

# Transesophageal echocardiography as a hemodynamic monitor in post operative cardiac surgery patients\*

William T. Costello, M.D., Frederic T. Billings, M.D., Julian S. Bick, M.D., Jason D. Kennedy, M.D., and Chad E. Wagner, M.D.

Vanderbilt University Medical Center, Nashville, TN, USA

## Introduction

Clinicians use systemic blood pressure (BP), central venous pressure, urine output, and pulmonary artery pressures as surrogate markers for cardiovascular function and to manage critically ill patients with hemodynamic instability, despite the well-recognized risks and limitations of these monitors. Slender flexible disposable transesophageal echocardiography (TEE) probes approved for 72 hours of continuous use have recently become available and provide direct assessment of cardiac function. We hypothesized that continuous TEE contributes to the postoperative management of hemodynamically unstable cardiovascular surgical patients.

## Methods

We placed TEE probes in consecutive post-cardiac surgery patients with gross hemodynamic instability in a university hospital cardiovascular ICU. Gross instability was defined as persistent systolic BP <100 mmHg, cardiac index <2.2 l/min/m<sup>2</sup>, SvO<sub>2</sub> < 60%, suspected pericardial effusion with tamponade, base deficit > 8 mEq/l, or lactate >5 mg/dl despite persistent inotropic, vasopressor, and/or volume resuscitation. We performed a monoplane TEE imaging session every 2-3 hours for the initial 6 hours and as needed until hemodynamically stable, extubated, or for 72 hours. We sought to obtain both the mid esophageal four chamber (ME4C) and transgastric short axis (TGSAX) views to assess left and right ventricular function, intravascular volume status, response to fluid resuscitation, and pericardial effusion with or without tamponade. Study endpoints included ability

to obtain ME4C and TGSAX views, left ventricular end diastolic area (LVEDA), and LV fractional area of change. In addition, the echocardiographer recorded whether information obtained during imaging sessions influenced the hemodynamic management of each subject.

## Results

Five hundred twelve video loops were recorded in twenty-one subjects. Five (23.8%) patients required reoperation, average ICU length of stay was 8.8±6.9 days (mean±std. dev.) among survivors, and 30-day mortality was 14%. Both the ME4C and TGSAX views were obtained in 90.5% of subjects, and at least one view in 95.2%. Mean LVEDA among all subjects and all exams was 17.1±6.3 cm<sup>2</sup>, and LV fractional area of change 48.7±16.6%. Cardiac index, measured by pulmonary artery catheter, was 2.75±0.41 l/min/m<sup>2</sup>. Bedside TEE findings revealed intravascular hypovolemia in 9 subjects and right ventricular failure in 10 subjects. TEE data aided intra-aortic balloon pump and ECMO weaning in one patient over the 72 hour study period. In another patient, bedside TEE identified pericardial effusion with tamponade, prompting re-operation. TEE data directed hemodynamic patient management decisions in 81.0 % of subjects.

## Discussion

Bedside TEE contributes to the postoperative management of cardiac surgery patients with hemodynamic instability. In conjunction with other hemodynamic monitors, bedside TEE may improve

\*Presented at ASA, October 2011, Abstract A1452

## Transesophageal echocardiography as a hemodynamic monitor in post operative cardiac surgery patients

patient management and reduce hemodynamic instability. Future randomized, controlled studies are needed to determine if TEE reduces hemodynamic instability or improves patient outcomes in postoperative cardiac surgery patients.