

## Role of blood biochemical components on cardiac parameters for shock patients.

Rabindra Nath Das<sup>1,2\*</sup>, Youngjo Lee<sup>2\*</sup>

<sup>1</sup>Department of Statistics, The University of Burdwan, Burdwan, West Bengal, India

<sup>2</sup>Department of Statistics, College of Natural Science, Seoul National University, Seoul, 151-747, Korea

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### Editorial

Generally, many blood components such as red blood cells (RBC), white blood cells (WBC), blood plasma volume (BPV), hemoglobin (HG), hematocrit (HCT), cholesterol, platelets, etc. may have an active role in atherosclerosis [1-3]. In clinical practice, complete blood count (CBC) is easily available but its practical utility as a potential risk factor for cardiac disease is uncertain [4,5]. A simple measure of RBC size heterogeneity is red blood cell distribution width (RDW), and the increased RDW value is correlated with atrial fibrillation (AF), peripheral artery disease (PAD), acute myocardial infarction (AMI), hypertension, stroke and heart failure (HF) [1,3,5,6]. Decreased hemoglobin level (HGL) is frequently associated with chronic heart failure (CHF), as HGL may affect the cardiovascular system (CVS) through blood viscosity and oxygen supply [3,6]. A low BPV is associated with shock, dehydration, and Addison's disease, while a high BPV is associated with liver and spleen disease, vitamin C deficiency [7,8].

Most of the earlier studies have examined the association of only one blood component with some cardiac disease. It is little known the association of many blood components together on any cardiac parameter such as blood pressure (BP) (systolic BP [SBP], basal BP [BBP], diastolic BP [DBP], maximum BP [MBP], mean arterial pressure [MAP], mean central venous pressure [MCVP]), heart rate (HR) (basal HR [BHR], peak HR [PHR], maximum HR [MHR]), ejection fraction (EF), cardiac index (CI) etc. It is stated above that low HGL, low RDW, low and high BPV have many effects on CVS and many diseases. Necessarily, the following queries arise.

- Is any blood component (HGL, BPV, HCT, RBC Index [RBCI]) associated with any or more cardiac parameters (SBP, DBP, HR, CI, MAP, MCVP) for shock patients?
- What is the association of any blood component with one or more cardiac parameters?
- What are the effects of the blood component on the cardiac parameters?
- How do we establish the association of the blood component with one or more cardiac parameters?

Answer of these queries is little examined in the previous articles (best of our knowledge). These answers are reported very shortly (detailed report will be appeared soon) in the current note with the help of real a data set of 113 shock patients with 20 study variables [9], and the data site is <http://www.umass.edu/statdata/statdata/data/shock.txt> The study characters of the data set are:

- Height (HEIGHT),
- Age (AGE),
- Sex (SEX) (male=0, female=1),
- Shock type (SHOCKT) (non-shock=1, hypovolemic=2, cardiogenic, or bacterial, or neurogenic or other=3),
- Survival stage (SURVIV) (survived=0, death=1),
- HR,
- SBP,
- DBP,
- MAP,
- Mean circulation time (MCT),
- Body surface index (BSI),
- MCVP,
- Appearance time (AT),
- CI,
- Urinary output (UO),
- HG,
- Blood plasma volume index (BPVI),
- HCT,
- RBCI,
- Card sequence record (initial=1, final =2) (CSO).

There are six cardiac parameters such as DBP, MAP, SBP, MCVP, HR, CI and four blood components such as RBCI, BPVI, HCT, HG in the above data set. An appropriate model of each cardiac parameter with the rest variables may give the association of the respective cardiac parameter with the remaining others. Similarly, a good blood component model can present its association with the remaining others. All these above 10 interested positive continuous variables are heteroscedastic, and non-normally distributed, and they are modeled by joint generalized Log-normal and gamma models [10,11]. The models of the above six cardiac parameters (completely or partially) are given in [12-16]. Models of the above four blood components are appeared soon. Cardiac parameter (DBP, MAP, SBP, MCVP, HR, CI) analyses [12-16] (only from the mean models) interpret the following associations of a cardiac parameter with all the blood components.

