Commercially available thermodilution apparatuses for measurement of cardiac output (CO) are not able to assess intracardiac shunts (IS). Aim of our study was to develop a method and computer based instrumentation measuring all three basic flow parameters: CO, IS and regurgitation. We were not able to find any reference about such apparatus in the literature.

We have developed a thermo-probe which is 0.035 inch in diameter which can be inserted through the diagnostic 5F catheter (fig. 1 and 2).

Thermic signal is fed through the measuring unit into computer (fig. 3), which measures continuously temperature of the blood, extrapolates the curve, calculates flow, displays the curve and all data on screen and produces hard copies (fig. 4), all on line during the procedure. Measurement of L-R shunt: 2 curves are needed. Different algorithm is required in atrial septal defect and in L-R at ventricular and aorto-pulmonary level.

Measurement in atrial septal defect (1-6): the 1st curve (RA injection - PA sensing) measures pulmonary blood flow (PBF) in l/min. The 2nd curve (LV inj.- AO sens.) measures systemic blood flow (SBF) in l/min. L-R is calculated as the difference: L-R = PBF - SBF (fig. 5).

In ventricular septal defect and patent ductus arteriosus (1-3) the 1st curve (RA inj. - PA sens.) measures PBF. The 2nd (LV inj. - PA sens.) measures L-R which is calculated: L-R in l/min= A2/A1 x PBF, where A2 and A1 are areas of the 2nd and 1st curve (fig. 6).

Measurement of R-L shunt (1-3): the 1st curve (LV inj.-AO sens.) measures SBF. The 2nd one (IVC inj.- AO sens.) measures R-L shunt which is calculated similarly: R-L in l/min = A2 / A1 x SBF, where A2 and A1 are areas of the 2nd and 1st curve (fig. 7). Sensitivity: 1 % of PBF or SBF respectively.

Altogether 1496 dilution curves were recorded in 142 patients. Using our apparatus we measured CO simultaneously with commercially available Braun instrument (BI) in 58 patients (542 curves). Mean value was 5.02 l/min (SD 0.227), while by BI it was 4.98 l/min (SD 0.315), r = 0.954 (fig. 8).

L-R shunt was assessed in 51 patients and good correlation was found with oximetry: r = 0.936 (fig. 9). We measured R-L shunt in 23 patients at rest and during Valsalva maneuver. Aortic regurgitation was estimated in 41 patients, mitral in 39 patients and tricuspid in 30 patients. Preciseness of regurgitation measurement is limited by inadequate mixing.

References: