

# FEASIBILITY OF DERIVING RIGHT ATRIAL PRESSURE IN INFANTS AND YOUNG CHILDREN NON-INVASIVELY

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**Background:** Studies in adults have shown that echocardiographic assessment of right atrial volume (RAV), inferior vena cava (IVC) diameter and hepatic vein flow velocity independently correlate with the right atrial pressure (RAP) by direct catheter measurement. We hypothesized that a predictive model could be developed to non-invasively determine normal RAP in infants and children based on echocardiographic data. With this goal, invasive RAP measurements and echocardiography data were prospectively obtained in infants and young children over a range of ages and sizes.

**Methods:** All subjects were inpatients who had a medically indicated central venous catheter through which RAP could be transduced. Specific inclusion criteria consisted of (a) biventricular heart, (b) absence of inotropic drugs, (c) sinus rhythm and (d) at least 24 hours from an operation. RAP was measured concurrently with a two-dimensional echocardiogram (2DE) and three-dimensional echocardiogram (3DE) with Doppler to measure RAV, systemic venous diameters and flow velocity. Regression equations of RAP with RAV, and systemic venous size and flow velocity were explored.

**Results:** Of 46 studies performed, 43 (93%) had echocardiograms adequate for 2DE and 3DE RA analysis and included 20 males and 23 females. The median age was 51 days (range 1 to 1619 days), median weight 4 kg (range 1 to 19 kg) and median BSA  $0.23 \text{ m}^2$  (range 0.13 to  $0.76 \text{ m}^2$ ). The mean RAP was  $8 \pm 3 \text{ mm Hg}$  (range 2 to 17 mm Hg). The RAP did not correlate with the BSA or the age. The mean maximal RAV measured by 3DE indexed to body surface area was  $32.17 \pm 14.1 \text{ ml/m}^2$  (range 9.49 to  $71.25 \text{ ml/m}^2$ ) and was significantly higher than indexed RAV measured by 2DE ( $p < 0.005$ ). RAP had significant correlation with the systolic flow velocity in the IVC ( $r 0.20$ ,  $p < 0.05$ ), with a resulting regression equation of  $\text{RAP} = 10.9 - 0.03$  (IVC systolic flow in cm/s). RAP did not show significant correlation with SVC or IVC diameters, or systolic and diastolic flow velocities in the SVC and hepatic veins.

**Conclusion:** It is feasible to obtain RAV from 3DE, with the measured volumes greater than those by 2DE. Regression incorporating echocardiographic measurement of the systolic flow velocity in the IVC provided the best non-invasive estimate of normal RAP in infants and children.