Left Ventricular Hypertrophy and Geometry Playground in TAVI Patients: After Pressure Unload to Volume Overload

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Conflict of interests

- None

Outline

- Different patterns of myocardial remodeling and hypertrophy process based on nature and timing of initiating hemodynamic stress stimulus
- Law of Laplace: LV wall stress (σ) is directly proportional to intracavitary pressure and chamber radius and inversely proportional to wall thickness (σ = [Pressure × radius]/wall thickness)

Ford LE. Circulation Research.1976;39:297-303

Outline

- Primary stimulus pressure overload: an increased wall stress during ventricular systole leads to increased thickness of ventricular walls with little or no change in chamber volume, a pattern of ***concentric hypertrophy***

Outline

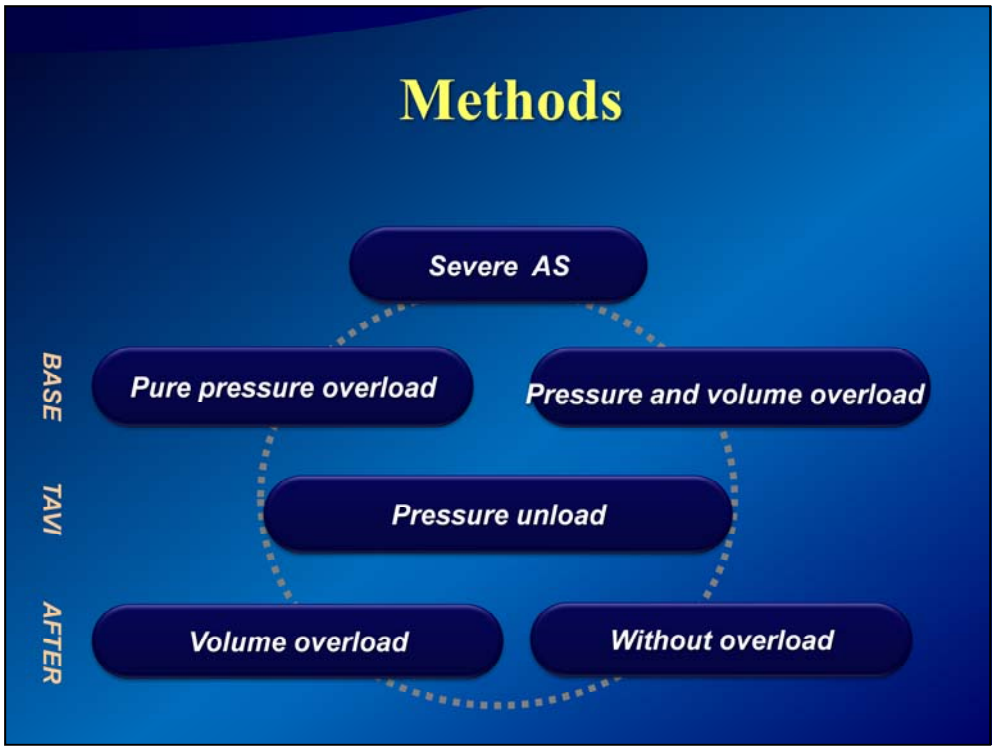
- Primary stimulus volume overload: an increases wall stress as in aortic or mitral regurgitation increase chamber volume with ventricular wall thickness increased in proportion with chamber dimensions, a pattern known as ***eccentric hypertrophy***

