

# Berlin Heart Pediatric Assistance Device: The Beginnings, The Teachings And The Cruising Speed : A Monocentric Experience With The Same System

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# Background

- Long term pulsatile mechanical ventricular assistance device (VAD) as **bridge to Recovery / Transplantation**
- Use of VAD in pediatric population limited by
  - technical issues
  - severe complications (stroke, infection)
- Largest pediatric experience : German group  
*Potapov EV, Stiller B, Herzer R. Pediatr Transpl 2007;11:241-55*
- European experiences: scarce, small-size sample

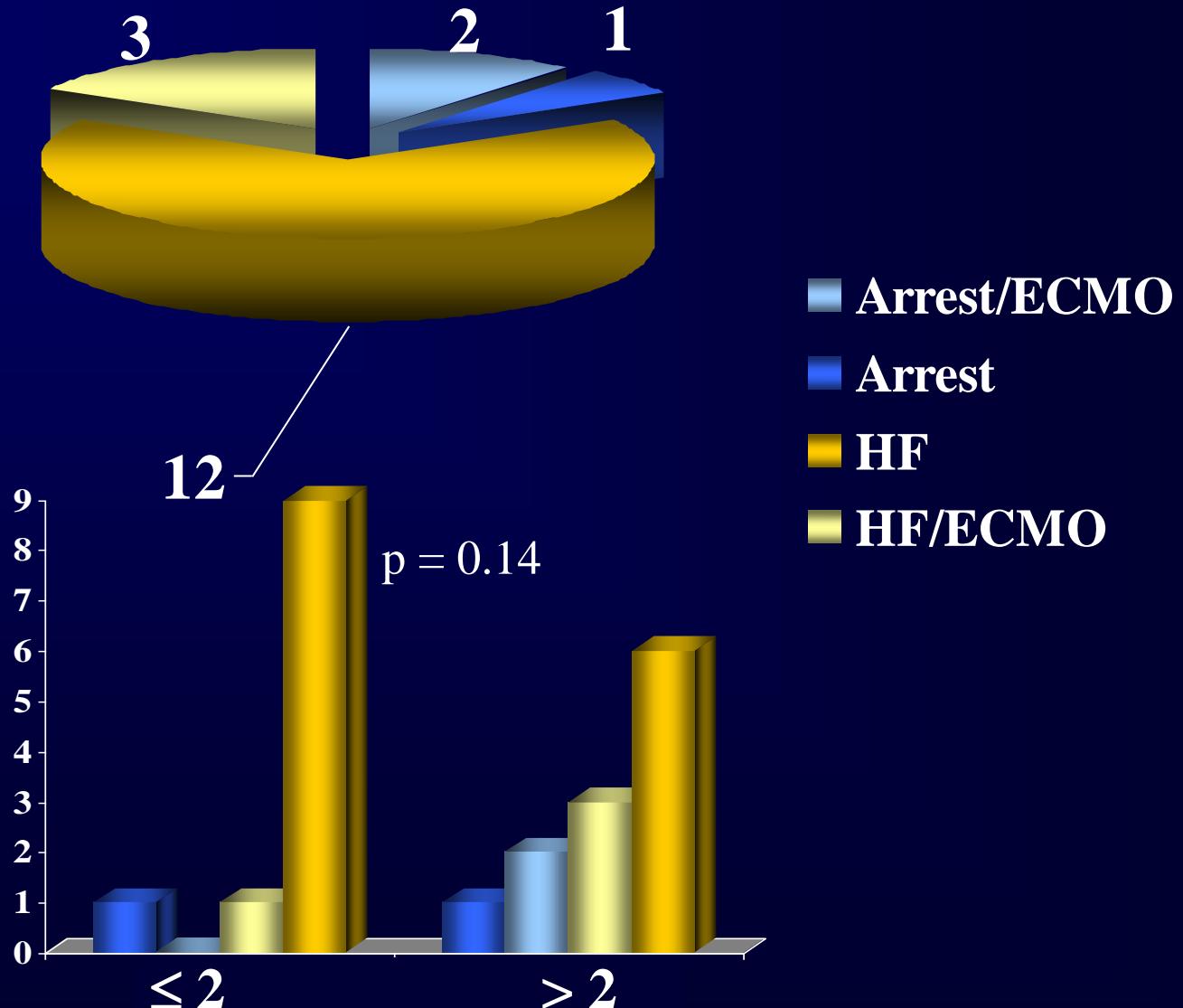
# Objectives

- Report French largest experience with Pediatric VAD
- Single center : Lyon University & Medical Center
- Onset of Lyon Pediatric VAD Program : 2005
- Patients less than 18 years of age at VAD implantation
- **Assess**
  1. short and mid-term outcomes after VAD implantation
  2. report challenges (mainly anticoagulation, infection, organ shortage) faced at initiation of a VAD program.

