



## CHAPTER III

### MATERIALS AND METHODS

#### Study Protocols

Echocardiogram was performed in patient prior to cardiac catheterization in Chulalongkorn University Hospital during the period of September 1990 to March 1991.

#### 1. Inclusion criteria

a) patient who undergo cardiac catheterization in Chulalongkorn University Hospital

#### 2. Exclusion criteria

a) Patient whose pulmonary artery pressure cannot be measured from cardiac catheterization

b) Patient who has poor resolution of trans thoracic echocardiogram

c) Patient who have symptom(s) and sign(s) of hemodynamic changes before or after performing the procedures as follow

1) Conscious change or sign(s) of shock

2) Systolic and/or diastolic blood pressure changes more than 20 mmHg

3) Heart rate changes more than 20 bpm

d) The treatment was modified before cardiac catheterization

### Equipment

The Pulsed wave Doppler and phased - array two dimensional echocardiography used a Aloka Color Doppler Model SSD-870 shown in figure 2. with 2.5 and 3.5 MHz transducers. The echocardiogram processed with an electrocardiogram monitored simultaneously and recorded on a thermal recorder model SSZ-320 at speed of 50 or 100 mm/s.

Cardiac catheterization used Shimazu' s c - arm system with cineangiography in catheterization laboratory of Chulalongkorn University Hospital.

The intracardiac pressures were measured with fluid filled NIH or Lehman catheter and connected with Statham pressure transducer to be recorded on a thermal recorder.

### Echocardiographic examination

Echocardiographic study was performed in patients within 24 hours prior to cardiac catheterization. Two dimensional echocardiogram was obtained in parasternal short axis view, placing the transducer in the second or third intercostal space along the left parasternal border to measure MPA diameter at the end of diastole guiding by simultaneous ECG monitoring. Then the pulsed wave doppler mode was selected and placed the sampling point at the MPA just distal to the pulmonic valve to get a justified echocardiographic tracing.