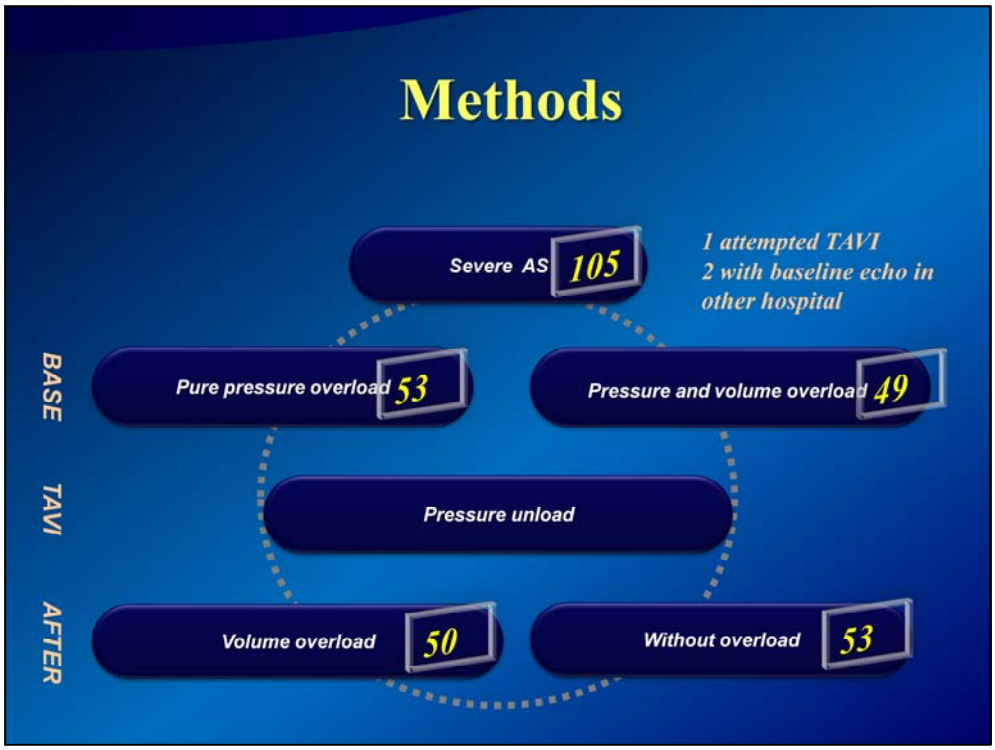
Outline

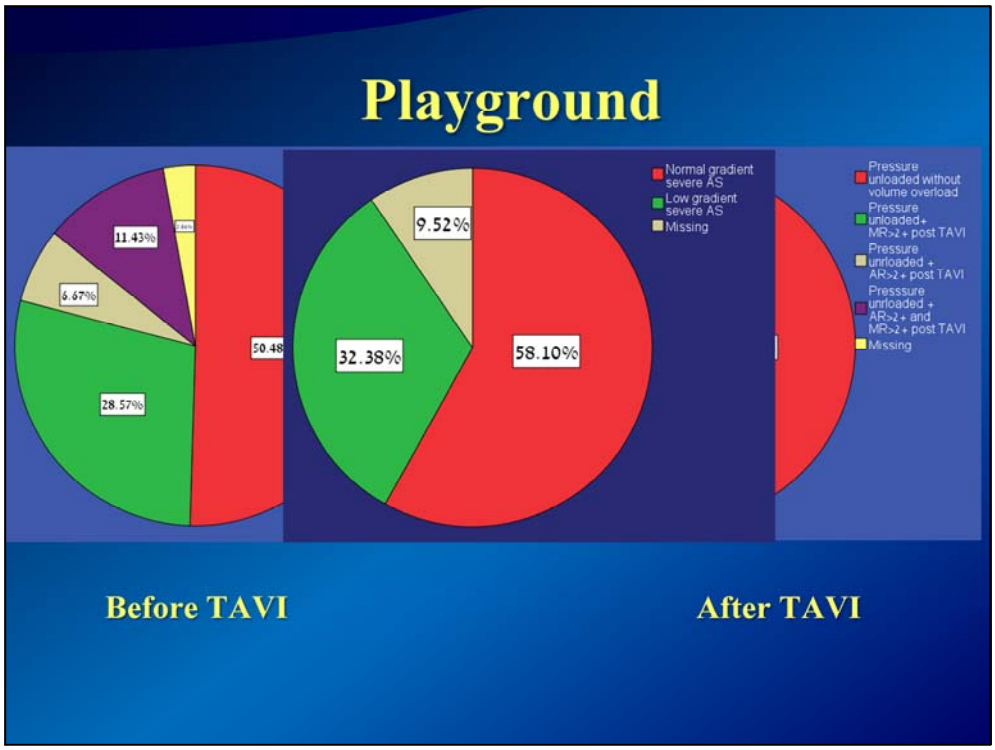
- Severe AS with pressure and volume overload based on amount of aortic and/or mitral regurgitation.
- LV after TAVI is pressure ***unloaded*** but some are volume overloaded based on aortic regurgitation post procedure.
- Such hypertrophy and geometry playground influence on heart shape and clinical outcome in patients undergoing TAVI is not well studied.

