TITLE: Accuracy of Arterial Blood Gas Analysis of $PO_2$ Compared to Tonometered Blood

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**INTRODUCTION:** Numerous factors may contribute to imprecision and inaccuracy of blood gas measurements of $PO_2$. Included are human variables such as sampling, handling, and processing errors, as well as inherent limitations of blood gas analyzers. We compared the performance of four commercially available blood gas analyzers in measuring $PO_2$ over a wide range of values under controlled conditions.

**METHODS:** Four blood gas analyzers (IL-1312, AVL-995, ABL-330, and Corning-178) were obtained from and set up by their respective manufacturers. Fresh whole blood obtained daily from a single donor was equilibrated by tonometer (IL-237) to analytic gas samples (accuracy ± 0.01%). Seventeen levels of $PO_2$ from 0 to 662 mmHg partial pressure with a constant level of $PCO_2$ (5±0.01%) were tested on three successive days. Five $PO_2$ measurements at each of the 17 levels of $PO_2$ were performed each day on each machine. Routine maintenance and calibration were performed on each machine daily according to manufacturer recommendations. Blood gas analyzer performance relative to tonometry was compared by bias (mean difference between analyzer reading and tonometry) and precision (standard deviation of the bias).

**Results:** The table compares the performance of each of the analyzers tested. Target $PO_2$ values from 0 mmHg to 662 mmHg were tested. The bias and precision were pooled for the ranges tested as shown in the table.

| $PO_2$ Range (mmHg) | Bias ± Precision (mmHg) IL | AVL | ABL | Corning |
|---|---|---|---|---|
| 0-50 | 2.13± 0.68 | 0.77± 0.63 | 0.25± 1.32 | 0.29± 2.16 |
| 50-100 | 3.01± 1.31 | 1.07± 1.18 | 1.65± 1.86 | -0.34± 1.79 |
| 100-150 | 4.30± 1.82 | 3.41± 2.01 | 4.69± 2.07 | 0.25± 2.27 |
| > 150 | -4.50± 8.0 | -5.38±16.49 | 5.80± 6.93 | -12.78±16.79 |
| Overall | 1.87± 4.68 | 0.54± 7.54 | 2.93± 3.92 | -2.14± 8.6 |

**Discussion:** This study shows that even under tightly controlled conditions, considerable variability exists in accuracy of $PO_2$ measurements. All analyzers demonstrated differences from the target values of $PO_2$. This bias was not constant across the values tested. In addition, variability, as measured by precision, also differed within and between analyzers. The potential inherent inaccuracies of blood gas analyzers should be considered when clinical decisions are made.





TITLE: **RIGHT VENTRICULAR FUNCTION DURING ORTHOTOPIC LIVER TRANSPLANTATION (OLT) WITH OR WITHOUT BYPASS**

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Patients undergoing OLT may develop significant hemodynamic instability, especially on reperfusion of the grafted liver (1). It has been suggested, using esophageal echocardiography, that isolated right ventricular (RV) failure may contribute to this instability (2). The aim of this trial was to investigate RV function during OLT using a rapid response thermodilution pulmonary artery catheter.

Twenty patients with cirrhosis aged 46 ± 10 yrs (mean ± SD), weighing 66 ± 14 kg and undergoing OLT were studied after approval by our Ethics Committee. General anesthesia was maintained continuously with fentanyl, midazolam and vecuronium. Patients were allocated in 2 groups: the group without veno-venous bypass (NBP n = 10) consisted of patients whose mean arterial pressure (MAP) did not decrease by more than 30 % and/or cardiac output did not decrease by more than 50% after a trial of clamping; the group with bypass (BP n = 10) consisted of patients whose MAP decreased by more than 30 % and/or cardiac output decreased by more than 50%, or needed a BP for easier surgical dissection. Hemodynamic measurements were obtained at preset intervals: one hour following surgical incision (T1), at the end of anhepatic phase (T2), unclamping the vena cava (T3), unclamping the portal vein (T4). Core temperature was maintained above 35°C. We aimed for the following electrolyte levels: Mg ++ > 0.75 mmol.l-1, ionised Ca > 1.1 mmol.l-1, K+< 3.2 mEq.l-1, pH > 7.30. Statistical analysis was performed using repeated measures ANOVA followed by appropriate post-hoc tests ($p < 0.05$ significant).

Results are summarized in the table and the figures.

Our results show that unclamping the portal vein does not alter the RV function in the NBP group. However, as observed with esophageal echocardiography, RV function is impaired in some patients of the BP group. We conclude that the assessment of ventricular compliance by a trial of clamping predicts accurately when failure will not follow portal unclamping.

References: 1-Tranpl. Proc., 19: 54-55, 1987
2-Anesth. Analg.,68: 777-782, 1989

| Table | Group | T1 | T2 | T3 | T4 |
|---|---|---|---|---|---|
| HR bpm | NBP | 89 ± 21 | 105 ± 15 | 102 ± 15 | 101 ± 10 |
| | BP | 97 ± 10 | 92 ± 14 | 89 ± 14 | 94 ± 13 |
| MAP mmHg | NBP | 99 ± 15 | 96 ± 12 | 104 ± 18 | 86 ± 20 |
| | BP | 100 ± 15 | 96 ± 12 | 104 ± 18 | 86 ± 20 |
| MPAP mmHg | NBP | 17 ± 5 | 11 ± 4* | 19 ± 8 | 24 ± 7* |
| | BP | 19 ± 4 | 15 ± 6 | 14 ± 6 | 17 ± 6 |
| CVP mmHg | NBP | 6 ± 4 | 3 ± 2 | 8 ± 7 | 9 ± 4 |
| | BP | 8 ± 3 | 5 ± 4 | 5 ± 4 | 6 ± 4 |
| CI l.min-1.m-2 | NBP | 4.6 ± 0.8 | 2.5 ± 0.7* | 4.6 ±1.7 | 6.5 ± 1.4* |
| | BP | 5.6 ± 1 | 3.6 ± 0.7* | 4,0 ± 1.5* | 5.4 ± 1.4 |
| SVI ml.beat-1.m-2 | NBP | 52 ± 12 | 25 ± 6* | 42 ± 12 | 63 ± 12 |
| | BP | 58 ± 7 | 39 ± 9 | 46 ± 12 | 58 ± 12 |
| EF % | NBP | 0.48 ± 0.12 | 0.44 ± 0.10 | 0.54 ± 0.20 | 0.63 ± 0.05* |
| | BP | 0.58 ± 0.11 | 0.58 ± 0.08 | 0.57 ± 0.11 | 0.59 ± 0.14 |
| SVR dynes.m-2 | NBP | 944 ± 237 | 1784 ± 655* | 1138 ± 499 | 586 ± 306* |
| | BP | 754 ± 143 | 1089 ± 230* | 1088 ± 242* | 601 ± 130 |

HR heart rate, MAP mean arterial pressure, MPAP mean pulmonary arterial pressure, CVP central venous pressure, CI cardiac index, SVI stroke volume index, EF ejection fraction, SVR systemic vascular resistance, mean ± SD, *p < 0.05 vs T1

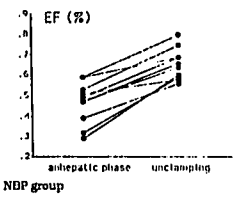


Fig. 1: NBP group

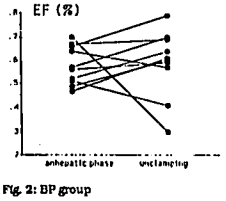


Fig. 2: BP group