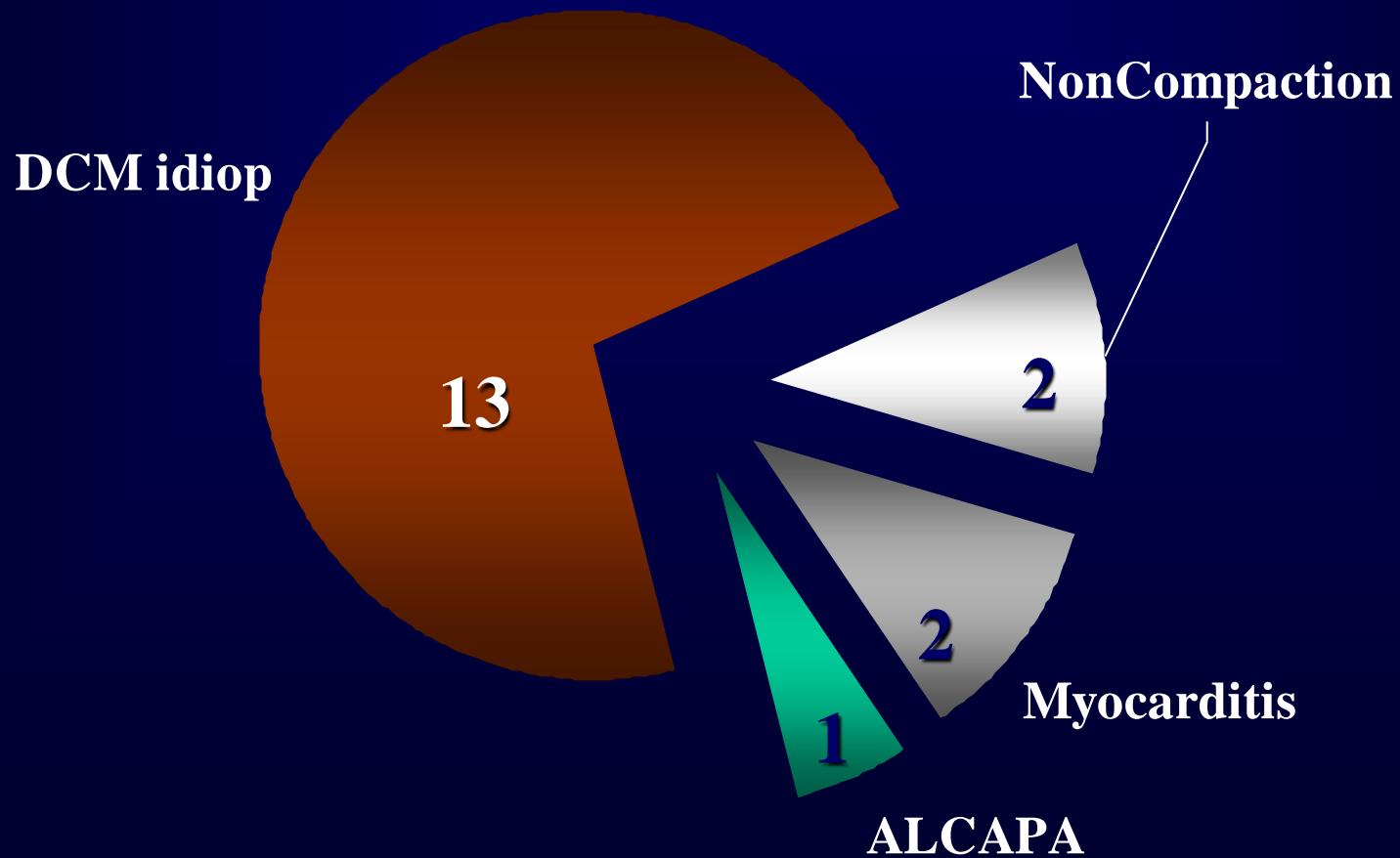
# **Population**

- From april 2005 to april 2011
  - N = 18
  - M / F : 10 / 8
- Age at VAD : **1.83 years [0.25-13]**
  - Patients <2 years: 9
- Weight at VAD :**10.5 kg [4.5-34]**

