Blood gases

USE OF DIFFERENT BLOOD GAS SYRINGES FOR BLOOD GAS ANALYSIS

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BACKGROUND: When considering all the errors reported in clinical laboratory settings, the preanalytical phase is responsible for more than two thirds of them. Blood gas analysis and result interpretation are very important for patients in both intensive care units and emergency services. Both methods and devices employed in the phlebotomy procedure for either gasometry or acid–base assays on samples are to be regarded with particular attention. In this study we aimed to investigate effect of different manufacturer’s blood gas syringe on blood gas analysis.

METHODS: Venous bloods from fifty-seven patients were collected into three different manufacturer’s lithium heparin calcium balanced syringes: Syringe I (Preset, Becton Dickinson); Syringe II (Pico 50, Radiometer); Syringe III (Simple Genject, local manufacturer). Both gasometric and acid-base assays were analyzed using Roche cobas b 221. Additionally, ionized calcium, sodium, potassium and chlorid levels were analyzed by Roche cobas 8000 with calculation formula.

RESULTS: Significant differences were as follows: a) Syringe I vs II: pH, pCO₂, glucose, potassium, calcium, chloride and lactate b) Syringe I vs III: pCO₂, glucose, total hemoglobin, potassium, sodium and lactate c) Syringe II vs III: pH, pCO₂, glucose, total hemoglobin, calcium and lactate. Median ionized calcium levels were significantly higher in syringe I, II, III (1.25, 1.26, 1.24 mg/dL, respectively) than autoanalyzer (1.02 mg/dL). Median sodium levels were significantly higher in syringe I, II, III (142, 142, 142 mmol/L, respectively) than result of autoanalyzer (138 mmol/L). Median potassium levels were significantly lower in syringe I, II, III (3.65, 3.74, 3.65 mmol/L, respectively) than result of autoanalyzer (4.02 mmol/L). Median chlorid levels were significantly lower in syringe I, II, III (101, 101, 101 mmol/L, respectively) than result of autoanalyzer (102 mmol/L).

CONCLUSIONS: It must be taken into consideration the different manufacturers of syringes can represent new source of variability on blood gas analysis.
EVALUATION OF PKA AS A CAUSE OF DISCORDANCE BETWEEN CALCULATED AND MEASURED BICARBONATE IN ARTERIAL AND VENOUS BLOOD

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BACKGROUND: Bicarbonate value [HCO₃⁻] obtained in arterial blood gas (ABG) analyser is a calculated parameter which is affected by pH and ionizing strength of blood. Direct measurement of Bicarbonate is not affected by these changes. Direct measurement measures total carbon dioxide (TCO₂) or the potential bicarbonate, which is essential in deciding on bicarbonate therapy. Our objectives are to check if there is
1. discordance between arterial and venous blood gas parameters
2. discordance between TCO₂ and [HCO₃⁻]
3. a way of predicting TCO₂ from [HCO₃⁻] and blood pH

METHODS: Method comparison study involving 250 patients for whom arterial blood sample is needed for acid base status assessment. Arterial and venous blood samples were collected using PICO50 syringes and were analysed in ABG analyser ABL80flex. The plasma from arterial and venous blood samples were utilized to measure TCO₂ by enzymatic method.

RESULTS:
a. There was no statistically significant difference between arterial and venous pH (7.382±0.436 vs 7.367±0.456, p=0.31), pCO₂ (39.3±14.32 vs 41.9±16.11, p=0.23), [HCO₃⁻] (22.91±7.93 vs 24.15±8.21, p=0.24), TCO₂ (24.82±8.15 vs 25.63±9.21, p=0.43).
b. There was a statistically significant difference between arterial and venous pO₂(126±48.5 vs 62±30.5, p<0.001).
c. On Bland Altman analysis
   # narrow limits of agreement (LOA) were observed when arterial and venous pH, pCO₂, TCO₂ and [HCO₃⁻] were compared (0.04 to 0.11, -0.3 to -1.1 to ~3.8, -2.1 to -4.4 respectively).
   # LOA observed between TCO₂ and [HCO₃⁻] in arterial (-2.72 to 5.75) & venous (-2.46 to 5.78) samples were wide.
d. There was weak correlation between pH and bias in TCO₂ and [HCO₃⁻] in arterial (r=0.576, p=0.01) and venous samples (r=0.532, p=0.01).

