routes of intraosseous epinephrine administration on short-term resuscitative outcome measures in an adult swine model of ventricular fibrillation: a randomized controlled study" [1]. In that well-designed animal study, the authors tried to explore the relationships between the anatomical distance of intraosseous (IO) epinephrine injection and measures of resuscitative outcome in an adult swine model of ventricular fibrillation. They found that the anatomical distance of IO epinephrine injection from the heart did not affect short-term measures of resuscitative outcome in an adult swine model of ventricular fibrillation including the occurrence of Return of spontaneous circulation (ROSC), 30-minute post-ROSC survival, and time to ROSC. They concluded that rapidly administered epinephrine, irrespective of route of administration, increased the chance that ROSC and survival to 30 minutes post-ROSC would occur in this study.

The essential step of cardiopulmonary resuscitation (CPR) is known to be establishment of access to the circulation [2]. It is known that the preferred venous access site during CPR is the largest and most accessible vein not preventing the interruption of resuscitation [2]. Intraosseous infusion is a plausible procedure because of the presence of veins draining the medullary sinuses in the bone marrow of long bones when venous access cannot be attained because of circulatory shock [3]. Those veins, which are supported well by the bony matrix, do not collapse in patients with shock or hypovolemia. From that point of view, the American Heart Association and the International Committee on Resuscitation have endorsed IO access as a safe and effective means of vascular access in critically ill patients [4].

Reades and coworkers [5] demonstrated that tibial IO placement was associated with a significantly higher frequency of initial vascular access success than peripheral IV placement (91% vs 43%, respectively) in a clinical trial of 182 adults receiving vascular access for cardiac arrest in the prehospital setting. On the other hand, Leidel and coworkers [6] showed that vascular access was successfully achieved on the first attempt in 80% to 90% of patients and within 2 minutes in a trial of IO needle placement using a battery-powered driver or spring-loaded device in 40 adults receiving prehospital care. Lastly, in a prospective observational well-designed study, the same authors compared IO cannulation using a battery-operated driver device with internal jugular or subclavian central venous access in 10 adult patients, all of whom received both procedures [7]. They found that IO access was achieved on the first attempt more frequently (90% vs 60%) and was a less time-consuming procedure (2 vs 10 minutes) than central venous access.

It was reported that any critical intravenous drug including sodium bicarbonate, lidocaine, atropine, epinephrine, dopamine, dobutamine, adenosine, digitalis, heparin, neuromuscular blocking agents, antibiotics, or routine resuscitation fluids such as crystalloids, colloids, and blood products might be administered safely by the IO route [2]. Practically, drug and fluid dosing is reported to be the same as for intravenous administration [8]. More importantly, it was demonstrated that the onsets of action and serum drug concentrations after IO infusion during CPR are comparable to those achieved after intravenous administration [9,10]. Moreover, animal studies suggest that the IO route can be as effective as the central intravenous route [9,11,12] and may be superior to the peripheral intravenous route during cardiac arrest [9].

In conclusion, it seems to be plausible to think that the patients with cardiopulmonary arrest or severe shock not having readily available intravenous access should undergo IO cannulation for life-saving medication administration and fluid therapy rather than percutaneous central venous line placement or surgical venous cutdown. We strongly believe that the current study reaffirms the critical role of the IO route in the management of patients with emergent conditions (especially circulatory shock) where reliable and quick venous access cannot be achieved.

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Are paramedics able to confirm endotracheal tube placement using ultrasonography?

To the Editor,

Endotracheal intubation is one of the key skills that should be possessed by every physician in Emergency Medicine as well as every paramedic [1]. For confirming endotracheal tube (ET) placement, there are multiple options, including direct visualization of the vocal cords, observation of chest auscultation, or chest

expansion [2]. However, each of those methods has unique limitations, particularly during CPR, because observation of chest movements requires interruption in chest compression. According to the American Heart Associate 2015 guidelines for CPR, capnography is recommended as the criterion standard for confirming correct ET placement; however, this method has also limitations, especially in patients in cardiac arrest. Capnography results can be affected by low cardiac output, low pulmonary flow, epinephrine use, or airway obstruction [3]. Focused ultrasonography (USG) has a wide range of uses in Emergency Medicine. It is a noninvasive, real-time diagnostic tool which can be used during CPR without interruptions in chest compressions. Many studies provide promising results for ET confirmation using USG [4,5].

The aim of this study was to evaluate the ability to use USG to confirm ET placement performed by paramedics. The study was approved by the Institutional Review Board of the International Institute of Rescue Research and Education (approval: 11.2016.01.32). Thirty-two paramedics participated in this trial. All participants were routinely involved in management and initial treatment of patients with cardiac arrest in emergency medical service teams. None of the study participants had experience in performing USG.

The preliminary test contained 2 USG pictures: whereas, on the first, intubation was performed correctly, on the second, the ET was inserted into the esophagus. After the test, all participants completed a 30-minute training session led by an anesthesiologist with extensive experience in focused USG, including an introduction to the USG and confirmation of ET placement using USG. Then, participants practiced performing USG of the anterior neck on themselves. Practice section was held until the participants felt comfortable during the test. At the end of the training, participants solved a test using a computer. Participants were given 10 USG photos (5 of properly introduced ET and 5 of the tube inserted into the esophagus). The sequence of images displayed was random. Participants were asked to assess whether, on a given image, intubation was performed correctly. At the end of the study, participants were asked to determine whether the use of USG for confirming correct ET placement in prehospital care as a routine examination is desirable.

During the preliminary test, only 21.9% of the participants can indicate which image is ET in the correct place. In this study (after the training), the effectiveness of the interpretation of USG images was 93.8%. The difference in correct interpretation of the images before and after the training was statistically significant ($P < .001$). The results of our study confirmed that the education has a positive effect on paramedics' knowledge of USG images interpretation for ET placement confirmation. Moreover, 96.9% of participants acknowledged that the use of USG to confirm ET placement should be a routine procedure in emergency medical service conditions.

In conclusion, paramedics after a short training session are able to use focused USG for proper ET placement confirmation.

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Biomarkers in sepsis

To the Editor,

We have greatly enjoyed reading the recently published article by Yao et al [1] entitled "Higher serum level of myoglobin could predict more severity and poor outcome for patients with sepsis." We thank them for sharing their experience; however, we have some concerns about the article. Patients with severe sepsis or septic shock have a high mortality [2]. The pathophysiology of sepsis may link to multiple mechanisms and is commonly associated with myocardial dysfunction [3]. Therefore, a prognostic evaluation is of importance for the outcome of patients with severe sepsis or septic shock. The National Institutes of Health defines a biomarker as a characteristic that should objectively measure and evaluate normal biological processes or pharmacological response to a therapeutic intervention [4]. A sepsis biomarker should be able to identify either the onset of systemic inflammatory response syndrome or compensatory anti-inflammatory response syndrome before the onset of multiple-organ dysfunction syndrome and aid in the lowering of mortality rates. However, Yao et al did not examine the predictive role of myoglobin on the onset of systemic inflammatory response syndrome or compensatory anti-inflammatory response syndrome. Our second concern is about other biomarkers. Although Yao et al showed that the elevated myoglobin levels were correlated with the severity and the prognosis of the disease, they did not provide the data about other biomarkers. Recent studies have shown that the alteration of natriuretic peptide and troponin levels strongly predicated the prognosis in patients with sepsis or septic shock [5]. The value of troponin and natriuretic peptide levels on admission and their relationship with myoglobin levels and sepsis prognosis would be valuable.