# Indication



# Cardiac Disease



# Pre-VAD Period

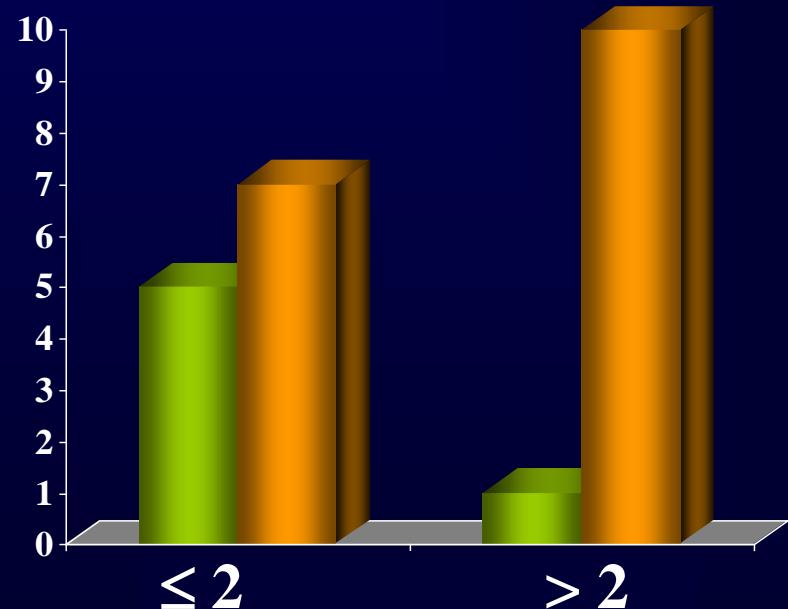
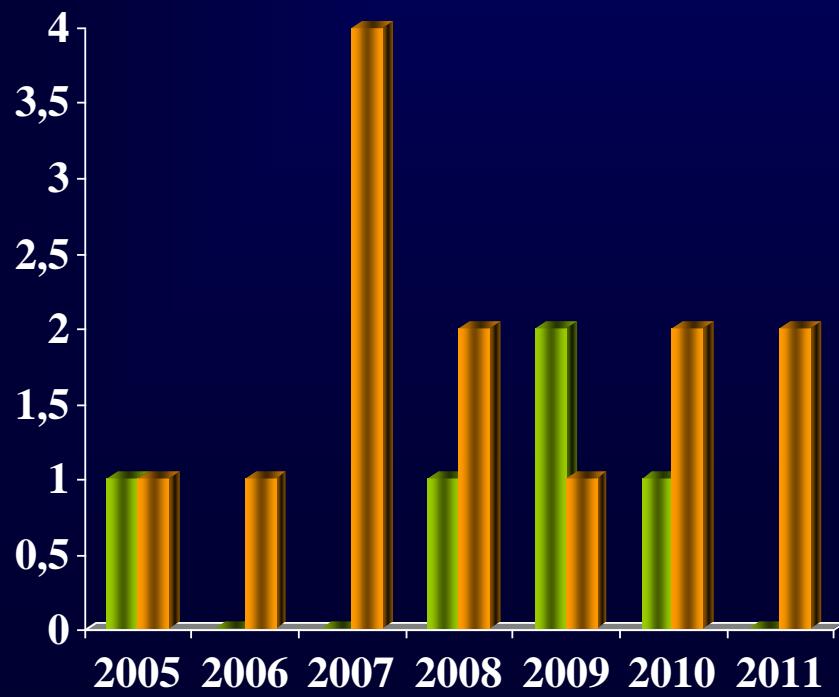
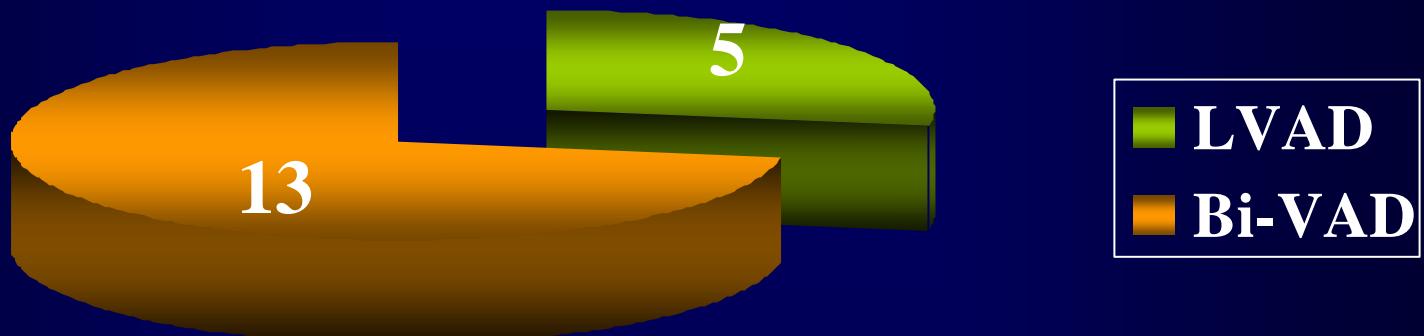
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Mechanical ventilation (patients)	13/18 (72.2%)
Median duration of ventilator support, days	8 (1-45)
ECMO support (patients)	5/18 (27.8%)
Median duration of ECMO support, days	7 (6-15)
Cardiac arrest pre-VAD (patients)	3/18 (16.7%)
Median time from hospitalization to VAD, days	14 (1-56)
Median time from diagnosis to VAD, days	45 (1-1014)

