Cardiac output technologies with special reference to the horse

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Critical illness, anesthesia, primary cardiovascular disease, and exercise may result in marked hemodynamic alterations. Measuring cardiac output (CO) is central to defining these alterations for both clinician and researcher. In the past 10 years, several new methods of measuring CO have been developed for the human medical market. Some of these methods are now validated in the horse and are in clinical use. The Fick method has been used in equine research for more than a century. It depends on simultaneous measurement of mixed venous (pulmonary arterial) and peripheral arterial oxygen content and oxygen uptake by the lungs. The technique is technically demanding, which restricts its clinical use. Indicator dilution techniques, with indocyanine green, cold (thermodilution), or lithium as the marker, have also been widely used in the horse. The indocyanine technique is cumbersome, and thermodilution requires right heart catheterization, which is not a benign procedure, making both of these methods less than ideal for clinical use. Lithium dilution requires catheterization of a peripheral artery and a jugular vein. It has recently been validated in anesthetized adult horses and neonatal foals. Doppler echocardiography is a noninvasive ultrasound-based technique. More accurate measurements are obtained with transesophageal than with transthoracic measurements; however, both methods require considerable technical expertise. Bioimpedance and pulse contour analysis are 2 new methods that have yet to be validated in the horse. With the currently available technology, lithium dilution appears to be the method of measuring CO best suited to the equine clinic.in systemic vascular resistance followed by a much greater reduction that may cause hypotension.