Methods

- From 2008-2012 a total of 105 pts with severe AS (Echo-derived AVA < 1 cm^2 or AVA index < 0.5 cm^2/m^2 and mean AVG > 40 mm Hg or peak jet velocity > 4.0 m/s
- At least 1 year F\U
- High surgical risk
- Clinical status baseline, month and year after
- Echo: baseline, after month and year (EF, LVM, LVMi, LVEDD, RWT)


Methods
Severe AS
Pure pressure overload
Pressure and volume overload
Pressure unload
Volume overload
Without overload
BASE
TAVI
AFTER

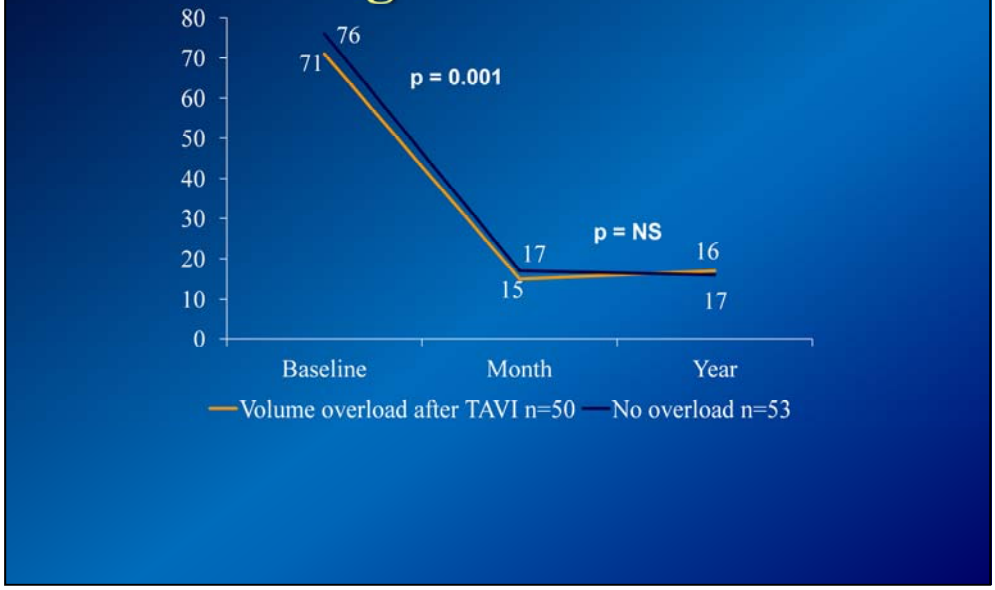

Methods
Severe AS 105
1 attempted TAVI
2 with baseline echo in other hospital
BASE
Pure pressure overload 53
Pressure and volume overload 49
TAVI
Pressure unload
AFTER
Volume overload 50
Without overload 53