CONCLUSIONS:
a. The agreement between arterial and venous pH, pCO₂, TCO₂ and [HCO₃⁻] and the discordance between arterial and venous pO₂ indicate that venous blood sample would suffice for acid base status assessment unless oxygen delivery is to be assessed.
b. The wider LOA of both arterial and venous TCO₂ and [HCO₃⁻] indicate that TCO₂ has to be measured to assess the acid base status.
c. Weak correlation between pH and bias between TCO₂ and [HCO₃⁻] indicate that predicting TCO₂ based of pH and [HCO₃⁻] values is not possible.
ASSESSMENT ON THE VALUE OF CARBONHEMOGLOBINE IN SMOKERS AND NON-SMOKERS

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BACKGROUND: The carbon monoxide (CO) is a colorless, odorless gas that is slightly less dense than air. CO is produced through the partial oxidation and is a component of smoke gases produced by industrial enterprises in tailpipe emissions of cars, smoke and other. CO is about 200-290 times greater affinity for Hemoglobine against O2. Dissociation of carbonhemoglobine (HbCO) is 3600 times slower than oxyhemoglobine (HbO2). To establish the relationship between the values of HbCO, duration of smoking and number of cigarettes smoked per day. Determination of reference limits for smokers as a basis for assessing the effects of working conditions in proceedings related to the formation of CO.

METHODS: CO-Oximeter Bayer is being used. The measurement is based on the Principle of characteristic absorption spectra which have Hb and its derivatives. We taking venous blood by vacutainers with Li Heparin. There is no significant difference in the values of HB CO in venous and arterial blood. Hb-CO is a stable chemical connection and low pO2 of the venous blood can’t dissociated it. Examined are 330 persons. Non smokers are 117. Smokers (n=213) were divided into 3 groups according to the duration of smoking and the 3 groups according to the number of cigarettes smoked daily. Data are processed statistically.

RESULTS: The values of HbCO in non-smokers has a range from 0.3 to 1,1% (mean 0,8 %). 10 years long smokers has a mean value 3,7% (n=57), up to 20 years - 4,4% (n=108) and up to 30 and more years - 5,1% (n=48). According to the number of daily smoked cigarettes groups are respectively: Up to 10 cigarettes x-3,8%; Up to 20 x- 5.2 % and 20 per day x-6,4%. Made statistical treatment of data and set reference values of Hb CO for smokers 1.6 -8,0%.

CONCLUSIONS: There is directly proportional increase of Hb CO with duration of smoking and the number of daily smoked cigarettes. There are major differences in the values of Hb CO in smokers and non smokers, irrespective of uniform conditions in proceedings relating to separation of CO and life in the big city. The values above 8.0% for HbCO for smokers in proceedings relating to separation of CO to be considered as pathological and dictated by labor conditions.
**THE EVALUATION OF BLOOD GAS CHANGES IN EXPERIMENTAL DOXORUBICIN TOXICITY**

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**BACKGROUND:** Doxorubicin (Dox) is a drug used in cancer therapy, but it has side effects including cardiotoxicity, liver injury and nephropathy. Particularly, due to producing free radicals to kill cancer cells, Dox causes irreversible damage to heart cells. The blood gas is a chemistry panel showing the status of acid-base and gases in patient and many toxins lead to acid-base changes. This study aimed to examine the effects of Dox on blood gases in rats.

