

Hypokalemia at the Time of Admission to the Intensive Care Unit (ICU) Increases the Need for Mechanical Ventilation and Time of Ventilation in Critically Ill Trauma Patients

Sir,

For critically ill trauma patients who suffer from respiratory failure, mechanical ventilation (MV) is an essential and universal form of treatment.^[1] Hypokalemia normally occurs immediately after trauma, and it appears that hypokalemia occurs more frequently in the more severely injured.^[2,3] Hypokalemia, a frequent electrolyte imbalance encountered in the Intensive Care Unit (ICU), is an important cause of morbidity and mortality in critically ill patients.^[4,5] In our research, we found that no investigation has been done on the relationship of hypokalemia with the need for connecting critically ill trauma patients to an MV, duration of MV or the length of stay in the ICU. The aim of this study is to define the prevalence of hypokalemia on admission in critically ill trauma patients and to evaluate the relationship of the potassium level with organ failure, ventilator need, and duration of MV.

After obtaining approval from the Ethics Committee of our University, this single-center prospective observational analytic study was performed on 200 trauma patients, >16 years old, who were admitted, without electrolyte disorder (except hypokalemia), burn injuries, cardiac surgery or for exclusion of myocardial infarction, and patients with no schedule for organ donation, to the adult medical–surgical ICU at the Kashani Hospital in Esfahan, Iran, from April 2011 through April 2012. If a patient died during the first 24 hours of ICU admission, he or she was excluded from the study. The survey was conducted after measuring the serum K level at admission to the ICU and at the time of connecting to the MV. Duration of MV, length of stay in the ICU, and general patient demographics were also recorded. In this research, hypokalemia is defined as a potassium level less than 3.5 mEq/L. The Sequential Organ Failure Assessment (SOFA) score was determined on the day of admission and at the time of connecting to the MV, and also at the time of weaning from it.^[6]

One hundred and thirty-one of the 200 patients had a blood potassium of less than 3.5 µg/ml at the beginning of admission. Ninety-two patients did not need MV at the beginning of admission, as their average potassium was 3.63 mEq/L. The potassium level of 108 patients, who needed MV at the beginning was 3.22 µg/ml ($P < 0.005$). The time of MV requirement in hypokalemic patients was 7.97 ± 12.5 days and in patients with $K > 3.5$ was 0.67 ± 2.8 days. The average length of stay in the ICU

for hypokalemic patients was 13.75 ± 15.34 days and in other patients it was 5.8 ± 5.86 days ($P < 0.005$). The area under the receiver operating characteristic (ROC) curve for potassium, in relation to connecting the patient to the MV, was 0.95%. The best cut-off point that could predict the need for MV was a potassium level of 3.4 µg/ml.

Hypokalemic patients had longer lengths of stay in the ICU, almost twice that of patients with $K > 3.5$ mEq/L ($P < 0.005$). Also, the investigation by Beal^[2] and Morell,^[7] showed that hypokalemia caused longer ICU stays. In another study, in 40% of the patients, hypokalemia was found for the first time on days one to four of their ICU stay.^[4] In our research, mortality (14 vs. 4.3%) and discharge with complication (11.1 vs. 5%) was more in hypokalemic patients ($P < 0.005$). Smith *et al.* found in their study that hypokalemic patients had more mortality.^[8] Hypokalemia could cause an increased need for MV, increased duration of MV, increased length of stay in the ICU, as well as mortality and morbidity in critically ill trauma patients.^[9]

According to the prevalence of hypokalemia in critically ill trauma patients, there is an increasing need for MV, duration of MV, ICU length of stay, and finally; a high complication of hypokalemia. Therefore, the potassium is checked frequently, and if it is possible, prevention of hypokalemia is done via intravenous infusion of potassium.

Acknowledgments

The authors wish to sincerely thank all their colleagues in the Kashani Hospital Medical Center affiliated to the Isfahan University of Medical Sciences, in Isfahan, Iran, for their support. Furthermore, the authors' special thanks go out to the patients, who wholeheartedly and actively assisted them in carrying out this research. No conflicts of interest exist. This study was approved by the Ethics Committee of their University, (Anesthesiology and Critical Care Research Center, Isfahan University of Medical Sciences, Isfahan, Iran) and all the patients had given a written, informed consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

**Mohammadreza Safavi, Azim Honarmand,
Mozhgan Karbalayi Mehrizi,
Mansour Siavash Dastjerdi,
Mohammad Emami Ardestani**

*From the Department of Anesthesia, Anesthesiology and Critical Care
Research Center, Isfahan University of Medical Sciences,
Isfahan, Iran*

Address for correspondence:

*Prof. Azim Honarmand,
Department of Anesthesia, Anesthesiology and Critical Care Research
Center, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: honarmand@med.mui.ac.ir*

References

1. Boles JM, Bion J, Connors A, Herridge M, Marsh B, Melot C, *et al.* Weaning from mechanical ventilation. *Eur Respir J* 2007;29:1033-56.
2. Beal AL, Scheltema KE, Beilman GJ, Deuser WE. Hypokalemia following trauma. *Shock* 2002;18:107-10.
3. Pardo M, Sonner JM. *Manual of Anesthesia Practice*. New York: Cambridge University Press; 2007. p. 134, 150, 212.
4. Gerçek A, Umuroğlu T, İnci F, Gögüs FY. The etiology and incidence of hypokalemia in Intensive Care Unit. *MMJ* 2003;16:32-5.
5. Upadya A, Tilluckdharry L, Muralidharan V, Amoateng-Adjepong Y, Manthous CA. Fluid balance and weaning outcomes. *Intensive Care Med* 2005;31:1643-7.
6. Smith JS Jr. Hypokalemia in resuscitation from multiple trauma. *Surg Gynecol Obstet* 1978;147:18-20.
7. Davies RG, Gemmell L. Severe hypokalaemia causing acute respiratory failure. *Anaesthesia* 2001;56:694-5.
8. Morell V, Lundgren E, Gillott A. Predicting severity of trauma by admission white blood cell count, serum potassium level, and arterial pH. *South Med J* 1993;86:658-9.
9. Honarmand A, Safavi M, Moradi D. The use of infection probability score and sequential organ failure assessment scoring systems in predicting mechanical ventilation requirement and duration. *Ulus Travma Acil Cerrahi Derg* 2009;15:440-7.

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

Access this article online	
Quick Response Code:	Website: www.advbiores.net
	DOI: 10.4103/2277-9175.205189

How to cite this article: Safavi M, Honarmand A, Mehrizi MK, Dastjerdi MS, Ardestani ME. Hypokalemia at the Time of Admission to the Intensive Care Unit (ICU) Increases the Need for Mechanical Ventilation and Time of Ventilation in Critically Ill Trauma Patients. *Adv Biomed Res* 2017;6:50.

Received: May, 2013. **Accepted:** May, 2014.

©2017 Advanced Biomedical Research | Published by Wolters Kluwer - Medknow