The effect of hypophosphatemia on critically ill patient with acute exacerbation of chronic obstructive pulmonary disease (COPD)

Thesis

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By

Hossam Ahmed Abdelwahab Abdel Raoof

M.B.B.CH,

Faculty of Medicine -Tanta University

Under supervision

Prof. Dr. Mohamed Hossam Shokeir

Professor of Anaesthesia and Intensive Care,

Faculty of Medicine, Ain Shams University

Dr. Nevein Gerges Fahmy

Assistant Professor of Anaesthesia and Intensive Care,

Faculty of Medicine, Ain Shams University

Dr. Reham Mustafa Hashim

Lecturer of Anaesthesia and Intensive Care

Faculty of Medicine, Ain Shams University

Faculty of Medicine

Ain Shams University

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بسم الله الرحمن الرحيم

وقُلِ اعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ ورَسُولُهُ والْمُؤْمِنُونَ

صدق الله العظيم

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Hossam Ahmed Abdelwahab

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List of Abbreviations

2,3BPG	:	2,3 Biphosphoguanide.
ABGs	:	Arterial blood gases.
AECOPD	:	Acute exacerbated chronic obstructive pulmonary disease.
ALT	:	Alanine aminotransferase.
AST	:	Aspartate aminotransferase.
ATP	:	Adenosine triphosphatase.
ATS	:	American Thoracic Society.
AUC	:	Area under the curve.
BE	:	Base excess.
BTS	:	British Thoracic Society.
BUN	:	Blood urea nitrogen.
Ca	:	Calcium.
CBC	:	Complete blood count.
CD4	:	Cluster Designation Antigen 4.
CD8	:	Cluster Designation Antigen 8.
CO_2	:	Carbondioxide.
COPD	:	Chronic obstructive pulmonary disease.
CT	:	Computed tomography.
CXCR3	:	CX chemokine receptor 3
dl	:	Deciliter.
DNA	:	Deoxyribonucleic acid.
ECG	:	Electrocardiogram.
EGFR	:	Epidermal growth factor receptor.
ERS	:	European Respiratory Society.
EU	:	European Union.
FET	:	Fisher exact test.

List of Abbreviations (Cont.)

FEV_1	:	Forced expiratory volume in one second.
FiO_2	:	Fraction of inspired oxygen.
FVC	:	Forced vital capacity.
GI	:	Gastrointestinal.
GOLD	:	Global Initiative for Chronic Obstructive Lung Disease.
H_2O	:	Water.
HCO_3	:	Bicarbonate.
ICU	:	Intensive care unit.
INR	:	International Normalized Ratio.
K	:	Potassium.
L	:	Liter
LV	:	Left ventricle.
MDI	:	Metered dose inhaler.
mEq	:	Milliequivilant.
Mg	:	Magnesium.
mg	:	milligram.
Mg SO_4	:	Magnesium Cabretate.
ml	:	milliliter
mmHg	:	Millimetermercury.
MMPs	:	Matrix metalloproteinases.
MV	:	Mechanical ventilation.
Na	:	Sodium.
NIPPV	:	Non invasive positive pressure ventilation.
NIV	:	Non invasive ventilation.
NPV	:	Negative Predictive value.
$PaCO_2$	:	Partial pressure of arterial carbon dioxide.

List of Abbreviations (Cont.)

PaO_2	:	Partial pressure of arterial oxygen.
PEEP	:	Positive end-expiratory pressure.
PEF	:	Peak expiratory flow.
PH	:	Negative logarithm of hydrogen ion concentration.
PO_4	:	Phosphorus.
PPV	:	Positive Predictive Value.
Pt	:	Prothrombine time.
PTH	:	Parathormone.
Ptt	:	Partial thromboplastine time.
RNA	:	Ribonucleic acid.
ROC	:	Receiver operator characteristic curve
SaO_2	:	Arterial oxygen saturation.
SD	:	Standard deviation.
SPSS	:	Statistical package for social science.
Th1	:	T helper1.
TIMPs	:	Tissue inhibitors of matrix metalloproteinases.
USA	:	United State of America.
WHO	:	World Health Organization
β_2	:	Beta 2.

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease with some significant extra-pulmonary effects that may contribute to the severity in individual patients. **Aim of the Work:** evaluate the effect of hypophosphatemia on patients with acute exacerbation of COPD. **Patients and Methods:** This study was performed on 50 patients with AECOPD admitted at chest department and respiratory ICU in Tanta university hospital in the period between July 2018 and January 2019., serum of phosphorus was measured on admission, hypophosphatemia is considered if serum phosphorus is below 2.5mg/dl. **Results:** Combination between hyponatremia and hypophosphatemia significantly increased the need for ventilation, duration of ventilation and associated with poor outcome (p value < 0.01), while hyponatremia alone not significantly affect the need for ventilation, duration of ventilation and outcome (p value > 0.05). **Conclusion:** Hypophosphatemia may increase the severity of COPD exacerbation, need for ventilation, duration of ventilation, weaning failure and so increases the rate of mortality. Combination between hypophosphatemia and hypokalemia or hyponatremia increased the need for ventilation, duration of ventilation and affected outcome badly.

Key words: hypophosphatemia critically ill patient, acute exacerbation, chronic obstructive pulmonary disease

Introduction

Chronic obstructive pulmonary disease (COPD) is a treatable disease with some significant extra-pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases. The chronic airflow limitation characteristic of COPD is caused by a mixture of small airway disease (obstructive bronchiolitis) and parenchymal destruction (emphysema), the relative contributions of which vary from person to person ***(GOLD, 2018)***

An exacerbation of COPD is a preventable disease and defined as an event in the natural course of the disease characterized by a change in the patient's baseline dyspnea, cough, and/or sputum that is beyond normal day-to-day variations, is acute in onset, and may warrant a change in regular medication in a patient with underlying COPD ***(Celli et al., 2004)***.

Exacerbations affect the quality of life and prognosis of patients with COPD. Hospital mortality of patients admitted for a hypercarbic COPD exacerbation is approximately 10%, and the long-term outcome is poor. Mortality reaches 40% at 1 year in those needing mechanical support, and all-cause mortality is even higher (up to 49%) 3 years after hospitalization for a COPD

exacerbation. Older age, decreased lung function, lower health status, diabetes, and pre-ICU admission quality of life are important risk factors for mortality in COPD patients hospitalized for acute exacerbation. In addition, exacerbations of COPD have serious negative impacts on patient's quality of life, lung function, and socioeconomic costs. Thus, prevention, early detection, and prompt treatment of exacerbations may impact their clinical progression by ameliorating the effects on quality of life and minimizing the risk of hospitalization ***(GOLD, 2018).***

Phosphorus is an essential element in all living cells, it is extremely important in the process of production of adenosine triphosphate, main element in the structure of nucleic acids, low levels of phosphorus in blood is rare, however it may be caused by unbalance between components participating in phosphorus cycle and affect performances of several systems. A low level of phosphorus in blood increases the exacerbation and severity of chronic obstructive pulmonary disease (COPD) and requires prolonged ventilation process ***(Farah et al., 2013)***.

Early detection and correction of hypophosphatemia can significantly improve performance of respiratory muscles in patients with low phosphorus levels, it also improves the ability to cough and prevents the accumulation of secretions in respiratory tract which might otherwise increase the risk of infections in ventilated patients ***(El Sammak et al., 2012).***