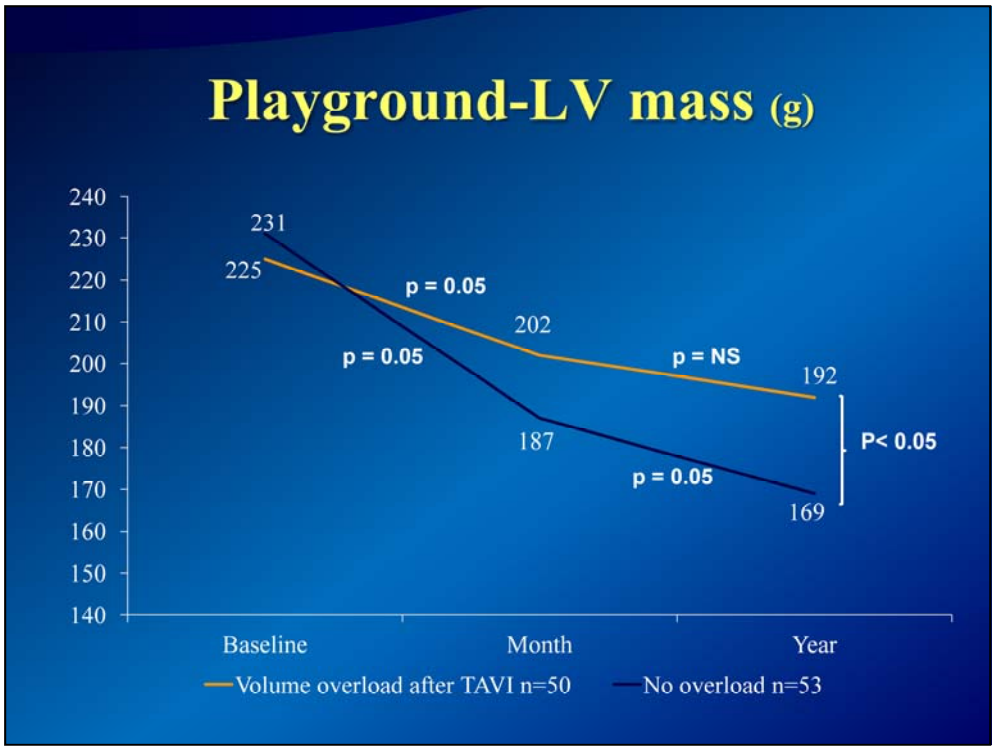

Playground
11.43%
6.67%
28.57%
50.48
9.52%
32.38%
58.10%
Normal gradient severe AS
Low gradient severe AS
Missing
Pressure unloaded without volume overload
Pressure unloaded+ MR>2+ post TAVI
Pressure unrloaded + AR>2+ post TAVI
Presssure unrloaded + AR>2+ and MR>2+ post TAVI
Missing
Before TAVI
After TAVI