# Pre-VAD status

Variable	Mean	SD	Min/Max	Median
LVEF %	20.7	7	8 / 30	20.5
LVSF %	12.73	4.5	4 / 23	12.5
VTI (cm)	7.41	2.1	3 / 11	8
Creat ( $\mu\text{M/l}$ )	72.7	28.3	35 / 119	66.5
Bili ( $\text{Mm/l}$ )	31.9	22.5	6 / 85	13
ProthrTime %	51.2	14.5	32 / 80	49
Factor V %	61.2	26.4	16 / 100	62
pH	7.40	0.1	7.30 / 7.50	7.40
Lactates mM/l	3.3	2.9	0.8 / 11	2
SvO2 %	46.7	14.3	28.6 / 68	34.5

# Mode of VAD



# VAD-Duration of supports

	<b>Total</b>	<b>≤ 2y</b>	<b>&gt; 2y</b>	<b>p</b>
<b>Mech Ventil (days)</b>	$10 \pm 9.5$ 2 to 37 med 7	$11.6 \pm 11.1$ 3 to 37 med 7	$8.5 \pm 8.6$ 2 to 29 med 6	0.54
<b>Inotrope (days)</b>	$8.4 \pm 8.2$ 1 to 31 med 7	$8.6 \pm 4.5$ 1 to 14 med 9	$8.1 \pm 11.3$ 1 to 31 med 4	0.92
<b>NO (days)</b>	$8.5 \pm 8.5$ 2 to 29 med 6.5	$4.7 \pm 2.2$ 2 to 7 med 5	$12.2 \pm 11.3$ 4 to 29 med 8	0.24
<b>Extubation</b>	18/23 78%	7/12 58%	10/11 90%	0.1

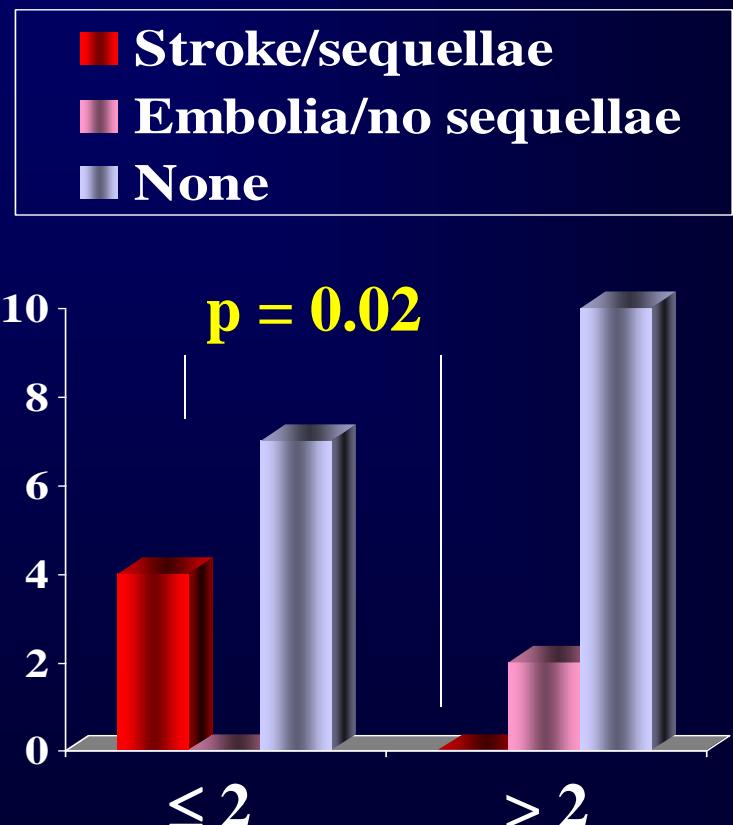
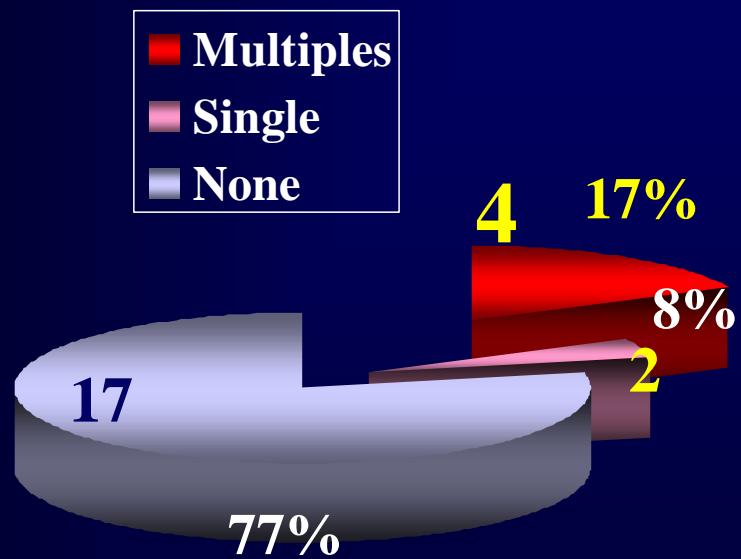
# Protocol for Anticoagulation

