Title : CHANGES IN RIGHT VENTRICULAR FUNCTION DURING RIGHT CORONARY ARTERY BYPASS GRAFT OPERATION

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Introduction: The concept of conduit function of right ventricle (RV) has been generally supported and it has been assumed that RV dysfunction does not significantly impair cardiac function. Recently, however, there has been accumulating evidences that RV is playing an important role in overall hemodynamic profile. The failing RV is unable to feed left ventricle (LV) adequately[1] and/or excessive distension of RV within the constraints of pericardium can encroach the LV to alter both its function and compliance.[2] While the LV functional changes have often been studied in the patients undergoing coronary artery bypass graft (CABG) operation, very little information is available regarding RV functional changes. Utilizing a rapid responding Swan-Ganz catheter, we evaluated RV functional changes in patients with right coronary artery disease before and after CABG operation.

Method: Six patients (ages 42-59) were studied perioperatively. All patients had significant right coronary as well as one or two additional left vessel diseases. None was in congestive heart failure and all medication was discontinued prior to operation except propranolol and nitrates. Premedication was with morphine and scopolamine, induction was with sodium thiopental. Anesthesia was then maintained with enflurane-N_2O-O_2 and pavulon. Monitoring were clinically routine including EKG, arterial line and a modified Swan-Ganz catheter (Baltherm Thermal Dilution Catheter, Electro-Catheter Co.). Cardiac output, RV pressures and the thermodilutional washout curve were then used to compute ejection fraction (EF), RV end-diastolic volume index (RVEDVI), stroke volume index (SVI) and RV end-diastolic compliance (RVED-COMP).[3] Three sets of measurements were performed and then averaged at five different stages: before induction (stage 1), after induction but before pericardium is open (stage 2), after pericardium is open (stage 3), after the cardiopulmonary bypass while chest is open (stage 4) and after chest is closed (stage 5).

Results: The results are summarized in the Table. Cardiac index (CI), heart rate (HR), mean arterial pressure (MAP), pulmonary arterial mean pressure (PAM), pulmonary capillary wedge pressure (PCWP) and RV end-diastolic pressure (RVEDP) were not significantly altered with an exception of RVEDP at stage 3 which dropped below the values of any other stages. In contrast, RVEDVI showed marked changes reflecting the concomittant changes in RV compliance; RVED-compliance markedly increased after pericardium is open (stage 3) allowing RVEDVI increases despite the decrease in filling pressures. Post-bypass periods, the compliance was markedly reduced and RV volume contracted even with higher filling pressures. EF showed no changes during pre-pump periods while there were significant changes in EF during post-pump periods; EF was elevated at stage 4 when chest was open, then decreased below baseline values after chest was closed. There were significant relationships between RVEDVI and SVI ($r^2=0.64$ $p>0.001$) and RVED-COMP ($r^2=0.47$, $p<0.001$). No relationships were found between RVEDP and any of the above parameters.

Discussion: In awake patients (stage 1), the values of RVEDVI, compliance and EF were comparable with the values reported previously.[3] Anesthesia and surgical stimulation (stage 2) reduced RVEDVI even with unchanged filling pressures. When the pericardium was open (stage 3) there were significant rises in RVEDVI and compliance indicating the pericardium was limiting RV dilation in patients with right coronary diseases. The reduced compliance (stages 4 and 5) and EF (stage 5) suggest RV function was deteriorated during post-bypass periods. Although there were no evidences of LV functional deterioration resulting from the observed RV dysfunction, the possible ill effects of RV dysfunction on overall cardic performances cannot be ruled out from our study since the RV afterload and preload were not elevated during study periods.[2] Finally, RVEDVI showed close positive relationship with SVI while RVEDP failed to do so indicating that the RV filling pressure (CVP or RVEDP) may be an inadequate guideline for the fluid volume management in patients undergoing right CABG operations.

TABLE

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
CI (l/m^2)	2.9±0.3	2.2±0.3	2.6±0.3	2.5±0.3	2.5±0.3
HR (bpm)	64±3.9	73±3.8	68±2.8	71±5.7	77±3.3
MAP (torr)	109±7.9	93±6.8	115±8.5	106±5.3	110±4.5
PAM (torr)	21±1.9	20±2.5	19±2.2	24±3.9	22±2.3
RVEDP (torr)	9.1±1.3	7.7±0.8	4.8±0.4[a]	8.0±0.8	7.6±0.5
PCWP (torr)	12±1.9	13±2.6	12±3.0	13±3.1	12±1.2
SVI (ml/m^2)	45±5.5	31±4.0[b]	38±3.9	37±5.5	34±4.0
RVEDVI (ml/m^2)	108±10	73±12[b]	96±9.0[b]	72±10[b]	88±11
RV-COMP (ml/torr)	23±4.4	18±2.9	38±4.6[b]	17±3.5[b]	23±3.9
EF	0.43±0.01	0.42±0.03	0.41±0.04	0.51±0.03[a]	0.39±0.03[a]

[a] $p<0.05$ compare to values of all other stages,
[b] $p<0.05$ compare to values of previous stage.

References:

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