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Lighting the way forward: using resonance Raman spectroscopy to non-invasively assess tissue perfusion

Chavi Rehani, Rosemary Kozar

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Poor tissue perfusion is an important driver of shock in patients after surgery, trauma, and sepsis.[1] Assessment of tissue oxygenation and volume status in these patients involves assimilating multiple endpoints of resuscitation.[2] This commonly includes measuring surrogate markers such as serum lactate and central venous oxygenation (ScVO2) through blood sampling. These data points are helpful in guiding treatment, but they can only offer intermittent insights when limited by the frequency of blood draws. In the case of ScVO2, they can also require invasive procedures such as central line placement which carries risks of infection, pneumothorax, and thrombosis.

To overcome these challenges, Garcia Mancebo *et al* fabricated a novel device that uses resonance Raman spectroscopy (RRS) to quantify oxyhemoglobin saturation (ShbO2) using a small probe placed on the surface of various tissues. Using two different rodent models of hemorrhagic shock, the authors demonstrated that RRS-measured ShbO2 in the esophagus and tongue strongly correlated with both ScVO2 and serum lactate. Depending on the site, ShbO2 also detected near-term death with 72-83% sensitivity.[3]

It is interesting to note that over three decades ago, Scalea *et al* proposed the use of central venous blood oxygen saturation to detect acute blood loss in animals and in trauma patients.[4 5] Although the idea of venous oxygenation monitoring may not be novel, the ability to non-invasively and continuously detect blood loss and hypoperfusion in real time may prove to be. The authors acknowledge limitations of their device, including the small size of the laser which only provides data over a small area of tissue. It can, therefore, be prone to sampling error and not reflect whole organ or systemic perfusion. Although this technology may prove useful in the battlefield or mass casualty setting to detect sequalae of massive hemorrhage and guide resuscitation, future studies should examine if RRS technology can detect subclinical hemorrhage which would have further application in both civilian and military trauma settings.

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ORCID iD
Rosemary Kozar http://orcid.org/0000-0002-9582-8622

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R Adams Cowley Shock Trauma Center, Baltimore, Maryland, USA

Correspondence to
Dr Rosemary Kozar; rkozar@som.umaryland.edu