- **Heparine initiated at H-3 postop : 400UI/kg/d**  
Control : tid (0.25 – 0.35)
- **Antithrombin III if < 60%**
- **Antiplatelets agents : aspirin bid 2,5 à 5 mg/j/kg**  
Test for platelet aggregation , Thromboelastogram
- **AVK if VAD > 1 month (INR 3 to 3.5)**
- **If needed : add other APA**  
Dipyridamole and/or Clopidogrel

# Evolution through experience

	2005-2007	2007-2009	2009-2011	
patient	5	6	7	
median age	3.2 (0.6-12.8)	2.5 (0.3-6.0)	1.1 (0.5-9.9)	p=0.84
infants (<2years)	2 (40%)	3 (50%)	4 (57%)	p=0.85
median weight	10 (5-35)	13.7 (5-19)	9 (4-22)	p=0.63
infants (<10kg)	1 (20%)	2 (33%)	4 (57%)	p=0.43
Median duration of VAD support(days)	37	36	31	p=0.97
significant TE event	1 (20%)	2 (33%)	1 (14%)	p=0.59
VAD pump change (patients)	0	4	2+1*	p=0.09
Mono-LVAD	1 (20%)	1 (16%)	3 (43%)	p=0.54
Reexploration for bleeding	3 (60%)	2 (33%)	1 (14%)	p=0.27
Median VAD time before HTx (days)	41 (15-66)	46 (35-57)	22.5 (10-182)	p=0.72
death while on VAD support	0	3	1	p=0.13
Mean Donor/Recipient ratio for HTx ± SD	1.5±0.8	2±1.4	1.9±0.8	p=0.81

