Original Article

APPROPRIATENESS OF BLOOD GAS ANALYSIS IN NEWBORNS WITH RESPIRATORY DISTRESS

*Shabih Manzar**

ABSTRACT

Objective: To look at the appropriateness of blood gas analysis in newborn with respiratory distress.

Subjects & Methods: We carried out an audit at the neonatal intensive care unit (NICU) of King Fahd Hospital of the University, Al-Khobar, Saudi Arabia. All newborn who got admitted to the NICU with the signs of respiratory distress were included. The neonates were only receiving oxygen as respiratory support. None were intubated or received positive pressure ventilation. The records of sixteen newborns with admission blood gas analysis available were reviewed.

Results: Except for the two cases, none had hypoxemia (PaO_2 < 80 mm Hg). Similarly only two cases were noted to have acidosis (pH < 7.30) while only one case had hypercarbia ($PaCO_2$ > 40 mm Hg). The base excess and bicarbonate measurements, in most of the cases, were also within the normal range.

Conclusions: The blood gas analyses were essentially normal of most of the samples suggesting inappropriateness and unnecessary use of this painful and costly procedure in otherwise stable newborns with respiratory distress. Based on these findings, an alternative approach, a combination of clinical parameters, pulse oximeter reading and findings on chest x-ray is suggested that may be useful in management of neonates with respiratory distress. The goal is to minimize the overuse of invasive painful procedure.

KEYWORDS: Blood gas, neonates, tachypnea, pulse oximetry, chest x-ray, non-invasive

Pak J Med Sci January-March 2004 Vol. 20 No. 1 33-35

INTRODUCTION

Blood gas analysis is one of the commonest routine investigations done at admission of neonate who presents with respiratory distress with the objective of knowing the acid-base status and to decide about the need for intervention. It has been shown in earlier studies that physicians use blood gas analysis excessively[1-4]. Blood gas analysis when drawn from capillary or arterial puncture, is a painful procedure, so its use should be minimal. It is performed on automatic analyzers, which are costly. In analysing one blood gas, from the person drawing the specimen to the person performing the test, a lot of time is spent, which has to be taken into account.

In addition to the use of blood gas analysis, neonates with respiratory distress could be observed clinically and by using pulse oximetry. This study was conducted to look at yield and appropriateness of the blood gas analysis carried out in neonates with signs of respiratory distress.

* Shabih Manzar, MBBS, FAAP
Department of Paediatrics
Hamdard University Hospital
Karachi, Pakistan

Correspondence:

Shabih Manzar
P.O. Box 17730
Gulshan-e-Iqbal 75300
Karachi, Pakistan
E-mail: shabihman@hotmail.com

Received for publication: April 28, 2003

Accepted: September 16, 2003

PATIENTS AND METHODS

The audit was carried out at the Neonatal Intensive Care Unit (NICU) of King Fahd Hospital of the University, Al-Khobar, Saudi Arabia. All newborn who got admitted to the NICU with the signs of respiratory distress (from January 1, 2000 to April 15, 2000) were included. The neonates were only receiving oxygen as respiratory support. None were intubated or received positive pressure ventilation. The records of sixteen newborns with admission blood gas analysis available were reviewed (Table-I).

RESULTS

Table-I summarizes the findings. Most of the blood gas analyses were arterial puncture. At the time of the blood gas analysis all neonates were receiving fraction inspired oxygen in variable amount, from 30-50%. Except for the two cases (6,10) none had hypoxemia (PaO_2 < 80 mm Hg). Similarly only two cases (case 4 and 10) were noted to have acidosis (pH < 7.30) while only one case had hypercarbia ($PaCO_2$ > 40 mm Hg). The base excess and bicarbonate measurements, in most of the cases, were also within the normal range.

Table-I: Results of blood gas analysis

Case No.	*PH*	*PCO_2*	*Base Excess*	*HCO_3*	*PO_2*	*SaO_2*
1.	7.40	26.2	-6.0	16.1	82.7	98
2.	7.35	27	-8.3	15.6	127	98
3.	7.40	27	-5.5	16.9	137	99
4.	7.29	30	-10.4	14.4	81	93
5.	7.43	24	-5.8	15.7	110	98
6.	7.36	31	-5.9	17.5	67	92
7.	7.37	25	-5.5	18.1	122	98
8.	7.30	26	-11.1	13	154	99
9.	7.38	31	-5.0	18.2	80	95
10.	7.25	49	-5.9	21	75	96
11.	7.33	39	-5.0	20	102	97
12.	7.33	33	-6.9	17.9	167	93
13.	7.51	18	-4.4	14.6	131	99
14.	7.32	35	-6.7	18	109	98
15.	7.39	21	-9	12.8	169	99
16.	7.35	28	-8.1	15.3	158	99

Most of the blood gas analyses were arterial puncture

PCO_2 & PO_2 as mm of Hg (For readings in kPa, the conversion factor is 7.5)

