

Physiologic Basis for Functional Hemodynamic Monitoring

During positive pressure breathing, measures of left ventricular outflow variation have been used as a preload response test. Recent studies from numerous centers have underscored the accuracy and usefulness of monitoring arterial pulse pressure variation (PPV) or stroke volume variation (SVV) during mechanical ventilation. The greater the degree of PPV or SVV the more cardiac output will increase for a fixed bolus volume challenge.

Since arterial pressure varies as a function of blood flow and arterial tone, the greater (or lesser) the arterial tone, the greater (or lesser) will be the PPV relative to SVV. The ratio of PPV to SVV defined the lumped arterial input elastance and has a normal range of 1 to 2. If arterial elastance is < 0.8 then pathological vasodilation is present. Thus, in a hypotensive patient, if PPV/SVV is < 0.8 even if volume resuscitation increases cardiac output, blood pressure may not increase sufficiently to restore pressure-dependent organ blood flow and the combined use of vasopressors plus fluid resuscitation would be indicated. Thus, by measuring relatively simple but varying cardiovascular variables, fluid resuscitation, vasoactive drug therapy and inotropic therapy can be given and their effects monitored in real time.