# Strokes / Embolic events



# ENFANT EXTUBE

- Surveillance de l'hémostase



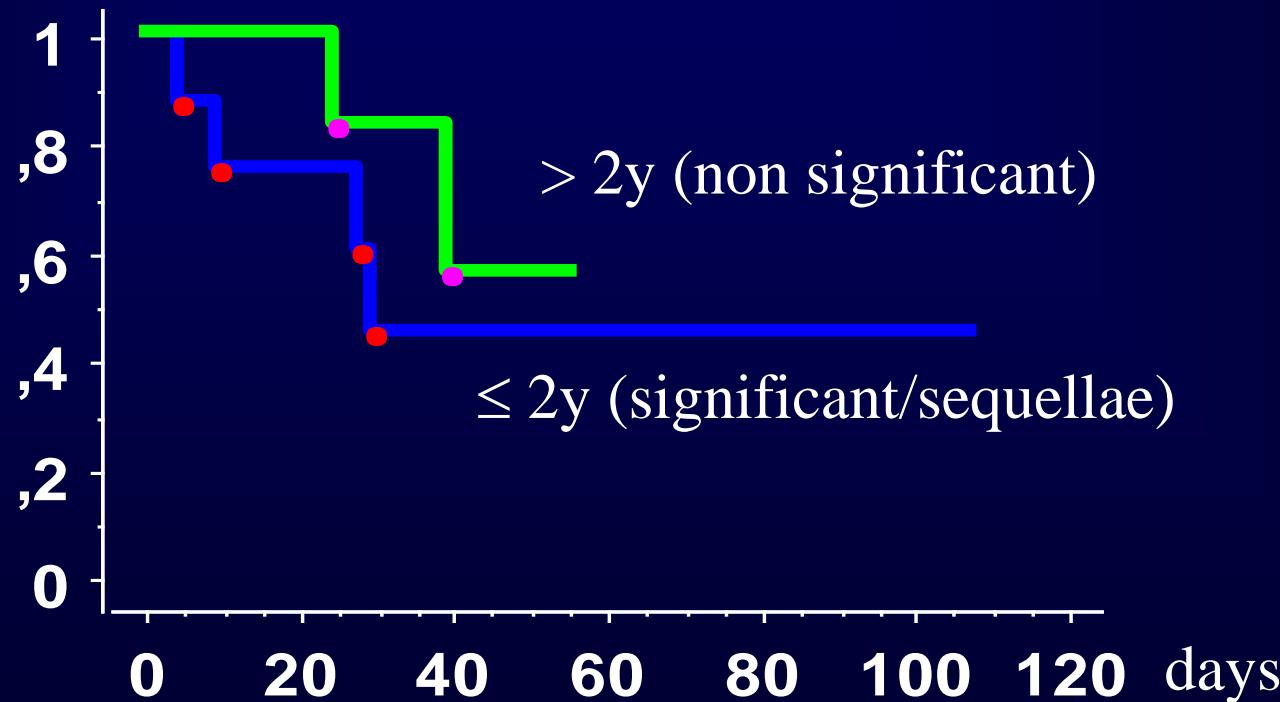
# ENFANT EXTUBE



# Strokes / Embolic events

**Time to first significant stroke**

$18.2 \pm 12.6$  days, med 19 (5 to 30)



<b>OTHER EVENT</b>	<b>TOTAL</b>	$\leq 2 \text{ y}$	$> 2 \text{ y}$	<b>p</b>
<b>Infection</b>	<b>10 (43%)</b>	<b>3</b>	<b>7</b>	<b>0.03</b>
Sepsis/ bacteriemia/ Canulas	2 / 2 / 4			
Lung / Urines	1 / 1			
<b>Microbial agent</b>	<b>10</b>			
Staph : Epi / Aureus	6 / 2			
Candida / E.Coli	1 / 1			
<b>Days to infection</b> (med)	$19 \pm 14$ (17)	$19 \pm 11$ (17)	$20 \pm 19$ (15)	0.97
<b>Ventricle change</b>	<b>5 : 21%</b>	<b>4</b>	<b>1</b>	<b>0.1</b>
<b>Days to change-1</b> (med)	$16 \pm 5.6$ (16)	$17 \pm 6$ (16)	<b>13</b>	