- DBP is inversely correlated (associated) with BPVI ( $P=0.0696$ ), indicating that DBP increases as BPVI decreases.

- DBP is directly correlated with HG (P=0.0773), concluding that DBP increases as HG rises.
- MAP is inversely correlated with HCT (P=0.0988), interpreting that MAP increases as HCT decreases.
- SBP is inversely correlated with HG (P=0.0051), interpreting that SBP increases as HG decreases.
- MCVP is directly correlated with BPVI (P=0.0333), indicating that MCVP increases as BPVI rises.
- MCVP is directly insignificantly correlated with RBCI (P=0.3136), indicating that MCVP increases as RBCI rises.
- HR is directly insignificantly correlated with HCT (P=0.1002), indicating that HR increases as HCT rises.
- CI is directly correlated with BPVI (P<0.0001), concluding that CI increases as BPVI rises.
- CI is inversely correlated with HG (P=0.0053), interpreting that CI increases as HG decreases.

Blood component (HG, HCT, BPVI, RBCI) analyses (only from the mean models) interpret the following association of a blood component with all the cardiac parameters.

- HG is directly correlated with MCVP (P<0.0001), concluding that MCVP increases as HG rises.
- HCT is inversely correlated with SHOCKT 2 (P=0.0014), interpreting that shock status is higher at level 1, than at level 2, if HCT increases.
- HCT is inversely correlated with SHOCKT 3 (P=0.0281), interpreting that shock status is higher at levels 1 & 2, than at level 3, if HCT increases.
- BPVI is inversely correlated with DBP (P<0.0001), interpreting that DBP increases as BPVI decreases.
- BPVI is directly correlated with MCVP (P<0.0001), interpreting that MCVP increases as BPVI increases.
- BPVI is directly correlated with CI (P<0.0001), concluding that CI increases as BPVI rises.
- BPVI is inversely correlated with SHOCKT 2 (P=0.0103), indicating that shock status is higher at level 1, than at level 2, if BPVI increases.
- RBCI is inversely correlated with SHOCKT 2 (P=0.0522), concluding that shock status is higher at level 1, than at level 2, if RBCI increases.

All the above interpretations are displayed in Table 1 as a summarized form. The report presents some blood component associations (arising only from mean models) with the cardiac parameters, but there are many more (arising from variance modes), which will be appeared very soon, along with detailed derivations. It is observed that all the blood components have some active role on cardiac parameters. Based on the above knowledge of association, medical practitioners may be able to predict the cardiac parameters, depending on the clinical reports of HG, BPVI, HCT and RBCI.

**Table 1:** Associations of blood components with cardiac parameters.

Variable	Associated with	Association type	P-value
DBP	BPVI	negative	0.0694
DBP	HG	positive	0.0773
MAP	HCT	negative	0.0988
SBP	HG	negative	0.0051
MCVP	BPVI	positive	0.0333
MCVP	RBCI	positive	0.3136
HR	HCT	positive	0.1002
CI	BPVI	positive	<0.0001
CI	HG	negative	0.0053
HG	MCVP	positive	<0.0001
HCT	SHOCKT-2	negative	0.0014
HCT	SHOCKT-3	negative	0.0281
BPVI	DVP	negative	<0.0001
BPVI	MCVP	positive	<0.0001
BPVI	CI	positive	<0.0001
BPVI	SHOCKT-2	negative	0.0103
RBCI	SHOCKT-2	negative	0.0522

### Conflict of Interest

The authors confirm that this article content has no conflict of interest.

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**\*Correspondence to:**

Rabindra Nath Das  
Department of Statistics  
The University of Burdwan  
Burdwan  
West Bengal  
India  
E-mail: rabin.bwn@gmail.com