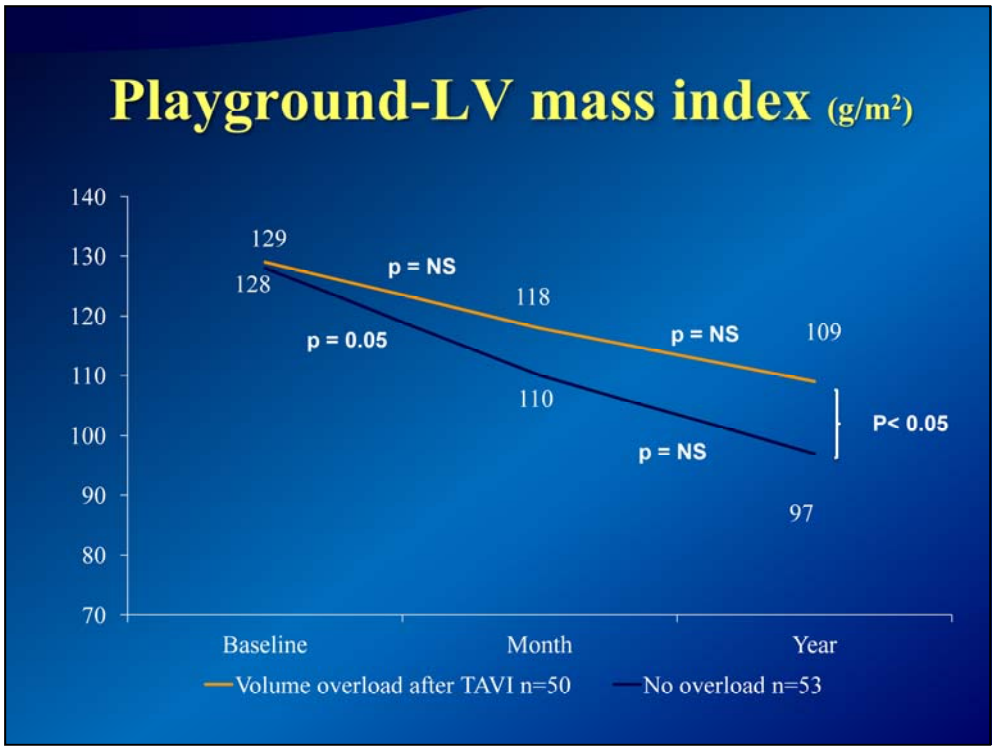
Baseline characteristics

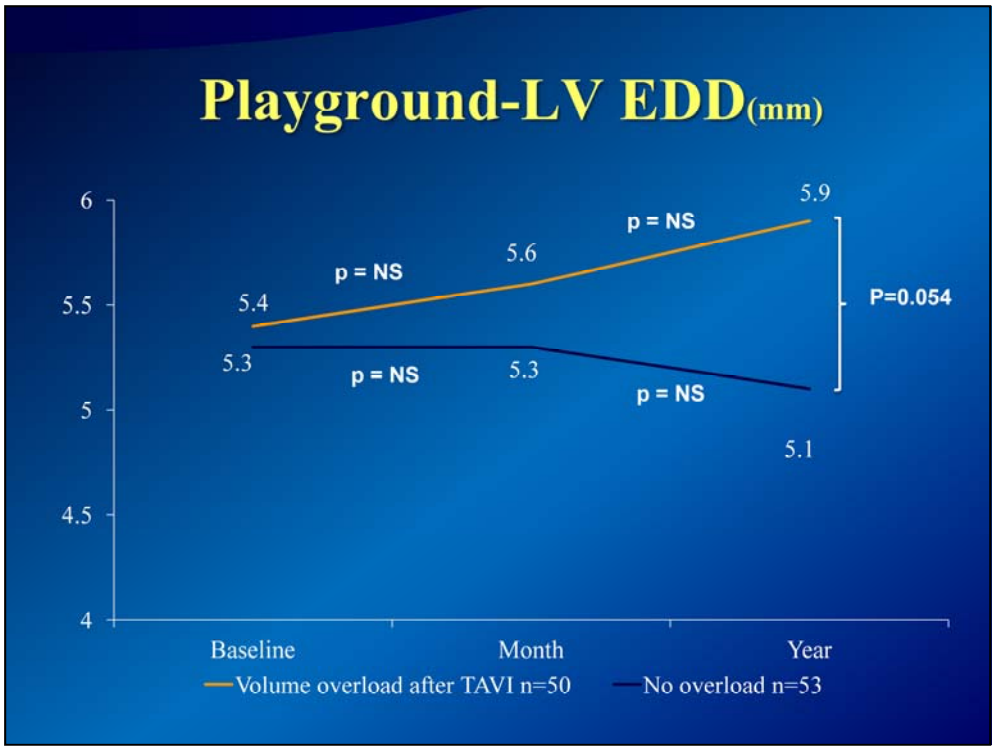
	No overload		Volume overload	
Characteristic	n	53	n	50
Age – years (Mean ± SD)	53	79.9 ± 7.01	50	80.9 ± 5.3
Male	24	45%	25	50%
NYHA Class III or IV	50	95%	48	97.0%
Previous coronary revascularisation	28	49%	22	48%
Normal or mildly reduced systolic LV function	44	83%	39	78%
Transfemoral access site	49	93%	40	80%
EuroScore (Mean ± SD)	53	18.6 ± 4.6	50	20.3 ± 3.5