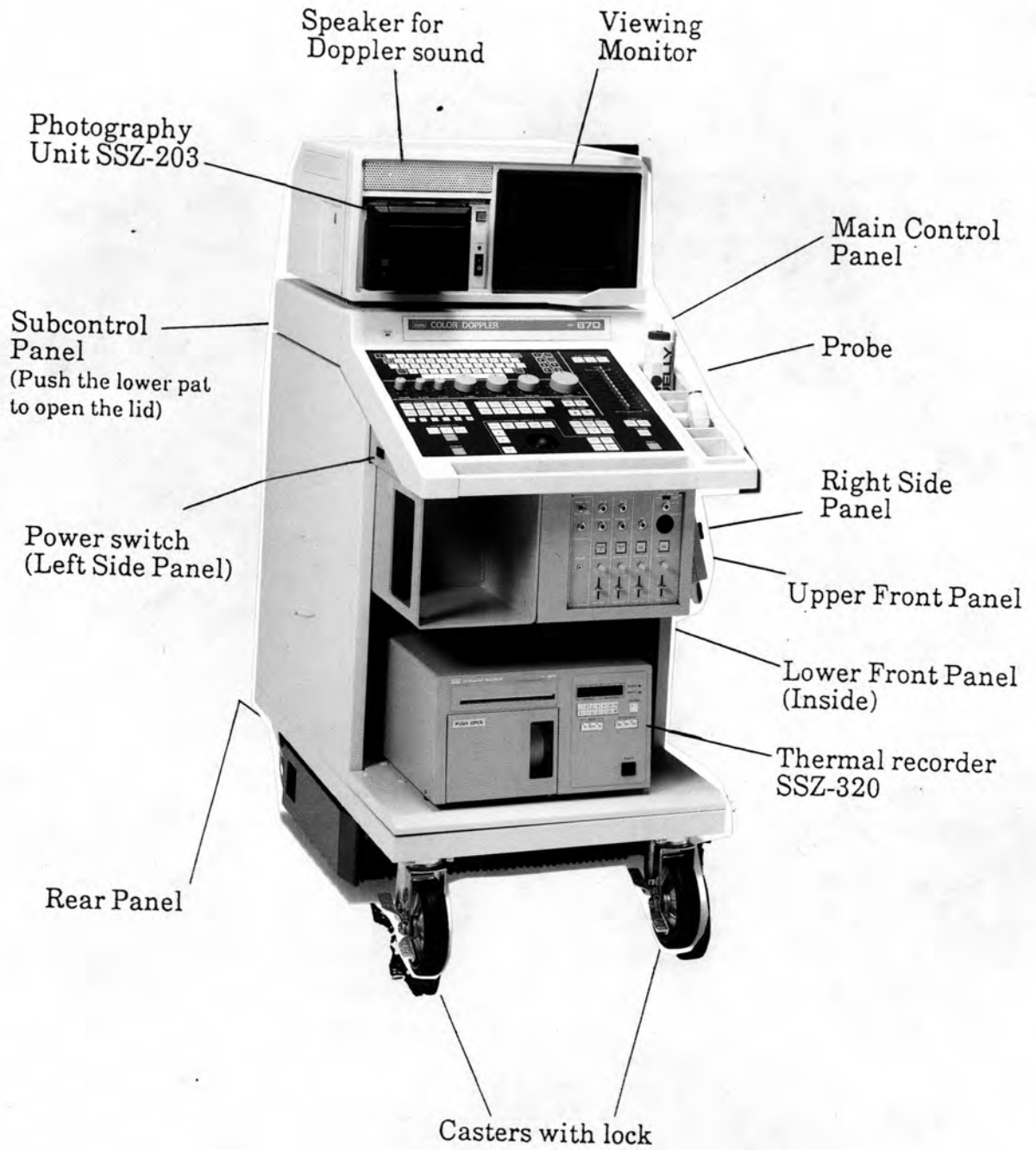


Fig.2 Echocardiographic machine ( Aloka Color Doppler model SSD-870 )

The parameters include RV pre-ejection period (PEP) defined as the time from the beginning of QRS complex in ECG to the onset of RV ejection flow. Acceleration time (AT) was defined as the time from the onset to the peak of the ejection flow velocity. Ejection time (ET) was defined as the interval between the onset and the termination of the pulmonary ejection flow and deceleration time (DT) was defined as the time from the peak to the termination of the flow velocity. Four ratios, PEP/AT, PEP/ET, AT/ET and AT/DT were calculated in each cardiac cycle at least for 5 consecutive beats.

Fig. 3 and 4 demonstrated the measurement techniques from echocardiogram.

#### Cardiac Catheterization

Right-sided cardiac catheterization was performed by cardiologists via right femoral or right brachial approach, using a standard technique. The catheter was placed at the main pulmonary artery and the MPA pressure was recorded. The average of MPA pressure was calculated at least for 5 consecutive cardiac cycles.

#### Statistical analysis

All values are expressed as mean  $\pm$  SD calculated by IBM compatible microcomputer CPU 80386SX using "Lotus version 2.2" and linear regression analysis, computed by the least squares method was used to determine the correlation between

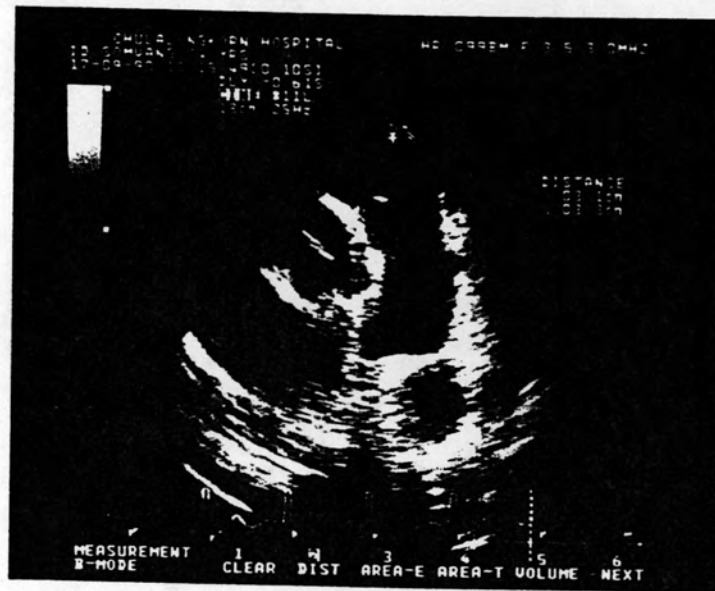


Fig.3 Measurement of MPA diameter using 2-D echogram with simultaneous ECG recording

