

guided technique facilitated correct PLMA positioning in all five cases.

Our technique may present several advantages over the 'blind' suction catheter technique and digital techniques when PLMA positioning is found to be difficult. We believe that our approach may be associated with a higher success rate while providing some protection against regurgitation. In addition, the distal cuff is less likely to fold over as the drain tube is stiffer (i.e., when the oropharyngeal axis is $< 90^\circ$, the GT could guide the distal cuff into the oropharynx). Furthermore, the GT can be used as a guide for reinsertion if the PLMA is displaced, and finally, direct visualization of the GT advancement reduces the risk of misplacement, overcoming one of the limitations observed by Garcia-Aguado *et al.* and Drolet *et al.*⁴ The Glidescope/GT technique may also prove to be a more gentle procedure than use of the laryngoscope-guided gum elastic bougie technique advocated by Brimacombe *et al.*⁵ Our initial experience is encouraging and will be further explored through a randomized, controlled trial.

Massimo Micaglio MD

Matteo Parotto MD

Daniele Trevisanuto MD

Vincenzo Zanardo MD

Carlo Ori MD

University of Padova, Padova, Italy

E-mail: m.micaglio@libero.it

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Less invasive cardiac output monitoring for OPCAB surgery

To the Editor:

Off-pump coronary artery bypass (OPCAB) surgery has been shown to provide improvement of select short-term and mid-term clinical and resource outcomes with similar mortality, stroke and myocardial infarction rates compared with conventional coronary artery bypass grafting using cardiopulmonary bypass.¹ Key challenges associated with OPCAB surgery include the detection and prevention of myocardial ischemia, and ensuring adequate blood flow and oxygen delivery to the vital organs. Both challenges are closely inter-related, hence the need for reliable and sensitive monitoring tools in order to detect the rapid hemodynamic changes during heart displacement in several coronary grafting positions. Abrupt hemodynamic deterioration may occur, particularly during coronary grafting on the lateral and inferior surfaces of the heart, due to twisting and virtualization maneuvers.²

Transesophageal doppler is a monitoring technique that measures descending thoracic aortic blood flow (TABF) and calculates cardiac output (CO) using an established algorithm. Descending TABF represents blood flow through the aortic valve minus flow to the cerebral, coronary and upper extremity vascular beds. Positioning the probe is not difficult during heart displacement, and requires only a minor degree of correction during grafting on the lateral and inferior surfaces of the heart to obtain maximum amplitude of the Doppler signal. The esophagus and thoracic aorta run parallel for more than 2 cm between the fifth and sixth dorsal vertebrae, and this relation remains fairly constant during heart displacement.

Continuous CO monitoring by the thermodilution technique most commonly used in cardiac surgery, has an *in vitro* lag time of five to 15 min to detect changes in CO. This delay is a limiting feature for the detection of very sudden hemodynamic changes associated with OPCAB. Furthermore, repeated intermittent measures are time-consuming, especially during the critical period of heart displacement. Wouters *et al.* recommend the use of a thermistor-tipped brachial arterial catheter that allows CO assessment by both transpulmonary thermodilution and arterial pulse contour analysis, and the performance of the two methods was comparable to thermodilution assessment.³ We recently reported an important discrepancy between thermodilution and transesophageal Doppler assessment of CO during heart displacement in OPCAB surgery. Although mixed venous blood

oxygen saturation showed a similar trend, it followed the change in TABF with some delay.⁴

The pulse contour method provides a surrogate marker of aortic blood flow and consequently, CO is measured indirectly by the arterial pressure waveform after initial calibration with the thermodilution technique. Recently, Yamashita *et al.* demonstrated that CO measured by pulse contour analysis was not interchangeable with the measurement by thermodilution in patients undergoing OPCAB.⁵ The CO calculations by the algorithms used in the pulse contour method can be markedly affected by cardiac and/or arterial compliance.

Off-pump coronary artery bypass is an evolving technique which requires a validated, sensitive and “less invasive” tool for CO monitoring to help the perioperative team monitor and manage the associated rapid hemodynamic changes. We suggest that the transesophageal Doppler technique of CO assessment may be a promising adjunct to OPCAB.

Sharif Al-Ruzzeh PhD FRCS FRCSED
Yorkshire Heart Centre, Leeds, UK
E-mail: sharifalruzzeh@yahoo.co.uk
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