# Duration of VAD

- Overall duration

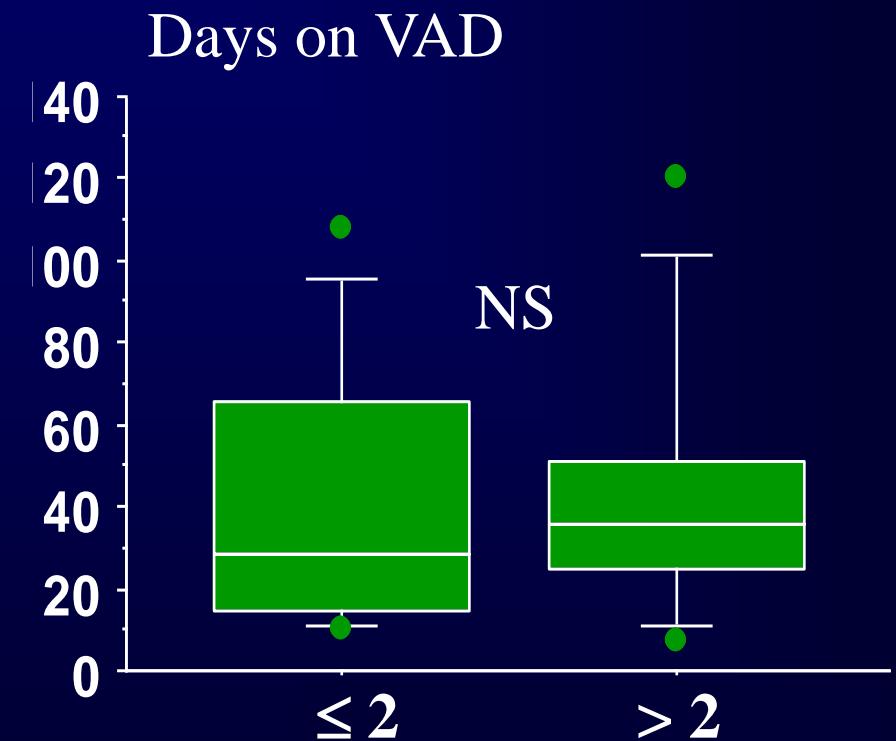
(7- 125) med 37 days

- Time to death

(7- 105) med 42 days

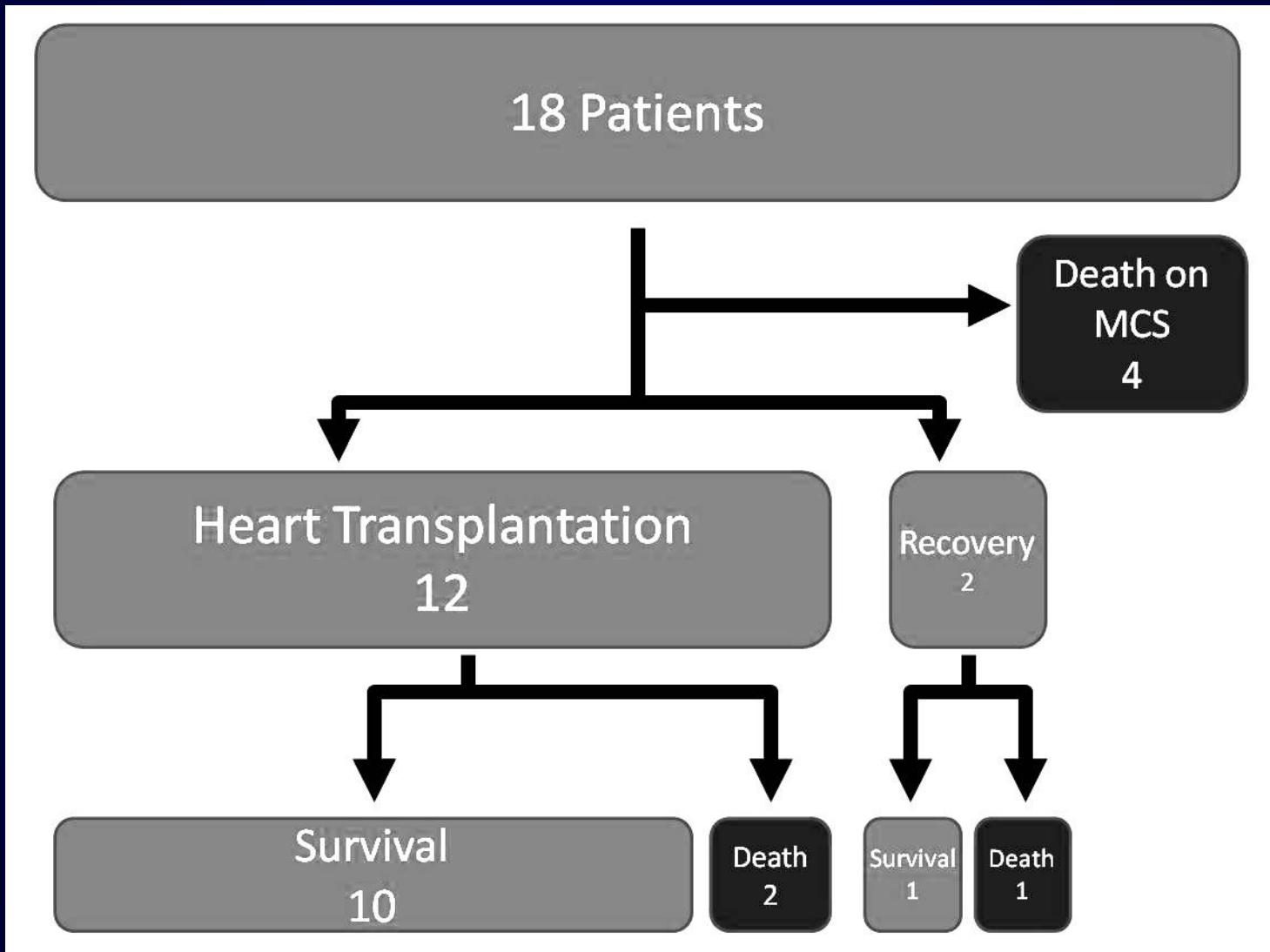
- Time to transplant

(7- 125) med 45 days

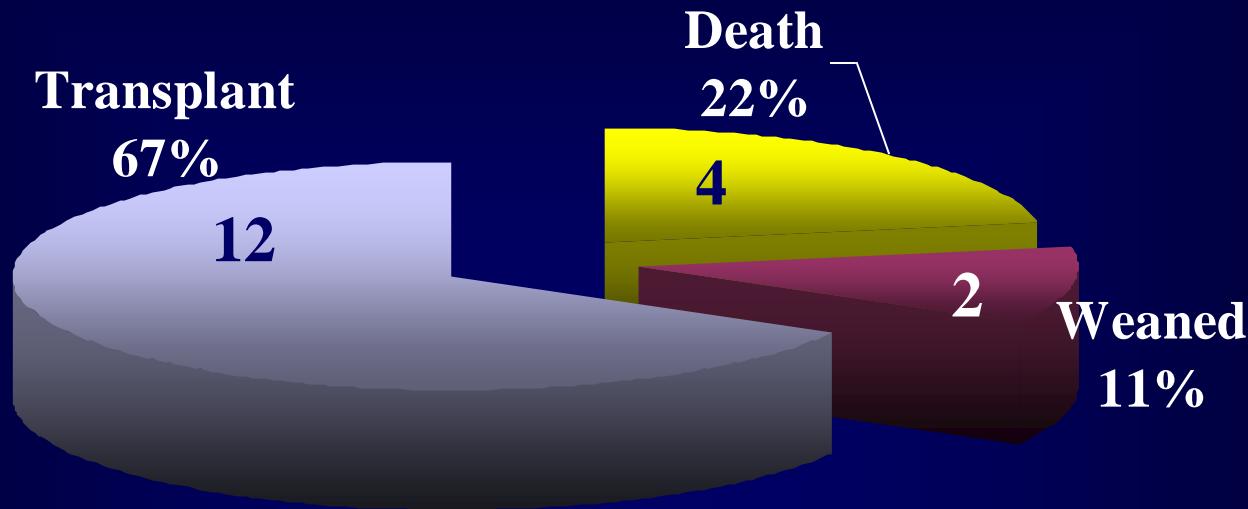