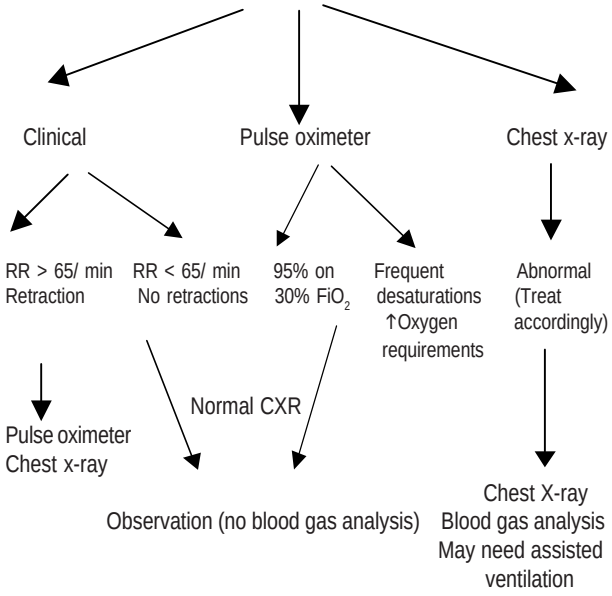
HCO_3 & Base Excess as mmol/l

DISCUSSION

With respiratory signs and symptoms, the main indication for obtaining a blood gas is to know about the status of oxygenation (PaO_2) and ventilation ($PaCO_2$ & pH). Knowledge of bicarbonate and base excess is of help in differentiating the type of acidosis but is not the major aim in such respiratory cases. In the present study we noted that the acid-base status of the cohort was essentially normal which indicated that the admission blood gas analysis in neonates with respiratory distress was of not much help in deciding about the intervention. Our finding of poor yield and unnecessary use of blood gas analysis is in agreement with the previous reports on adult patients[1-4].

The other aspect of the blood gas analysis is the associated pain and cost. Neonatal pain perception is widely documented[5]. The

Figure 1: Algorithm for neonates with respiratory distress without assisted ventilation



painful experience is further enhanced by the virtue of invasive procedure carried out in neonatal ICU[6]. The blood gas analysis (capillary or arterial) is an invasive painful procedure to neonates, hence it should be avoided if not necessary. This is exclusive of the cost of automated analyser and personnel. To limit the painful invasive procedure other alternatives should be explored, which could include the combination of clinical, pulse oximetry and radiological findings. The use of pulse oximetry, as a non-invasive alternative, has been shown earlier[7,8]. The pulse oximetry in neonates with respiratory distress not requiring assisted ventilation has advantage over the blood gas analysis due to the fact that it is non-invasive, reusable besides being a bedside procedure. It could be applied intermittently in case of a very busy nursery with limited equipment.

We suggest an alternative approach that may be useful in minimizing the number of blood gas analysis (Figure 1). In neonates who develop tachypnea, decision could be made on the basis of combination of clinical parameters (degree of tachypnea, extent of oxygen requirement, cyanosis), pulse oximeter reading (episodes of desaturations) and a single view chest x-ray (pneumothorax, diaphragmatic hernia). The point we would like to emphasize is not only the cost involved in blood gas analysis but also the pain caused during arterial puncture in neonates where there is no indication for indwelling catheters. A neonate who is tachypneic (respiratory rate of 60/ minutes) with no subcostal or suprasternal retraction, saturating 95% on 30% oxygen, with a normal chest x-ray could be observed safely without any invasive measurement of blood gas, as most likely it will be within normal limits, as observed in our audit. A randomized control trial on neonates with respiratory distress not requiring assisted ventilation with one group with non-invasive monitoring approach while other with blood gas analysis is warranted to validate the conclusions extrapolated from our findings.

CONCLUSIONS

The frequent unnecessary use of blood gas analysis in otherwise stable newborns with respiratory distress should be discouraged based on our findings of poor yield. By not doing a blood gas analysis in neonates who present with tachypnea the chances of missing the pathology is remote. This is in addition to the reduction in the management cost and pain of invasive procedure. We suggest an alternative approach of combining a good clinical examination with a chest x-ray and pulse oximetry that could be used safely at the initial assessment of neonates. However, further studies would be of great help in this regard.

REFERENCES

1. Al-Moamary M, Daniel D, Battwa F, Al-Jahdali H, Al-Shimemeri A. Appropriateness of arterial blood gas measurements in acute care general wards. Annals of Saudi Medicine 1999; 19(2): 153-155.
2. Pilon C, Leathley M, London R, McLean S, Phang Y, et al. Practice guidelines for appropriate use of arterial blood gas analysis in the intensive care unit decreases number and increases appropriateness of tests. Crit Care Med 1997;25: 1308-1313.
3. Muakkassa FF, Rutledge R, Fakhry SM, Meyer AA, Sheldon GF. ABGs and arterial lines: the realtionship to unnecessary drawn arterial blood gas samples. J Trauma 1990; 30: 1087-1095.
4. Browning J, Kaiser D, Durbin C. The effect of guidelines in the appropriate use of arterial blood gas analysis in the intensive care unit. Respir Care 1989; 34:269-276.
5. Craig KD, Grunau RVE. Neonatal pain perception and behavioural measurement: In: Anand KJS, McGrath PJ, eds. Pain in neonates. Amsterdum: Elsevier Science BV, 1993: 66-69.
6. Barker DP, Rutter N. Exposure to invasive procedures in neonatal intensive care unit admissions. Arch Dis Child Fetal Neonatal Ed 1995:72:F47-F48.
7. King T, Simon RH. Pulse oximetry for tapering supplemental oxygen in hospitalized patients. Chest 1987;92:713-716.
8. Mihm F, Halperin B. Noninvasive detection of profound arterial desaturations using a pulse oximetry device. Anesthesiology; 1985:62:85-87.