Section Secretary
San Diego

NORMAN LEVIN, MD
CMA Section Assistant Secretary
Northridge

FLOYD S. BRAUER, MD
Section Editor
Loma Linda University

H. BARRIE FAIRLEY, MD
Stanford University

JOHN H. EISELE, JR, MD
University of California, Davis

KEVIN TREMPER, MD
University of California, Irvine

RONALD L. KATZ, MD
University of California, Los Angeles

HARVEY M. SHAPIRO, MD
University of California, San Diego

RONALD D. MILLER, MD
University of California, San Francisco

JOHN F. VILJOEN, MD
University of Southern California

THOMAS A. FEELEY, MD
Portola Valley

PETER L. MCDERMOTT, MD
Camarillo