

EVALUATION OF A CONTINUOUS BLOOD GAS MONITOR IN PATIENTS.

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Introduction: We have evaluated a newly developed fiber optic, intra-arterial (intravascular) blood gas (IVBG) catheter which measures oxygen and carbon dioxide tensions continuously.

Methods: With Institutional Review Board approval and informed consent, seven patients ranging in age from 8 to 80 years, and undergoing neurosurgical procedures under general anesthesia were studied. Similar studies in an additional 40 patients requiring anesthesia for neurosurgical or cardiovascular procedures will be completed by July, 1990. Following institution of general anesthesia, a standard 20 g radial artery cannula was inserted, and the IVBG catheter was threaded inside the cannula. Upon completion of the operation, the patients were transported to the ICU and blood gas monitoring was continued during the recovery phase. Blood was drawn from the arterial cannula every 30 min. for comparison of the *in vivo* values with those obtained from conventional blood gas analyzers (Corning Model 178). The data were analyzed by calculating the mean absolute difference as a percentage of reading (MAD%) between the C178 vs. the IVBG catheter. As a means of assessing the imprecision

between the measurements of the devices the standard deviation of the MAD% (Normalized Precision) was also calculated.

Results: The IVBG catheter was accurate and reliable at oxygen and carbon dioxide tensions ranging from 67 to 626 and 24 to 51 mmHg, respectively, as demonstrated by the MAD% and Normalized Precision results (Table 1.). The regression analysis demonstrated good correlation between the IVBG and the conventional analyzer. Blood pressure tracings taken before and after insertion or removal of the IVBG catheter were not significantly different.

Discussion: In this study we evaluated a wider range of blood gas values than in prior studies, and found the correlation of the values to be very good between the indwelling monitor and conventional methods for blood gas measurement, even during unsteady state conditions in patients. We conclude that continuous PaO₂ and PaCO₂ monitoring is feasible and reliable over a wide range of arterial blood gas values.

	PaO ₂ ENTIRE RANGE	PaO ₂ < 150 mmHg	PaCO ₂ ENTIRE RANGE
N	76	31	93
RANGE	67 - 626 mmHg	67 - 146 mmHg	24 - 51 mmHg
MAD%	3.0%	3.5%	5.1%
NORM. PRECISION	3.0%	3.2%	5.1%
r VALUE	0.998	0.977	0.917

TABLE 1. Statistical Results

TITLE: TRANSESOPHAGEAL DOPPLER CARDIAC OUTPUT
DETERMINATION IN CRITICAL CARE PATIENTS
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INTRODUCTION Monitoring cardiac output (CO) in the ICU has thus far required placement of a pulmonary artery catheter. However, transesophageal pulse-wave doppler analysis of flow through the mitral orifice, in conjunction with 2-D echocardiographic (2D-TEE) measurement of the valve diameter, provides a non-invasive and safe means of obtaining CO. The present study evaluates the validity of CO determinations using doppler echocardiography, as compared to the thermodilution method, in mechanically ventilated ICU patients.

METHOD Mechanically ventilated ICU patients (n = 10) with hemodynamic instability requiring invasive hemodynamic monitoring and evaluation by 2D-TEE were included in this study. Informed consent for the procedure was obtained in each case. A standard long-axis four chamber view was used to obtain pulse-wave doppler and 2D-TEE measurements. A super-VHS VCR was used to record all studies. The internal calipers and software incorporated in the Hewlett-Packard Sonos 1000 2D-TEE were used for measurements and calculations. The area under the mitral valve doppler curve, or flow-velocity integral, was multiplied by the mitral valve area to obtain stroke volume. Simultaneously, thermodilution CO measurements were obtained in triplicate at end-expiration.

RESULTS Comparison of thermodilution and pulse-wave CO determinations is shown in Fig. 1. CO measurements ranged between 4.5 to 13 l/min. There was excellent correlation between thermodilution and transesophageal

doppler (TED) cardiac outputs. Regression analysis of the data yielded a correlation coefficient of .77 and a significance level P < 0.009.

CONCLUSION Transesophageal doppler cardiac outputs are easily obtained, providing a practical non-invasive alternative to pulmonary artery catheterization. The correlation between doppler and thermodilution CO was excellent, validating its use in the mechanically ventilated patient. The ability to directly assess ventricular volume and contractility, in addition to measuring CO, suggests that 2D-TEE will play an increasingly important role in monitoring ICU patients.

Cardiac Output Measurements
Thermodilution vs TEE Doppler