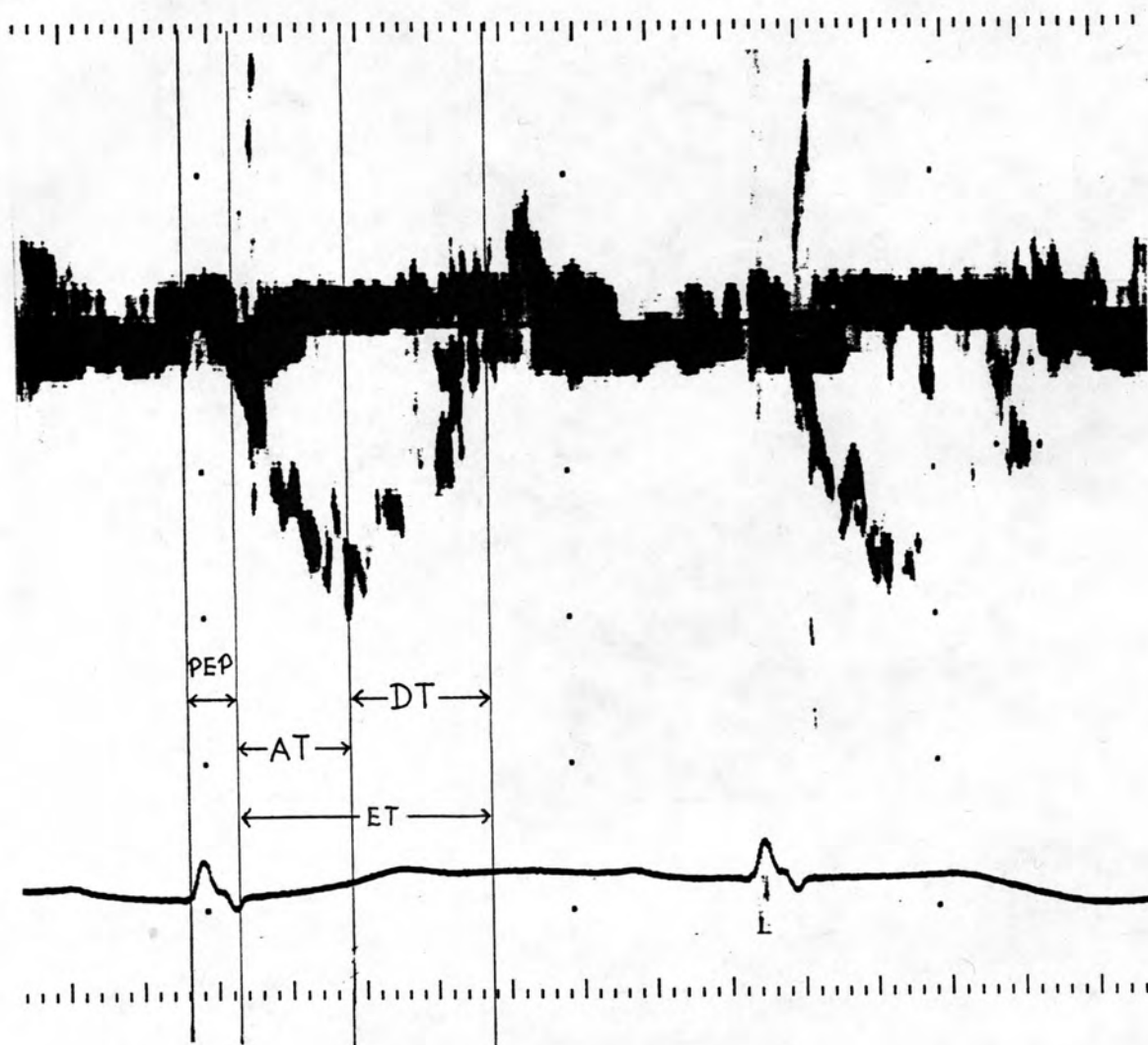


Fig.4 Echocardiographic parameters used to estimate PAP

PEP = preejection period, AT = acceleration time

DT = deceleration time, ET = ejection time

each doppler assessment and pulmonary artery pressure with "dBstat" program.

A probability of 0.01 or 0.001 was selected as the criterion for statistical significant.