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Estimation of Haemoglobin with Arterial Blood Gas Analyzer Compared to Conventional Laboratory Methods In Intensive Care Unit.

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Abstract : *A sample of the patient's blood may be sent to the laboratory which allows (Haemoglobin) Hb to be measured using various methods, or the Hb value may be obtained by Arterial blood gas (ABG) analysis in the operating room or Intensive care unit. Our aim was to compare haemoglobin level obtained by Arterial blood gas Analyzer with Conventional laboratory method. A Comparative observational study was designed, patients admitted for trauma to Intensive Care Unit from April 2015 to July 2015 of Tertiary care teaching Hospital and Research centre. Categorical data was represented in the form of Frequencies and proportions. Continuous data was represented as mean and standard deviation. Independent t test was used. A total of 80 consecutive paired analyses were conducted. T test showed the difference between the two methods was statistically significant. Using the method of Bland and Altman, the overall mean difference in Hb concentration between the coulter counter and the blood gas analyzer was –4.3 g/l (95% CI = –11.0 to 2.4). Of the 11 (5.4%) Hb measurements that extended beyond the upper and lower 95% CI, 10 (5.0%) were within ±3 g/l of these confidence limits. We concluded that, an arterial blood gas analyzer may provide a valid alternative method to the traditional coulter counter for the rapid assessment of Hb concentration among critically ill adults.*

Keywords: *Haemoglobin, analysis, Blood gas analysis.*

I. Introduction

In Intensive care unit (ICU) frequent collection of blood specimens may contribute to iatrogenic blood loss, compounding the problem of acute anaemia that is frequently found among individuals with active haemorrhage, with a bleeding diathesis or with hemodilutional anaemia. Many factors affect the accuracy of haemoglobin concentration values [1].

Rapid analyses through arterial blood gas (ABG) analyzers in most ICUs and hospital laboratories gives us information about pH,pO2,Serum electrolytes also Hb concentration [1]. ABG machines can be vital tools in the assessment of critically ill and trauma patients. Current ABG analysers provide information on haemoglobin, glucose and electrolytes in addition to acid-base balance [3].

Due to delay in laboratory reporting there could be a lag time in the diagnosis of severe acute anaemia and may have important clinical consequences [1]. The decision to measure the haemoglobin (Hb) level, and on the basis of the results obtained, when to transfuse blood, is important and crucial [2]. Awaiting results from laboratory may present a significant delay in diagnosis and management, so reliance on ABG determination of these parameters is increasing [3].

Hence this study was undertaken to evaluate whether the haemoglobin concentration obtained by means of arterial blood gas (ABG) co-oximetry and central laboratory techniques clinically correlate when using simultaneous measurements of haemoglobin concentration obtained from trauma patient.

II. Material and Methods

Our objective was to compare haemoglobin level obtained by Arterial blood gas Analyzer with Conventional laboratory method.

After obtaining institutional ethical committee clearance, patients admitted for trauma to Intensive Care Unit were enrolled in the study. Study design was a prospective, clinical comparison study. Inclusion Criteria was trauma patients admitted to Intensive Care Unit. Exclusion criteria was refusal to participate in the study; post operative cases and all the non trauma cases like medical cases admitted to intensive Care Unit.

All consecutive patients admitted to the ICU during the period between 1st April and 31st July 2015 were included. As part of their routine admitting blood work, an arterial whole blood specimen was obtained from each patient, shortly after admission to the ICU. A portion of that specimen was placed directly into a

heparinised ABG glass syringe, while the remainder was placed in an EDTA vacuum collection tube. The ABG syringe was analyzed using ABL 80 Flex ABG Analyser. The EDTA blood specimen tube was transported at room temperature to the same core laboratory where Beckman Coulter CBC Machine was used to measure the Hb concentration. Processing of the ABG and coulter counter specimens was carried out by different laboratory technologists, who were masked to each other's test results. These data were subsequently abstracted by one author.

Data was entered into Microsoft excel data sheet and analysed using SPSS 15.Categorical data was represented in the form of Frequencies and proportions. Continuous data was represented as mean and standard deviation. Independent t test was used as test of significance to identify the mean difference between two groups. p value <0.05 was considered as statistically significant.

III. Results

Table 1: Age wise distribution

Age in years	No. of patients	%
<20	1	1.3
20-30	37	46.3
31-40	9	11.3
41-50	12	15.0
51-60	16	20.0
>60	5	6.3
Total	80	100.0

Mean ± SD: 38.49±15.59

Table 2: Gender wise distribution

Gender	No. of patients	%
Female	15	18.8
Male	65	81.3
Total	80	100.0

There was no statistically significant difference in distribution of age, and sex .($p>0.05$).Most of the patients were from the age group of 20-30 yrs. Out of eighty patients 15 were female patients and 65 were male patients.

