TITLE: TAPSE CAN BE REPRODUCIBLY QUANTIFIED BY TRANSESOPHAGEAL ECHOCARDIOGRAPHY

AUTHORS: M.A. Durkin MB, F.C. Anaes., T. Rafferty M.D.
AFFILIATION: Anes. Dept., Yale University School of Medicine, Yale New-Haven Hospital, New Haven, CT 06510

Tricuspid annular plane systolic excursion (TAPSE) is a recognized transthoracic 2D-echo right ventricular (RV) performance index.[1] The feasibility of transesophageal (TE) measurement is unreported.

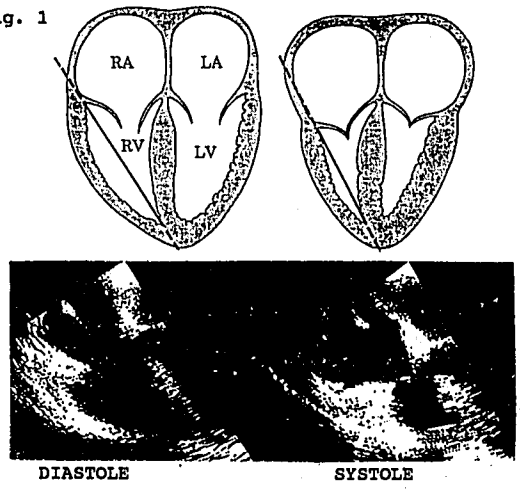
Methods. Twenty adult cardiac surgery patients fulfilling Human Investigation Committee criteria were studied. Long axis (LA) images (TE 5.0 MHz phased-array transducer) were viewed at two levels, namely, with the coronary sinus (CS) and anterior mitral leaflet (AM) in the far field, respectively. Diastolic and systolic TAPSE (Fig. 1) and LA planed areas were expressed as ratios, i.e. $TAPSE_R$ and $LA\ area_R$, respectively. Measurements were obtained following induction/intubation, sternotomy, pericardectomy, and post-CPB preceding and following chest closure. Observer variabilities were calculated as estimate 1 minus estimate 2 divided by mean estimate 1 + 2 and expressed as percent. Estimate 2 viewing order was by random number table. Relationships were evaluated by regression analysis, variance ratio test and the Bland Altman technique.

Results. The CS LA view was incompatible with consistent coincident imaging of the tricuspid annulus and RV apex. In the MV LA view this was possible in 20/20 cases. $TAPSE_R$ intra/interobserver variabilities were 7 and 13%, respectively. Values (.30 ±.11) were contrasted with $LA\ area_R$ (.44 ± .13) (n=97;r=0.64). There was no significant difference between the respective variances (F=1.31; P>0.05). Differences did not vary systematically over the measurement range. The null hypothesis that pre and post-CPB regressions were parallel and coincident was not rejected.

Comment. $TAPSE_R$ can be reproducibly quantified by TE 2D-echo. We recommend that for LA RV imaging, the AML should be taken as the independent reference structure. $TAPSE_R$ measurements were equally accurate/inaccurate as a standard 2-D echo measurement. Concurrence of pre and post CPB $TAPSE_R/area_R$ relationships inferred validity under conditions of post-CPB ventricular translocation.

Ref. 1. Am Heart J 3:526, 1984

Fig. 1



A469

Title: TIDAL VOLUME MEASUREMENT ERRORS - THE IMPACT OF LUNG COMPLIANCE AND A CIRCUIT HUMIDIFIER

Authors: J.M. Feldman, M.D., J. Muller, M.D.
Affiliation: Dept. Anes., Yale University School of Medicine, Yale-New Haven Hospital, New Haven, CT 06510

Introduction. Expired tidal volume (VT) measured at the end of the expiratory limb (VT_{EL}) of a circle system is not an accurate measure of exhaled VT.[1] VT_{EL} measures exhaled gas plus gas that was "stored" in the circuit during inspiration due to gas compression and circuit compliance. Humidifiers increase the compression volume and circuit compliance.[2] This study determines: 1) the difference between VT_{EL} and exhaled VT measured at the airway (VT_{AW}) as lung compliance (C_L) changes and 2) the impact of a circuit humidifier on the difference between VT_{EL} and VT_{AW}.

Methods. The equipment consisted of an Ohmeda Modulus II anesthesia machine, Ohmeda 7000 ventilator, Kendall-Curity adult breathing circuit (#6866), Mallenckrodt 9-0 ID endotracheal tube and Michigan Instruments Vent-aid TTL test lung. An RCI Inc. Concha II humidifier was integrated with the circuit using a Vital Signs circuit tube #5039A. Fresh gas flow was kept constant at 200 ml/min. Three circuit configurations were studied: 1) circle system without humidifier, 2) circle system with humidifier at 24°C and 3) circle system with humidifier at 34°C. For each configuration, the ventilator was adjusted to obtain a VT_{EL} of 800 mls. VT_{AW} was then measured. These measurements were repeated at four C_Ls - 80, 40, 15 and 10 mls/cmH2O. VT measurements were repeated three times at each site. Circuit pressure (American Edwards #53-DRS-260) and temperature (Intermedics Inc.) were measured at the airway.

The data were analyzed using a three factor ANOVA to determine if measurement site, circuit configuration and C_L were significant factors.

Results. VT_{EL} was significantly different from VT_{AW} under all conditions. The difference $VT_{EL} - VT_{AW}$ is shown in the figure versus C_L and circuit configuration. The VT measurement difference for each circuit configuration was compared against the other configurations at each compliance. All comparisons were significantly different with the exception of the humidified circuit at 24°C versus 34°C at C_L=40, and the unheated humidified circuit versus no humidifier at C_L=80.

Discussion. VT_{EL} consistently overestimates exhaled VT. The overestimation becomes clinically important with even mild reductions in C_L and addition of a humidifier to the circuit. Heating the circuit further increases the error. This study simulates several common clinical situations and demonstrates that VT_{EL} must be carefully interpreted to avoid inadequate VT.

References.
1. Ohmeda 5420 Volume Monitor Operations Manual, Ohmeda, Englewood, CO.
2. Anesthesiology 59:442-446,1983.