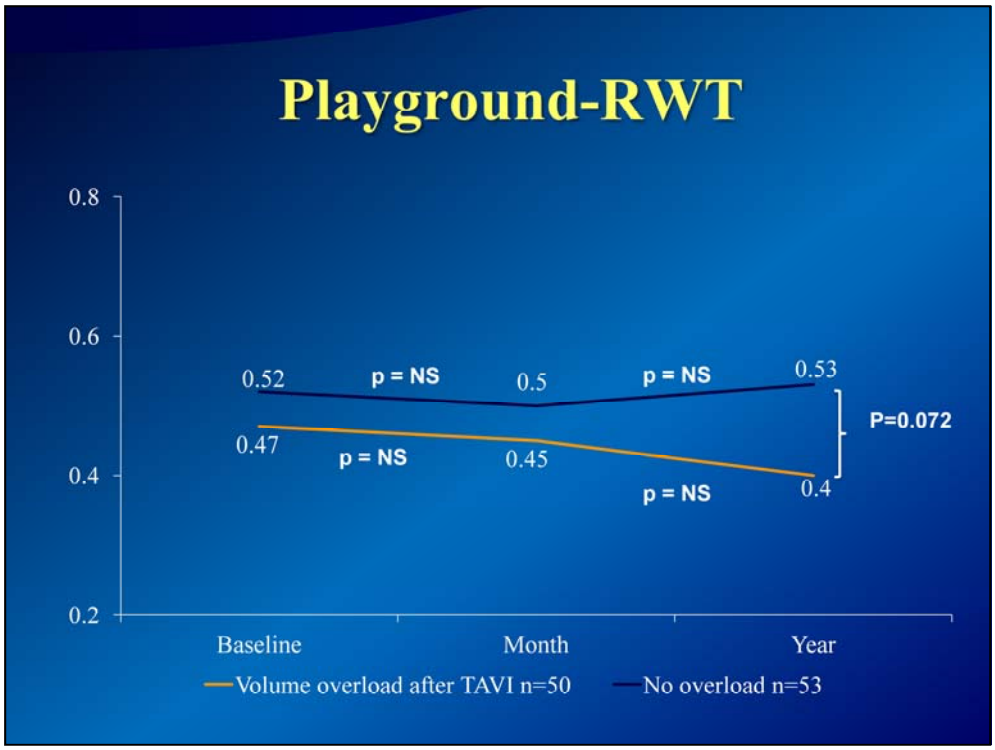
Pressure unloading-peak gradient

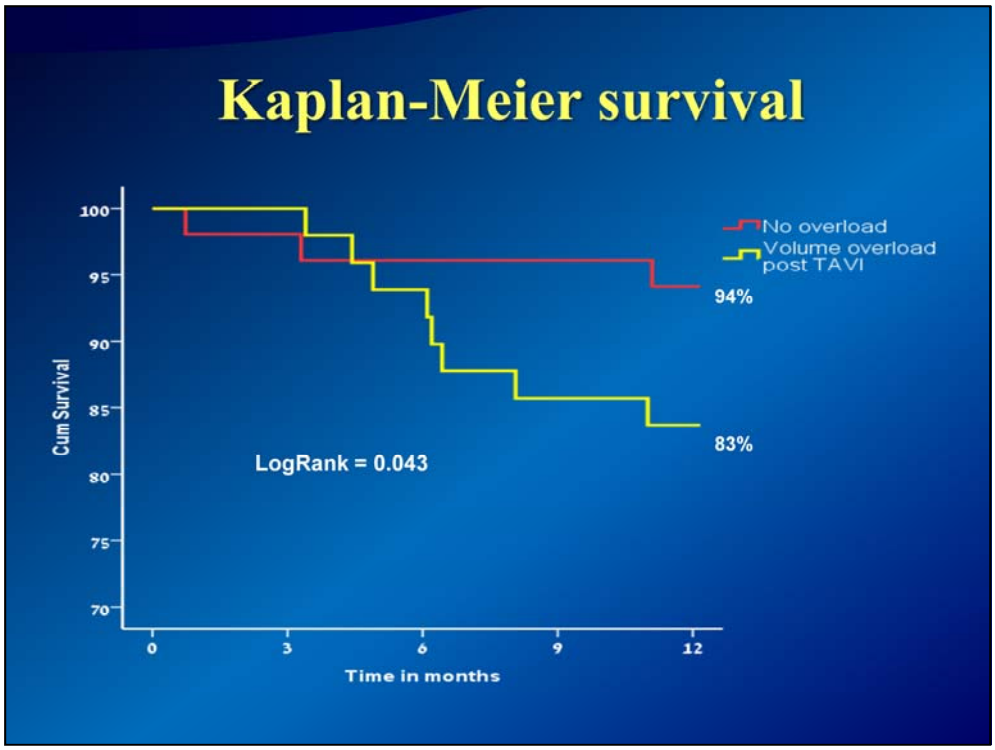


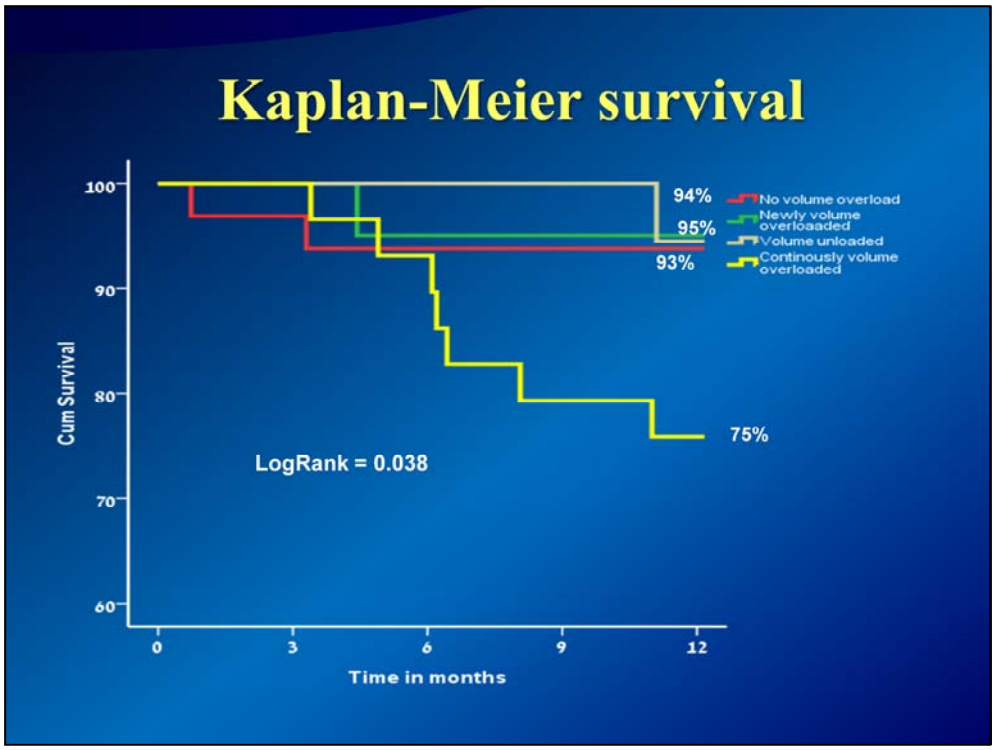

Playground-LV mass (g)
240
230
220
210
200
190
180
170
160
150
140
231
225
p = 0.05
202
p = 0.05
p = NS
192
187
p = 0.05
169
P< 0.05
Baseline
Month
Year
Volume overload after TAVI n=50
No overload n=53

