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Arterial blood gas analysis in chronic obstructive pulmonary disease

KEYWORDS: Chronic Obstructive Pulmonary Disease (COPD), Arterial Blood Gas (ABG), Acidosis, Alkalosis

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ABSTRACT Patients with an exacerbation of chronic obstructive pulmonary disease (COPD), Arterial blood gas analysis (ABG) pao2, pco2, pH and bicarbonate have been studied in 60 patients. Among them 35 were Acidosis (20 respiratory acidosis, 5 metabolic acidosis and 10 mixed respiratory and metabolic acidosis) and 25 cases were found to be Alkalosis (4 metabolic alkalosis, 15 respiratory alkalosis and 6 mixed respiratory and metabolic alkalosis). The mean age was 56.50 ± 5.81 years and pco2 (mean ± S. D.) 49.30 ± 1.37 and po2 64.72 ± 2. 31 mmHg, pH was found in the range 7.25 – 7.55 and HCo3- 28.30 ± 2.12 (mean ± S. D.). In present study choice of respiratory and metabolic ABG in COPD are important due to respiratory acidosis and respiratory alkalosis.

Introduction:
Chronic obstructive pulmonary disease (COPD) is a worldwide disease especially in developing world (Vestab, Jorgen ,2013). There are many factors which influence COPD such as tobacco smoking, air pollution and genetic marker of individual (Decramer M et al,2012). These factors may cause inflammatory response in the lungs which results narrowing of the small airways and destruction of lung tissue, known as Emphysema. Different method are available for diagnosis of COPD (Nathell L et al ,2007). According to the World Health Organization (WHO) COPD will become the third leading cause of death worldwide by 2030 (Murray C J ,2012, C Raheriron and P. O Girodet ,2009) Determination of Arterial blood gas analysis (ABGA) is important in diagnosis, prognosis and management of acute exacerbation COPD. We have study arterial blood gas pco2, po2 and pH and HCo_3^- ion in chronic pulmonary obstructive in present study.

Material and methods:
We have studied Arterial blood gas analysis in 60 patients (male and female) with lung disease acute exacerbation of COPD admitted to Intensive Care Unit (ICU) between December 2008 to December 2009 in SRG Hospital and Jhalawar Medical College Jhalawar (Rajasthan). Pao2, paco2, pH and HCo_3^- evaluated in patients of chronic obstructive pulmonary tuberculosis (COPD). Arterial blood sample were collected from radial artery by heparinised syringe with 20- 25 gauge needle and deliver the sample immediately for analysis and there should be no delay otherwise error may occur and paO_2 and $paCo_2$, pH and $HCO3^-$ evaluated in COPD patients.

Stepwise approach to ABG Analysis
Determine whether patient is alkalemic or acidemic state using the arterial pH measurement.

Determine whether the acid- base disorder is a primary respiratory or metabolic disturbance based on the $paCo_2$ and serum HCO_3^- level.

If a primary respiratory disorder is present, determine whether it is chronic or acute.

In metabolic disorders, determine if there is adequate compensation of the respiratory system.

In respiratory disorders, determine if there is adequate compensation of the metabolic system.

Determine pateint's oxygenation status (PaO2 and SaO2)-hypoxemic or not. If a metabolic acidosis is present, determine the anion gap.

Results:
Arterial blood gas analysis was carried out in chronic obstructive pulmonary disease patients admitted to ICU with clinical features of cough, dyspnea. The mean age of our study group was 56.50 ± 5.81 (mean ± S. D.) years of both male and female patients. Respiratory acidosis and alkalosis case were found to 35 and 25 respectively. Among them Acidosis cases 20 of respiratory acidosis,5 metabolic acidosis and mixed acidosis were found to be 10 and in 25 alkalosis case 15 respiratory acidosis, 04 metabolic acidosis and 06 were of mixed alkalosis. (Table 1)

The mean ± S. D. pco2 49.30 ± 1.37 and po2 64.72 ± 2.31 mmHg, pH in the range 7.25- 7.50 and HCo_3^- ion 28.30 ± 2.12 (mean ± S. D.) (Table 2)

Table 1- Clinical correlation of COPD patients

	ACIDOSIS (35)	ALKALOSIS(25)
Respiratory	20	15
Metabolic	5	4
Mixed	10	6

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Table 2 – (Mean ± S. D.) value of Arterial blood gas Parameters in COPD

PARAMETER	MEAN ± S. D.
Pco2 (mmHg)	49.30 ± 1.37
Po2 (mmHg)	64.72 ± 2.31
pH	7.25 - 7.55
HCo_3^-	28.30 ± 2.12

Discussion:
The following definitions and terminology used in reference to acid-base balance (Richard M. Jeffery,2005) -:

Acidosis - Presence of process which tends to decrease pH by virtue of gain of H^+ or loss of Hco_3^- .

Alkalosis – Prescence of a process which tends to increase pH by virtue of loss of H^+ or gain of Hco_3^-

Respiratory Vs metabolic –
Respiratory – process which leads to acidosis or alkalosis through a primary alteration in ventilation and result excessive eliminationor retention of CO_2.

Metabolic- process which lead to acidosis or alkalosis through their effects on kidney and the consequent disruption of H^+ and HCO_3^- control.

Compensation – The normal response of the respiratory system or kidney to change in pH induced by a primary acid-base disorder.

Simple Vs. Mixed Acid-Base Disorder-
Simple acid-base disorder – a single primary process of acidosis or alkalosis

Mixed acid-base disorder - presence of more than one acid base disorder simultaneously.

Compensation - In the presence of acidosis or alkalosis, regulatory mechanism occur which attempt to maintain the arterial pH in the physiologic range. These process result in the return of pH towards, but generally just outside the normal range.