**METHODS:** The Control group was assigned as negative control with no medication having placebo injection of saline. The group 1 received 2.5 mg/kg i.v. Dox. The group 2 received 2.5 mg/kg i.v. Dox plus 1 mg/kg p.o. ramipril. The group 3 received 2.5 mg/kg i.v. Dox plus 10 µg/kg i.p. darbepoetin alfa. The group 4 had 2.5 mg/kg i.v. Dox plus the same amount and duration of ramipril and darbepoetin together. Blood gas analysis was determined in whole fresh blood samples using an automated blood gas and electrolyte analyzer.

**RESULTS:** The mean pH values were 7.28±0.01, 7.24±0.02, 7.28±0.01, 7.29±0.01 and 7.32±0.02 in Control and groups 1, 2, 3, 4, respectively. Comparing the Control group, mean blood pH value was lower in group 1 and higher in group 4 indicating acidemia and alkalemia, respectively (p<0.05). The mean PCO2 values were 69.5±2.2, 69.4±1.5, 65.4±1.8, 63.6±1.8, 59±4.1 in Control and groups 1, 2, 3, 4, respectively. The lowest mean level of PCO2 was found in group 4 among groups (p<0.05) and the level tended to decrease in group 3. The mean PO2 values were 12±1.2, 10±0, 11±0.8, 14.1±1.5 and 12.2±0 in Control and groups 1, 2, 3, 4, respectively. The highest mean level of PO2 was found in group 3 among groups (p<0.05) and the lowest level of PO2 was in group 1. The mean HCO3- values were 30.1±0.6, 28±1.2, 28.2±0.5, 28.3±0.7 and 27.5±0.7 in Control and groups 1, 2, 3, 4, respectively. The lowest mean value of HCO3- concentration was in group 4 among groups (p<0.05). The heart itself, the blood cells and the materials carried by the bloodstream are strongly related parts to maintain the body's hemostasis.

**CONCLUSIONS:** The results showed the significant increase in PO2 level in group 3 and the significant decrease in PCO2 level in 4 indicating, therefore, the efficacy of an ACE inhibitor accompanied by an erythropoietin hormone during Dox toxicity.
EVALUATION OF EQUATIONS FOR CALCULATING SERUM OSMOLALITY

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BACKGROUND: There are 20 equations used to calculate osmolality when it cannot be measured directly. Blood gas analyzers also sometimes calculate the osmolality as well, and osmolality is usually matched with blood gas analysis orders, when not measured directly. Some of these equations make use of parameters such as urea, calcium, magnesium and glucose which are not or may not be derived from blood gas analysis.

METHODS: The performance characteristics of these equations have been reviewed and the formula suggested by Bhagat (1.89 Na + 1.38 K + 1.03 urea + 1.08 glucose + 7.45) was found to best reflect the measured osmolality. Due to reimbursement regulations, parameters which are not obtained by blood gas analysis may not be determined simultaneously in all cases. We evaluated the accuracies of five formulae which only use the parameters obtained with blood gas analysis against Bhagat’s equation. 1) Osm = 2xNa; 2) Osm = 2.1xNa; 3) Osm = 2xNa + 7; 4) Osm = 2.63xNa - 65.4; 5) Osm = 2xNa + Glucose.

RESULTS: The osmolalities of 5373 patients simultaneously having Na, urea and glucose results besides blood gas analysis were calculated retrospectively using Bhagat’s equation. Osmolalities were also recalculated with the 5 equations and the correlations of these osmolalities and the Bland Altman plots were compared. All of the 5 equations’ osmolality results were statistically different than Bhagat’s results (p<0.0001). This difference was usually within ± 1.96 SD, except in cases with increased osmolality. Equation 5 had the strongest correlation (r=0.74) among the 5 equations. In hypernatremic and hypoglycemic cases, there was no significant difference between equation 2 and Bhagat’s equation.

CONCLUSIONS: In order to estimate the osmolality best, the results of urea, calcium, magnesium and glucose besides electrolytes should also be considered. One of the best estimating equations is Bhagat’s equation which makes use of Na, K, urea and glucose. Still, each equation has its merits and weak points, in different clinical situations. Equations which do not include glucose results may underestimate the osmolality in diabetic patients, whereas equations taking urea into account must be used in kidney failure patients.