TITLE: PULSE CONTOUR ANALYSIS DERIVED CARDIAC OUTPUT DETERMINATION: COMPARISON WITH THERMODILUTION IN THE ICU SETTING

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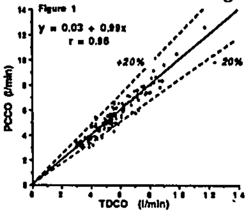
Continuous determination of cardiac output (CO) may improve our ability to care for the critically ill. The COM-3 CO computer (Baxter Edwards, Santa Ana CA) computes beat-to-beat CO by arterial waveform contour analysis after calibration with thermodilution CO.

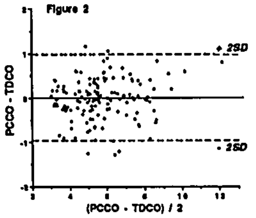
This study compares pulse contour CO (PCCO) to thermodilution CO (TDCO) in thirteen Surgical Intensive Care Unit (ICU) patients. All patients had pulmonary artery and arterial catheters in place. Operative procedures included 8 abdominal aortic aneuysm repairs, 1 aortobifemoral bypass, 1 nephrectomy, 1 repair of dissecting thoracic aneurysm, and one hysterectomy. One patient was also studied preoperatively while receiving inotropic agents to improve cardiac function prior to above knee amputation. Patients received a variety of drugs during study periods, including dopamine, dobutamine, nitroprusside, and diuretics. The COM-3 was employed for periods of 1 to 8 hours without alteration of normal care for 1 to 5 days following surgery. Approval of the Institutional Review Board and informed consent were obtained.

TDCO was measured using a pneumatically driven syringe pump that injected 10ml of iced D5W at four specific points in the respiratory cycle. The respiratory waveform was obtained from a capnometer or a respiratory inductance plethysmograph. The four TDCO's were averaged and compared to simultaneous PCCO measurement. The average TDCO was then used to adjust calibration constant (aortic impedance value, Zao) employed by the computer. The COM-3 was used on 25 occasions for a total of 136 hours. Averaged TDCO's were obtained 151 times after the initial calibration of the system. Regression analysis (Figure 1) showed a correlation coefficient (r) of 0.96 and a slope of 0.99. The average percent difference between data pairs was 0.1±8.4% (SD) (range -22.4 to 26.9%) while the mean of the absolute differences was 0.01±0.45 L/min (range -1.16 to ± 1.25 L/min). Figure 2 is a plot of the bias (TDCO-PCCO) vs. the average of each TDCO and PCCO pair and demonstrates that nearly all of the values fall within 95% confidence limits.

Inspection of individual patients data revealed that Zao decreases with increasing temperature and the use of afterload reducing agents. These trends suggest that changes in vascular impedance can be expected to occur in these situations and that more frequent calibration with TDCO is needed.

Although this system requires initial calibration with thermodilution, it provided accurate CO measurements in the group of patients studied. This may prove useful in the care of the critically ill patient. Studies continue to validate this system at the extremes of CO and during other clinical situations.




## A423

TITLE: A SIDE-BY-SIDE COMPARISON OF BLOOD GAS CONTROLS USING FOUR DIFFERENT BLOOD GAS ANALYZERS

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**INTRODUCTION:** The purpose of this study was to determine which blood gas controls would provide the lowest variability for pH, $PCO_2$, and $PO_2$ on four different blood gas analyzers in a side-by-side comparison under identical conditions.

**METHODS:** Four blood gas analyzers (IL-1312, Corning-178, AVL-995, and ABL-330) were used to test the following brands of controls: ABC, Bio-Rad, Bio-Rad Plus, Certain Plus, Confitest III, Dade, Prefer, Qualicheck, and Quantra. Qualicheck had four levels (Acidemic, Alkalemic, Normal, and High $O_2$), while the others had three levels (High, Low, and Normal or Acidemic, Alkalemic, and Normal), for a total of 28 controls. A vial of each control was placed into a box, and random selection determined the order each control was tested. The controls were run simultaneously on the four analyzers, and pH, $PCO_2$, and $PO_2$ were recorded. Once each control had been tested, the process was repeated using the same lot number for each control throughout the five rounds of the experiment. Mean ± SD for pH, $PCO_2$, and $PO_2$ were determined for each control on each analyzer, and these results were then compared to determine the variability for each value between the machines, using alpha <0.0167. Results for each control were then combined to determine the coefficient of variation (CV). These results were compared separately for pH, $PCO_2$, and $PO_2$.

**RESULTS:**
pH: Although there were significant differences in mean pH between machines for 22 of 28 controls, the largest CV was 0.35% (average 0.22%). Thus, even the most variable control has a 95% confidence limit of ± 0.052 pH units.

$PCO_2$: 19 of 28 controls had statistically significant differences in mean $PCO_2$, and the CV ranged from 1.0 to 11.6% (average 3.5%).

$PO_2$: Half of the 28 controls had no statistical difference between machines, but this is due, in part, to the higher CV, which ranged from 1.5 to 25.1% (average 7.0%).

We then calculated the average CV for each brand of control (combining all levels) for each parameter, and the table shows the controls and the average CV for each parameter, arranged from top (lowest average CV) to bottom (highest average CV):

| pH | | $PCO_2$ | | $PO_2$ | |
|---|---|---|---|---|---|
| Qual | (0.15) | Bio+ | (2.4) | ABC | (3.1) |
| Conf | (0.17) | Cert | (2.7) | BioR | (5.9) |
| BioR | (0.19) | Qual | (3.0) | Bio+ | (6.2) |
| Quan | (0.20) | BioR | (3.1) | Conf | (6.8) |
| Bio+ | (0.24) | ABC | (3.3) | Qual | (6.9) |
| Cert | (0.24) | Pref | (3.5) | Dade | (6.9) |
| Dade | (0.27) | Dade | (3.6) | Cert | (7.8) |
| Pref | (0.31) | Quan | (3.9) | Pref | (8.5) |
| ABC | (0.33) | Conf | (6.2) | Quan | (11.3) |

**DISCUSSION:** While all brands of blood gas controls provided consistent results for pH on four different blood gas analyzers, $PCO_2$ and $PO_2$ measurements had significant variability between the machines. No single brand of control proved to be significantly better than all the others for both $CO_2$ and $O_2$ determinations. For a single parameter, however, there are controls which provide significantly lower variability among the four analyzers we tested.