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Another Solution to Monitoring the Electrocardiograph in Patients with Extensive Burn Injury

To the Editor:—Ravindran presented a method for monitoring the electrocardiograph (ECG) in patients with extensive burns in whom it is difficult to monitor the ECG because of the lack of natural skin and the application of protective ointments that prevent the adherence of the ECG pads.¹ We present another option.

A pacing esophageal stethoscope (Model 250 used in conjunction with the Model 3 preamplifier and the Model 7A pulse generator, Arzco Medical Systems, Inc., Tampa, FL*) permits the recording of atrial and ventricular electrograms in addition to transesophageal atrial pacing. The electrogram will usually provide sufficient information for rate and rhythm monitoring, but it is not useful for ischemia monitoring.

Potential advantages of this system compared to Ravindran's suggestion are that it is not invasive nor painful. In patients in whom there is a dysrhythmia, atrial electrograms can be superior to surface ECGs for diagnosing dysrhythmias.² Additionally, it provides a method for antibradycardia or antitachycardia atrial pacing should it become necessary.³ However, a limitation of the pacing esophageal stethoscope is that it needs to be placed after endotracheal intubation and removed before extubation; hence this ECG is not available during induction nor emergence. However, 4- and 10-French catheters that are compatible with the above-mentioned pulse generator and preamplifier and which can be inserted into and maintained in an awake patient are available (Arzco Medical Systems, Inc.); hence these elec-

trograms can be used pre-, intra-, and postoperatively. Another limitation of this suggestion is that it cannot be used in patients in whom esophageal instrumentation is contraindicated (*e.g.*, those with dysphagia, esophageal web or diverticulum, esophageal stenosis or stricture, radiation injury, or recent esophageal surgery).

I hope this information is helpful for the care of these patients.

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Transesophageal Pulse Oximetry for Monitoring Patients with Extensive Burn Injury

To the Editor:—Ravindran¹ presented a method for monitoring the surface electrocardiogram (ECG) in patients with extensive burns, in whom it is difficult to obtain a surface ECG signal because of the lack of natural skin and the application of protective ointments that prevent the adherence of ECG pads. His technique does, however, have some limitations in the clinical setting he describes: (1) inability to place electrodes optimally because of involvement in the surgical field, (2) potential loss of electrodes during the surgical procedure, and (3) lack of accessibility, which might limit the ability of the anesthesia care team to replace electrodes. We suggest another moni-

toring option, the transesophageal pulse oximeter (ESOX®) probe (ARISTO Medical, Waukesha, WI), which provides accessibility, is not affected by the surgical procedure, and provides pulse oximetry readings (an ASA-mandated standard for intraoperative monitoring), in addition to temperature and auscultation.

In a recent case report, we presented a patient in whom ESOX® was used successfully when peripheral oximetry was unobtainable because of peripheral vascular disease.² Atlee³ and Prielipp⁴ have suggested that core organ perfusion is maintained during periods of poor peripheral perfusion, and that ESOX® is, therefore, a potentially

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useful monitor in these patients. It is likely that ESOX® would be useful in burn patients such as the one described by Ravindran because core organ perfusion likely would be maintained.

Dorn *et al.*⁵ demonstrated the application of ESOX® in a critical care setting. They concluded that ESOX® seems to be more reliable than surface pulse oximetry in intensive care unit (ICU) patients, especially in situations of hemodynamic instability. Their findings support the potential usefulness of ESOX® in Ravindran's patient.

Atlee *et al.*^{3,6} introduced ESOX® and demonstrated a favorable comparison with lingual or rectal oximetry in dogs subjected to desaturation. Prielipp *et al.*⁴ compared ESOX® with peripheral surface oximetry in patients undergoing CABG. They found that the ESOX® signal was sometimes well preserved when peripheral sensors failed. Dhamee *et al.*⁷ compared ESOX® SpO₂ measurements with simultaneous SaO₂ measurements (co-oximetry) during clinical desaturation of a patient with alveolar proteinosis undergoing pulmonary lavage; they found comparable, favorable trending during transient desaturations to SaO₂ values as low as 70%.

In conclusion, we suggest ESOX® as a potentially useful monitor in intubated critically ill patients such as the one reported by Ravindran.¹

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In Reply:—Dr. Roth's recommendation that pacing esophageal stethoscope (Arzco Medical Systems, Inc.) may be used to monitor the ECG in patients with extensive burn injury is also a nice solution. It offers the additional advantage of the ability to pace the atrium should that need arise. However, I see two problems with it. (1) It is an expensive solution compared with what I have proposed. (2) It can be used in patients only after induction of anesthesia is accomplished as the probe has to be inserted into the esophagus. Because of this necessity, (as pointed out by the authors) baseline ECG monitoring of the patient before induction and during induction are not possible.

Dr. Borum's suggestion about the use of transesophageal pulse oximeter addresses the other issue of difficulty in monitoring oxygen

saturation in these extensively burned patients. However, it does not address the issue raised by me, which is, monitoring the ECG in these patients.

The difficulty in placement of esophageal probes in patients with extensive burns (who may have feeding tubes or nasogastric tubes) also has to be considered.

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