Disturbance in HCO_3^- (metabolic acidosis or alkalosis) result in respiratory compensation while changes in CO_2 (respiratory acidosis/alkalosis) are counteracted by renal compensation.

Arterial blood gas analysis pao2, pco2 and HCo_3^- is important in diagnosis, prognosis and and medical management of acute exacerbation of chronic obstructive pulmonary disease (R. Begin et al 1975). Interpretation of pao2, pco2, pH and HCo_3^- are considered respiratory and metabolic parameter and useful in acid – base disorder (Rechard M J. AW 2005). Choice of respiratory and metabolic parameter. Arterial blood gas especially in chronic obstructive pulmonary disease are important due to respiratory acidosis and respiratory alkalosis. Respiratory acidosis is defined as low pH, high paCO2, normal or high normal bicarbonate. (Robe K F et al 2007)

The mean ± S. D. age of our study was 56.50 ± 5.81 which were correlated with other markers (Pragnesh J et al 2014, Burrow B 1964, Burrow B 1969). In our study most of the case were male, among 60 cases 51 were found to be male and only 9 cases of female. Other workers also shown male predominance (Pragnesh J et al 2014, Burrow B 1969, Rupmate RU 1989). According to Pragnesh J et al 2014 males are more prone to exposure to smoking, environmental dust and irritants.

In present study COPD patients were found to be acidosis, alkalosis and among them a respiratory, mixed and metabolic conditions present. The mean pCo2 (49.30) level increase i.e, hypercapnea and pO2 was (64.72). the relationship of pCO2 and pO2 showing in our study acidosis and alkalosis both condition were involved due to body compensate towards acid – base balance we have correlated our findings with reported in literature (Crofton and Dongla 2000, Ingram R 1972, Pragnesh J et al 2014, Rupware RU 1989)

pH in the range of 7.25- 7.55 (male) and HCo_3^- 28.30. blood pH is important to maintain homeostasis to avoid cellular destruction (Singh V et al 2013). Disturbances in pH causes respiratory or metabolic or mixed disorders of acidosis and alkalosis (Ghosh A k 2006, Adrogne HJ 2006, Richsrd M 2005). Buffer mechanism of body which can be either renal or respiratory maintain blood pH within normal range.

In present study HCO_3^- mean value was 28.30. Bicarbonate ions also important to achieve condition acidosis and alkalosis within normal limits by body compensation and decompensation by kidney by disruption of H^+ and HCO_3^- control, other workers reported bicarbonate ions role in acid base balance (R Begins et al 1975, Abhishek Verma 2010, Rabe KF 2007).

Conclusion:
Analysis of ABG and interpretation is important and relevant, sensitive parameter for clinician as well as Anaesthetist. In COPD arterial blood gas analysis and acid base state are significant in present study.

REFERENCE 1. Abhishek Verma (2010). The interpretation of arterial blood gases. Vol 23,4,124-125. 2. Adrogne HJ (2006) mixed acid base disturbances. J Nephrol, 9, 597- 103. 3. Burrow B Early R H (1969). Cause and prognosis of COPD, A prospective study of 200 patients. N Eng J Med. 280 (8) 397- 404. 4. Burrow B (1964). Clinical physiological findings in 175 patients and their relationship to their age and sex in COPD. Relationship of clinical physiological findings to severity of airway construction. British Medical Journal 665- 677: 521- 539. 5. C Raheriron and P. O Girodet (2009) "Epidemiology of COPD". European Respiratory Review. 18, (5) 114, 213- 221. 6. Croffon and Douglas (2000) Respiratory Diseased Fifth Edition, Blackwell Science, 730- 732. 7. Decramer M, Janssens W, Mirallition M (2012). Chronic obstructive pulmonary disease, Lancet, 379 (9823) 1341- 51. 8. Ghosh AK (2006). Diagnosis acid base disorders. J Assoc physicians india 54, 720 – 724. 9. Ingram R, Miller RB Tale LA. (1972) Arterial CO2 changes during voluntary hyperventilation in COPD. Chest 62(1) 14- 18 10. Murray C J (2012). Disability adjusted life years (DALYS) for 291 diseases and injuries in 21 regions 1990- 2010. A systemic analysis for the global Burden of disease study 2010. Lancet 380 (9859): 2197- 223. 11. Nathell L, Nathell M, Malmberg P, Lesson K (2007). COPD diagnosis related to different guidelines and spirometry techniques. Respire. Res. 8 (1): 89. 12. Pragnesh J. Patel, Nandita Mehta, Sanjay Chauhan and Piyush Solanki. (2014). Arterial blood gas analysis in chronic obstructive pulmonary disease cases. NJRIM. 5(1) 10- 12. 13. R. Begins, T. Racine, J. C. Roy (1975) value of capillary blood gas analysis in the management of acute respiratory distress. The American review of respiratory disease 112, (6), 879- 881. 14. Richard M. Jeffery A. W. Acid Base Balance- Text book of Respiratory medicine. Vol. 1 (4th ed) (2005): p172 – 194. 15. Robe K F et al (2007) Global Strategy for the diagnosis and prevention of chronic obstructive pulmonary disease. Gold executive summary. AM Respir. Crit. Care. Med. 176. 532- 555. 16. Ruphlate R U, Vaidya PR, Kamat SR (1989). Correlation of ventilator tests and arterial blood gases in chronic bronchitis. Lung India. 1(8): 23- 25. 17. Singh V, Khatana S, Gupta P. (2013). Blood gas analysis for bedside diagnosis. Nasion J Maxillfasc surg. 4(2), 136- 141. 18. Vestab, Jorgen (2013) "Definition and overview. Global strategy for the diagnosis, management and prevention of chronic obstruction pulmonary disease".Global initiative for chronic obstructive lung disease1- 7