Comparison of the effect of 1000 and 10000 units heparin on umbilical venous blood gases

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Arterial blood gas (ABG) analysis is the major tool for proper diagnosis, and treatment of acid-base imbalance, but the invasive nature of arterial puncture and its possible hazards such as arterial spasm has resulted in a worldwide trend toward less-invasive diagnostic methods including venous blood gas (VBG) analysis.[1] In some diseases such as respiratory distress syndrome, neonatal sepsis, renal failure, pneumonia, diabetic ketoacidosis, and status epilepticus, VBG analysis showed a good validity (high sensitivity and specificity) accompanied by a suitable clinical agreement (over 40%), but in other diseases such as neonatal seizure, shock, congestive heart failure, and congenital heart disease, there was either an inappropriately low validity or a weak clinical agreement (under 20%).[2,3] Umbilical cord blood gas and the acid-base (pH) values should always be obtained in the high-risk delivery, and whenever newborn depression occurs. Determination of cord blood gases and pH is recommended in all neonates with low Apgar scores to distinguish metabolic acidosis from hypoxemia or from other causes that might result in low Apgar scores.[4] A complete blood gas analysis may provide important information regarding the type, and cause of acidemia and sampling the artery and vein may provide a more clear assessment. Blood gas test is a useful test, which is given frequently to high-risk neonates in the intensive care unit.[3] So the validity of this test has a very important role in diagnosis and treatment. Results of the ABG analysis can be biased by pre-analytical factors, such as time to analysis, syringe type, and temperature during storage.[5] Perhaps, a consensus could be reached to establish the optimal method of collection and the best methods for analyzing and reporting the results from cord blood gas and acid-base studies. Therefore, this study was designed to determine the influence of 2 different heparin doses on umbilical blood gas result of neonates in a clinical situation.

This is double blind clinical trial with self control study was carried out in the Neonatal Intensive Care Unit (NICU) of Imam Reza Hospital in Mashhad, Iran from October 2007 to December 2008. Fifty neonates who were admitted to the NICU were entered in the study. Before entry into the study, informed consent paper was provided from each patient's parents, and the study was approved by the University Ethical Committee in Mashhad. Characteristic of neonates were obtained by recording from file or interviewing with mothers. After that if they meet inclusion criteria, they were selected as our sample. The inclusion criteria consisted of all neonates admitted to the NICU of Imam Reza hospital, have working umbilical vein, and with a need for blood gas analysis. Exclusion criteria was diagnosis of anemia, heart disease, and congenital anomaly. Because of the affects of these factors on VBG results, we eliminated those patients from our study. Two blood samples were obtained from each neonate by insulin syringe through the umbilical cord. The insulin syringe (1 cc) was manufactured by SUPA Medical Devices, Tehran, Iran. At first, the plastic insulin syringe was coated with heparin sodium in 2 different doses; in sample one the syringe was coated with 1 cc/1000 units sodium heparin, and in sample 2, it was coated with 1 cc/10000 units sodium heparin, after that dead space fluid was completely removed from the cannula. Then 1 cc blood was taken for each sample under standard conditions from each neonate. We took 2 samples for each neonate in a volume of 1 cc. Before sampling, the syringe was coded, and the examiner was not aware of its kind. The lab analyzer also was not aware of the dose of heparin. The sample was stored in ice for a maximum of 30 minutes to rule out oxygen consumption, and then transferred to the laboratory. Blood gas was measured by the PHX model blood gas analyzer made in Waltham, Massachusetts, USA. Oxygen saturation, partial pressure of oxygen (PO_2), partial pressure of carbon dioxide (PCO_2), bicarbonate (HCO_3), and pH were the main variables extracted from the results of the blood gas analysis. The data were analyzed by using

Table 1 - Characteristics of newborns.

Variable	Mean ± SD	Minimum	Maximum
Birth weight (gr)	1643.33 ± 761.64	730	3260
Weight at study (gr)	1703.55 ± 763.61	810	3380
Age at study (day)	4.35 ± 2.38	1	9

Table 2 - Effect of 2 different heparin doses on results of blood gas.

Variable	Sample 1 mean ± SD (1 cc/1000 units) n=50	Sample 2 mean ± SD (1 cc/10000 units) n=50	Result Pair t test *P*-value
pH	7.22 ± 0.16	7.23 ± 0.15	0.27
PO_2	45.1 ± 19.84	47.21 ± 21.56	0.095
PCO_2	62.76 ± 22.64	62.21 ± 25.58	0.58
HCO_3	25.99 ± 5.9	25.74 ± 5.6	0.61
SVO_2	68.44 ± 18.4	70.19 ± 19.8	0.084

PO_2 - partial pressure of oxygen, pH - acid/base values, PCO_2 - partial pressure of carbon dioxide, HCO_3 - bicarbonate, SVO_2 - venous oxygen saturation

the Statistical Package for Social Sciences version 11.5 (SPSS Inc., Chicago, IL., USA), and the 2 samples were compared. The anthropometric data are presented as means ± SD. Frequency and mean were determined by descriptive statistics. To determine normality of data, we used from one sample Kolmogorov-Smirnov test. If data were in normal distribution, paired t-test was used, and for non-normal distribution, Wilcoxon test was used. All of our data were normal so comparison between the groups was performed using paired t-test. The cut-off level for significance was chosen at $p \leq 0.05$.

Demographic analysis shows that 80% of our neonates were preterm, and 53.1% were female. Other characteristics are shown in **Table 1**. As shown in **Table 1** we have various range of neonates from very low birth weight to normal birth weight neonates. Paired t-test showed that there was no significant difference between the variables tested in the 2 samples (**Table 2**).

The results show that a greater concentration of heparin had no effect on SVO_2, PO_2, pH, PCO_2 and HCO_3's there was no significant difference between them. We coated the syringe with heparin as studies recommended that it is better after heparinization as the fluid can completely be evacuated.[6] Some studies suggest that using syringes with vaporized heparin in obtaining neonatal ABG is more reliable, and have consistent results.[7] We could not find similar studies according to our method. Some studies have indicated that more concentration of heparin can have effects on PCO2 and PH, and some of them confirmed our result. We preferred this method as it is used usually in our ward, but it was a question how a low dose or high dose heparin can affect VBG results. Finally, our study showed that when the syringe was coated with sodium heparin, the effect of more concentration is not significant on result of VBG in neonates. So according to our aim, when syringe was coated with low dose or high dose of heparin, the VBG result does not change significantly.

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