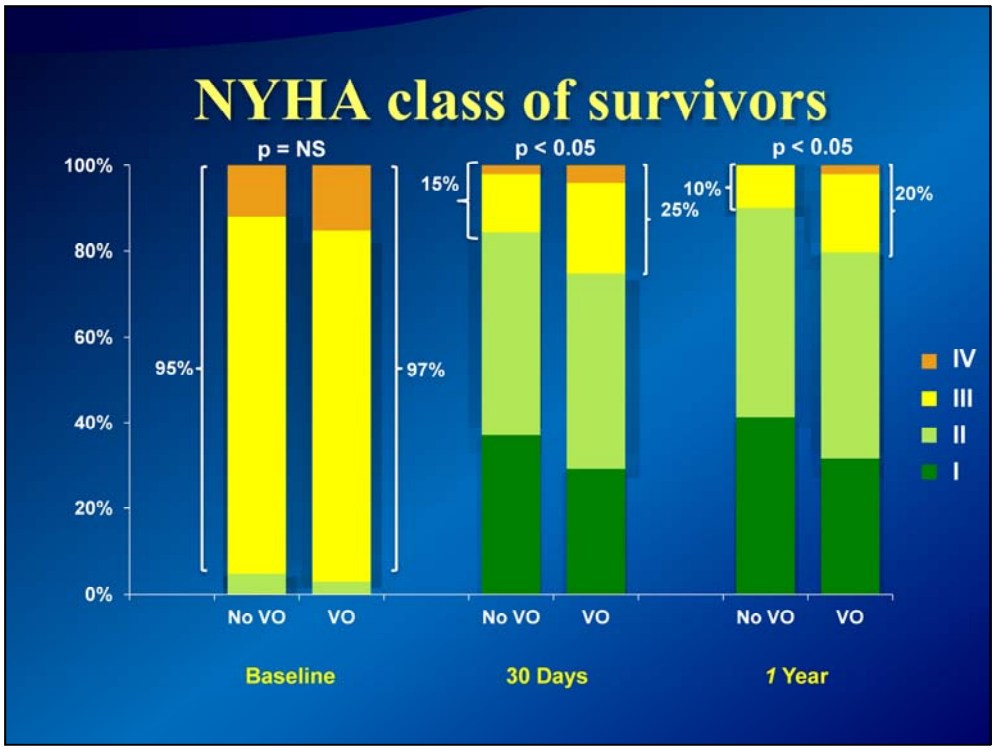

Playground-LV mass index (g/m²)
140
130
120
110
100
90
80
70
129
128
p = NS
118
p = 0.05
p = NS
109
110
P< 0.05
p = NS
97
Baseline
Month
Year
Volume overload after TAVI n=50
No overload n=53


Playground-LV EDD(mm)
6
5.5
5
4.5
4
5.4
5.6
5.9
5.3
5.3
5.1
p = NS
p = NS
p = NS
p = NS
P=0.054
Baseline
Month
Year
Volume overload after TAVI n=50
No overload n=53


Playground-RWT
0.8
0.6
0.4
0.2
0.52
p = NS
0.5
p = NS
0.53
P=0.072
0.47
p = NS
0.45
p = NS
0.4
Baseline
Month
Year
Volume overload after TAVI n=50
No overload n=53


Kaplan-Meier survival
100
95
90
85
80
75
70
Cum Survival
0
3
6
9
12
Time in months
No overload
Volume overload post TAVI
94%
83%
LogRank = 0.043


Kaplan-Meier survival
100
90
80
70
60
Cum Survival
0
3
6
9
12
Time in months
94%
95%
93%
75%
LogRank = 0.038
No volume overload
Newly volume overloaaded
Volume unloaded
Continously volume overloaded


NYHA class of survivors
p = NS
p < 0.05
p < 0.05
100%
80%
60%
40%
20%
0%
95%
97%
15%
25%
10%
20%
IV
III
II
I
No VO
VO
No VO
VO
No VO
VO
Baseline
30 Days
1 Year

Conclusion

- At 1 year, in patients with symptomatic severe AS underwent TAVI and are volume overloaded…
  - There was *slower reduction* of LV mass and LV mass index
  - There was *tendencies* to shift from concentric to eccentric hypertrophy
  - There was significantly higher percentage of patients with NYHA III and IV month and year after TAVI
  - There was significant higher all-cause mortality
- A group of patients *continuously* volume overloaded had worse prognosis