Table 3: Comparison of hemoglobin and PCV in two methods ABG analyzer and Conventional lab method

Variables	ABG Analyzer	Conventional lab method	difference	t value	P value
Hemoglobin %	12.47±1.41	10.72±1.17	1.750	26.978	<0.001**
PCV	37.34±4.21	31.87±4.69	5.462	11.987	<0.001**

The mean coulter counter and ABG Hb values were compared using an unpaired t test. The mean Hb concentration measured by the coulter counter was 10.72 g/dl (standard deviation = 1.17g/dl), while that measured by the ABG was 12.47 g/dl (standard deviation = 1.41 g/dl) (mean difference = 1.750 g/dl; P = 0.060).

Table 4: Results of Bland and Altman Plot for ABG analyzer and Conventional lab method

Variables	Bias	95%CI
Hemoglobin %	1.75	0.61-2.89
PCV	5.10	1.50-8.60

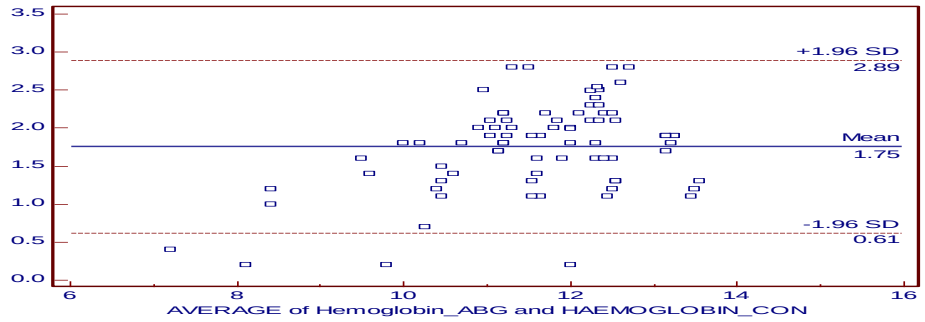

Fig 1: Bland and Altman Plot comparing Hb with 2 different methods.

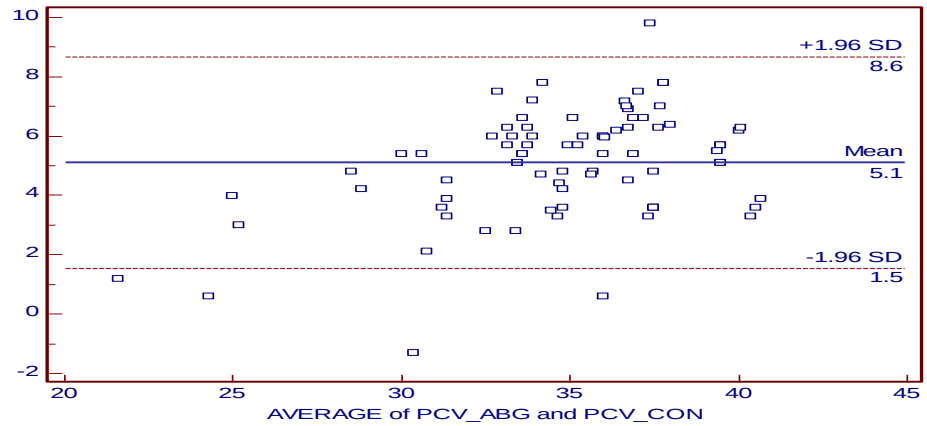

Fig 2: Bland and Altman plot comparing PCV with 2 different methods [5].

A total of 80 consecutive paired analyses were conducted. Using the method of Bland and Altman, the overall mean difference in Hb concentration between the coulter counter and the blood gas analyzer was 1.75 g/dl (95% CI = 0.61-2.89).

IV. Discussion

A sample of the patient's blood may be sent to the laboratory which allows Hb to be measured using various methods, or the Hb value may be obtained by ABG analysis in the ICU [2].ABG machines can be vital tools in the assessment of critically ill and trauma patients. The ABG analyzer determines the Hb concentration using a spectrophotometric carbon monoxide oximeter module, and Beckman Coulter CBC Machine uses the dilutional scattering principle which is based on the density of the particles.

In our study we compared the use of an ABG analyzer with the use of a traditional coulter counter for the evaluation of the Hb concentration among 80 trauma patients. We observed that the ABG analyzer provides a reasonable value of the Hb concentration , but may overestimates the Hb value by approximately 1.7 g/dl. In one of the studies conducted previously to estimate haemoglobin concentration among critically ill adults showed that the ABG analyzer provided a reasonable estimate of the Hb concentration and overestimates the Hb value by approximately 4.3 g/l [1].

In other study conducted to measure haemoglobin using ABG analyser and traditional coulter counter measurement during liver transplant also showed that ABG analyser was useful for haemoglobin evaluation in settings where rapidity of analysis is important [4].Hence we can say that the Hb value obtained from ABG over estimates the Hb value obtained from Conventional laboratory method but still can be used as an alternative method of determination of Hb concentration.

V. Conclusion

ABG analyser may provide a valid alternative method to the traditional coulter counter for the rapid assessment of Hb concentration among trauma patients.

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