The Role of Mean Platelet Volume as a Predictor of Mortality in Mechanically Ventilated Patients

Thesis

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Sarah Abdel Fattah

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List of Abbreviations

Abb.	Full term

AA ..... *Arachidonic acid*

ADP ..... *Adenosine diphosphate*

APACHE II ..... *Acute Physiology and Chronic Health Evaluation II*

ASV ..... *Adaptive support ventilation*

ATC ..... *Automatic tube compensation*

ATP ..... *Adenosine 5'-triphosphate*

CPAP ..... *Continuous positive airway pressure*

EDTA ..... *Ethylenediaminetetraacetic acid*

EMPs ..... *Endothelial cell-derived microparticles*

FiO_2 ..... *Fraction of inspired oxygen*

FITC ..... *Fluorescein isothiocyanate*

GP ..... *Glycoprotein*

I: E ..... *Inspiratory to expiratory*

ICUs ..... *Intensive care units*

ITP ..... *Immune thrombocytopenic purpura*

MAPK ..... *Mitogen-activated protein kinase*

MGDF ..... *Megakaryocyte growth and development factor*

MPC ..... *Mean platelet component*

MPV ..... *Mean Platelet Volume*

NO ..... *Nitric oxide*

OCS ..... *Open canalicular system*

PAV ..... *Proportional assist ventilation*

List of Abbreviations *(Cont...)*

Abb.	Full term
PCT	*Plateletcrit*
PCV	*Pressure-controlled ventilation*
PDW	*Platelet distribution width*
PE	*Phycoerythrin*
PEEP	*Positive end-expiratory pressure*
PKC	*Protein kinase C*
PLT	*Platelet*
PSV	*Pressure Support Ventilation*
RA	*Rheumatoid arthritis*
RDS	*Respiratory distress syndrome*
SIMV	*Synchronized intermittent mandatory ventilation*
SLE	*Systemic lupus erythematosus*
TF	*Tissue factor*
THPO	*Thrombopoietin*
TXA_2	*Thromboxane A2*
VC	*Volume-cycled*
vWf	*von Willebrand factor*

INTRODUCTION

Mechanical ventilation is frequently used for life support in intensive care units (ICUs). When initial attempts of spontaneous breathing fail to achieve the goal of liberation from mechanical ventilation, clinicians must choose appropriate mode(s) of ventilatory support. Different ventilatory modes may be used during weaning from mechanical ventilation. The most common ones are: pressure support ventilation (PSV), synchronized intermittent mandatory ventilation (SIMV), continuous positive airway pressure (CPAP) and spontaneous breathing witha T-tube. But, there are other modes which have a role in weaning process such as automatic tube compensation (ATC), proportional assist ventilation (PAV), servocontrolled ventilation and adaptive support ventilation (ASV) ***(Krmpotic and Lobos, 2013).***

Mean Platelet Volume (MPV) is a reflection of both proinflammatory and prothrombotic conditions, where thrombopoietin and numerous inflammatory cytokines regulate thrombopoiesis. MPV is higher when there is destruction of platelets. This may be seen as in inflammatory bowel disease, and in immune thrombocytopenic purpura (ITP), and in myeloproliferative diseases and Bernard-Soulier syndrome. It may also be related to pre-eclampsia, and recovery from transient hypoplasia ***(Liu et al., 2012).***

Ye et al. (2018) investigated platelet volume indices and in-hospital mortality in children on mechanical ventilation. They revealed that risk factors for mortality in critically ill children may differ at different ages. Increased lactic acid levels appear to be the main risk factor for mortality in all critically ill children, and platelet count was found to be associated with mortality in patients aged>3 years only.

AIM OF THE WORK

To compare whether there is an association between MPV and mortality in mechanically ventilated patients as regard:

- What is the mechanical ventilation?
- What is the mean platelet volume (MPV)?
- Association between them.

Chapter 1

PHYSIOLOGY OF PLATELETS

Platelets were discovered by Giulio Bizzozero in 1882, but for many decades the dynamic and multifunctional nature of platelets remained a field of interest only for biologists. Anucleate, discoid platelets are the smallest blood particles which unveil their dynamicity through their morphology ***(Ribatti and Crivellato, 2007).***

Primarily they are associated with hemostasis, which is to initiate blood coagulation. Although very dynamic, they usually prefer to remain in inactive state and get activated only when a blood vessel is damaged. But hemostasis or blood coagulation is not the sole function of platelets; rather it is employed in several multifunctional attributes monitoring the homeostasis of the body. Its high sensitivity to different disease states eventually assigned it to be one of the most accessible markers. While keeping interactions with leukocytes and endothelial cells, it restores its behaviour as an important inflammatory marker ***(Cerletti et al., 2012).***

Platelet reactivity for different disease pathogenesis is widely dependent upon some biologically active markers like CD36, CD41, CD42a, CD42b, and CD61. These include some active surface receptors and platelet secretory products. Platelet

tends to alter the expression and signaling of these markers in different disease diagnosis and prognosis, providing a huge field to explore disease progression.

Primarily, platelet activity is associated with the initiation of coagulation cascades. Damage in blood vessel makes the subendothelial surface the primary target site of platelet action, where it establishes the hemostasis. Various proaggregatory stimuli also known as platelet agonists promote the action of platelet adhesion to the subendothelial surfaces. During this process, platelet changes its shape, releases its granule contents, and gradually forms aggregates by adhering with each other. Thus its primary activity remains associated with minimizing blood loss. However, as discussed earlier platelets are not only confined in regulating hemostasis and thrombosis, but they also play many pivotal roles in disease pathophysiology ***(Vinik et al., 2001).***

Platelet interaction and cardiovascular disease progression remain an unsolved riddle for many years. Platelet hyperaggregation among the diabetic patients with CVD remains another striking area to explore. Platelet hyperactivity in various diseases provokes adverse effects in some cases, especially in coronary artery disease where hyperaggregation obstructs blood circulation. Expression of platelet markers can be well studied by ELISA or Western blot. However, till date flow cytometry is the best standardized method to study platelet function ***(Sharma and Berger, 2011).***