Computer simulation of the Left Ventricular Pressure-Volume Relationship (LVPVR). Mion G, Koulmann P, Le Gulluche Y. D.A.R, HIA Val de Grâce, BP 302 -F- 00446 Armées. Tel : (33) 01.40.51.45.06 ; Mail : drgmion@club-internet.fr

BACKGROUND : The concept of time-varying elastance developed by Suga and Sagawa in the 1970s integrates on the same graph all the components of LV function : contractility (Ees, slope of ESPVR[1]), preload (Ved), afterload (slope Ea $\approx$ HR.SVR), matching of LV with arterial system (graphical analysis of SV) and LV efficiency[2]. A computer simulation makes it a remarkable didactic tool.

METHODS : **input data :** volemia (V); compliance of capacitive vessels (Cv); venous resistance at the entry of LV (Rv); LV compliance (C_{LV}); (Ees); zero-volume intercept (Vd); Systemic resistances (SVR); heart rate (HR).

output data : $Ved = (MSP.C_{LV}) - (MSP.C_{LV}-Ves).e^{(-t/Rv. C_{LV})}$

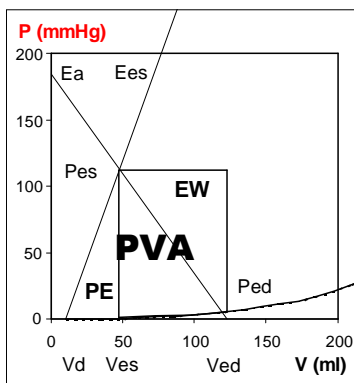with loading time (t) = (60/HR)-0.2 and mean systemic pressure (MSP) = V/Cv;

$Ped = e^{(0.33/C_{LV})(Ved-Vd)} - 1$; Ea = HR.SVR; Ves = (Ea.Ved + Ees.Vd) / (Ees + Ea);

SV = Ved - Ves; Pes = Ea.SV; LVEF = SV/Ved; CO = HR.SV ;

Pressure-Volume Area PVA = EW + PE; External Work EW = SV.(Pes-Ptd/2);

Potential Energy PE = ½ (Ves-Vd).Pes; $MVO_2 = 2.5$ x APV + 0.3 x Ees + 1;

1 mmHg $\approx 1.333 \times 10^{-4}$ J ; Mechanical efficiency ME = EW/MVO_2.

RESULTS : the computer calculates output values according to input data and simultaneously modifies the classic graph on the screen. **Figure 1 :** Results for V = 5500; Cv = 660; Rv = 0.03; C_{LV} = 20; Ees = 3; Vd = 10; SVR = 20 ; HR = 75 **:** Ea = 1.5; Ea/Ees = 0.5; Ved = 123 ; Ves = 48; SV = 75 ; Ped = 5; Pes = 113; CO = 5.6 ; EF = 0.61 ; WE = 1.1 ; PVA = 1.4; MVO_2 = 5.4 ; ME = 0.21.

DISCUSSION : The sofware simulates realistically the altering of preload (Ved) and afterload (Ea, HR, SVR), contractility (Ves, Vd) and the corresponding modifications of ME. LVEF and ME evolve according to theoric and experimental expectations, ie: ME = 0.28 to Ved = 250 mL; ME max to Ea/Ees = 0.5.

REFERENCES : 1.Suga H, Sagawa K, Shoukas A : *Circ. Res.* 1973; **32**:314-322. 2.Suga H, Goto Y, Kawaguchi O et al. *Bas. Res. Cardiol.* 1993; **88** (suppl 2) : 43-65.