

The information provided above would be helpful to estimate the clinical value of MPV in resuscitated patients.

Disclosure of Conflict of Interests

The author states that he has no conflict of interest.

References

- 1 Chung SP, Yune HY, Park YS, You JS, Hong JH, Kong T, Park JW, Chung HS, Park I. Usefulness of mean platelet volume as marker for clinical outcomes after out-of-hospital cardiac arrest: a retrospective cohort study. *J Thromb Haemost* 2016; **14**: 2036–44.
- 2 Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, Mohler ER, Reilly MP, Berger JS. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. *J Thromb Haemost* 2010; **8**: 148–56.
- 3 Lancé MD, Sloep M, Henskens YM, Marcus MA. Mean platelet volume as a diagnostic marker for cardiovascular disease: drawbacks of preanalytical conditions and measuring techniques. *Clin Appl Thromb Hemost* 2012; **18**: 561–8.
- 4 Leader A, Pereg D, Lishner M. Are platelet volume indices of clinical use? A multidisciplinary review. *Ann Med* 2012; **44**: 805–16.
- 5 Yarlioglu M, Ardic I, Dogdu O, Akpek M, Zencir C, Kasapara HA, Kelesoglu S, Elcik D, Ozdogru I, Oguzhan A, Kaya MG. The acute effects of passive smoking on mean platelet volume in healthy volunteers. *Angiology* 2012; **63**: 353–7.
- 6 Mazza F, Stefanutti C, Di Giacomo S, Vivenzio A, Fraone N, Mazzarella B, Bucci A. Effects of low-dose atorvastatin and rosuvastatin on plasma lipid profiles: a long-term, randomized, open-label study in patients with primary hypercholesterolemia. *Am J Cardiovasc Drugs* 2008; **8**: 265–70.
- 7 Arik OZ, Ozkan B, Kutlu R, Karal H, Sahin DY, Kaypakli O, Ozel D, Cayli M. Relationship between platelet indices and international normalized ratio in patients with non-valvular atrial fibrillation. *Platelets* 2014; **25**: 311–6.
- 8 Dastjerdi MS, Emami T, Najafian A, Amini M. Mean platelet volume measurement, EDTA or citrate? *Hematology* 2006; **11**: 317–9.

Usefulness of mean platelet volume as a marker for clinical outcomes after out-of-hospital cardiac arrest: reply

S. P. CHUNG and J. S. YOU

Department of Emergency Medicine, Yonsei University College of Medicine, Seoul, Korea

To cite this article: Chung SP, You JS. Usefulness of mean platelet volume as a marker for clinical outcomes after out-of-hospital cardiac arrest: reply. *J Thromb Haemost* 2017; **15**: 198–9.

See also Chung SP, Yune HY, Park YS, You JS, Hong JH, Kong T, Park JW, Chung HS, Park I. Usefulness of mean platelet volume as a marker for clinical outcomes after out-of-hospital cardiac arrest: a retrospective cohort study. *J Thromb Haemost* 2016; **14**: 2036–44 and Zeng D-X. Usefulness of mean platelet volume as a marker for clinical outcomes after out-of-hospital cardiac arrest: comment. This issue, pp 197–8.

We are pleased that Zeng *et al.* have taken an interest in our paper. As Zeng *et al.* pointed out, mean platelet volume (MPV) is a crucial parameter that reflects platelet size and activation [1]. Recently, MPV has also been highlighted as a critical inflammatory marker in infectious, cardiovascular and immunologic diseases [2–5]. We also recognize that changes in MPV may be influenced by disease conditions, current medications, and environments. Although we retrospectively analyzed the Cardiac

Arrest Registry in our emergency department, which prospectively collects critical data of patients with out-of-hospital cardiac arrest (OHCA), our registry was simply composed of traditional Utstein-style data, and frequently used information in the OHCA study because the registry is not intended to provide evidence for the usefulness of MPV as a marker of clinical outcomes after OHCA [1]. As Zeng *et al.* pointed out, thyroid functional and laboratory tests for autoimmune diseases were not routinely performed. Although data pertaining to hepatic failure, hypercholesterolemia, obesity, smoking and the use of medications such as statins and anticoagulant drugs were available via medical records and laboratory test results, we did not focus on these areas, because our study was conducted on the basis of data from a predefined registry, and essentially many variables concerning prehospital factors and resuscitation were considered in the study of patients with OHCA. It is practically and statistically difficult to consider all of the confounders identified by

Correspondence: Je Sung You, Department of Emergency Medicine, Yonsei University College of Medicine, 211 Eonju-Ro, Gangnam-Gu, Seoul 135-720, Korea.

Tel.: +82 2 2019 3030; fax: +82 2 2019 4820

E-mail: youjsmd@yuhs.ac

DOI: 10.1111/jth.13550

the authors for clinical studies. However, in our study, we made efforts to include the variables as much as possible. Zeng *et al.* pointed out that the proportion of patients with cardiovascular diseases might be high at 27.2% [6]. In our study, no statistically significant differences in MPVs were found in the patients with cardiovascular diseases. Considering the occurrence of acute and severe inflammation after OHCA, we think that the previous changes in MPV caused by these confounders would have trivial effects on the prognosis of patients with OHCA. In fact, we agree with their opinions, and future studies are needed to evaluate the usefulness of MPV as a prognostic marker for patients with OHCA after adjustment for confounders that can affect MPV. For study of the effects of MPV, they recommended acid citrate-based anticoagulation as a better choice for blood sample collection, because of the time-dependent swelling of platelets in a tube with EDTA. It may be very important to evaluate the clinical implications of MPV in several conditions. Diaz-Ricart *et al.* also demonstrated that MPV tends to progressively increase with the time of storage in EDTA [7]. However, the increase in MPV reached statistically significant levels in blood samples exposed for ≥ 6 h to EDTA. The study revealed that marked increases in MPV were observed at 24 h [7]. In the emergency departments of our institutions, complete blood counts are reported within 60 min after blood sample collection. The laboratory test results of patients who have received resuscitation are preferentially analyzed as soon as possible in the critical pathway for therapeutic hypothermia in patients with OHCA. Therefore, in our study, EDTA exposure time may not have significantly affected MPV. In addition, Diaz-Ricart *et al.* suggested that an EDTA-based solution containing wortmanin and tyrphostin as inhibitors of protein phosphorylation provided good stability for most of the platelet parameters at room temperature [7]. Storage at lower temperatures of 4 °C also provided favorable results for the platelet parameters [7]. To date, no definite prognostic factors have been identified for clinical application after OHCA. Whether MPV could contribute to the estimation of disease severity and mortality in resuscitated patients during this early phase of post-cardiac arrest syndrome remains unknown. Our study suggested that an elevated MPV

was independently associated with increased 30-day mortality, with the highest discriminative value being obtained upon admission after OHCA, and that an increased MPV on admission was associated with poor neurologic outcomes [1]. We also do not claim that MPV has clinical value as a definite prognostic marker for resuscitated patients. However, the clinical value of MPV in reflecting aggravation of systemic inflammation after whole-body ischemia and reperfusion injury can help in the estimation of disease severity among resuscitated patients [1]. We thank Zeng *et al.* for their important comments on MPV.

Disclosure of Conflict of Interests

The authors state that they have no conflict of interest.

References

- 1 Chung SP, Yune HY, Park YS, You JS, Hong JH, Kong T, Park JW, Chung HS, Park I. Usefulness of mean platelet volume as a marker for clinical outcomes after out-of-hospital cardiac arrest: a retrospective cohort study. *J Thromb Haemost* 2016; **14**: 2036–44.
- 2 Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, Mohler ER, Reilly MP, Berger JS. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. *J Thromb Haemost* 2010; **8**: 148–56.
- 3 Lance MD, Sloep M, Henskens YM, Marcus MA. Mean platelet volume as a diagnostic marker for cardiovascular disease: drawbacks of preanalytical conditions and measuring techniques. *Clin Appl Thromb Hemost* 2012; **18**: 561–8.
- 4 Leader A, Pereg D, Lishner M. Are platelet volume indices of clinical use? A multidisciplinary review. *Ann Med* 2012; **44**: 805–16.
- 5 Yarlioglu M, Ardic I, Dogdu O, Akpek M, Zencir C, Kasapkar HA, Kelesoglu S, Elcik D, Ozdogru I, Oguzhan A, Kaya MG. The acute effects of passive smoking on mean platelet volume in healthy volunteers. *Angiology* 2012; **63**: 353–7.
- 6 Dastjerdi MS, Emami T, Najafian A, Amini M. Mean platelet volume measurement, EDTA or citrate? *Hematology* 2006; **11**: 317–19.
- 7 Diaz-Ricart M, Brunso L, Pino M, Navalon F, Jou JM, Heras M, White JG, Escolar G. Preanalytical treatment of EDTA-anticoagulated blood to ensure stabilization of the mean platelet volume and component measured with the ADVIA counters. *Thromb Res* 2010; **126**: e30–5.