# Outcome after VAD

Global survival:61%



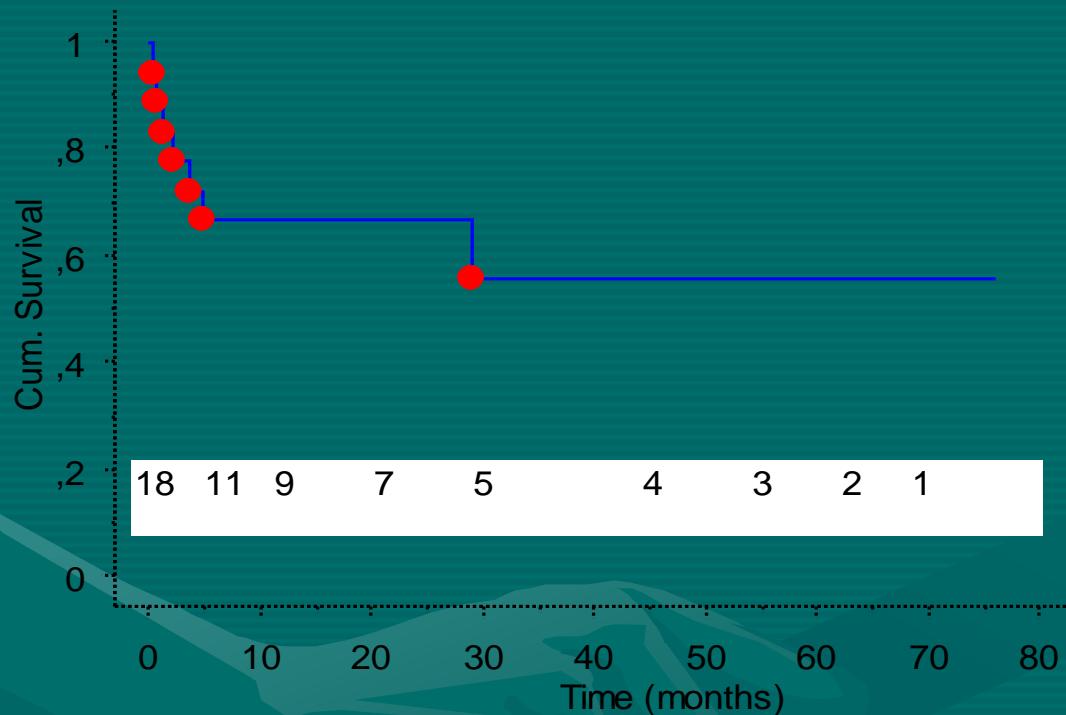
# Termination of VAD



N°	Age at VAD	Duration VAD	Cause of death
10	1 year	23 days	Mutiple embolia
11	0.29 year	60 days	Acute hemorrhage
12	3.5 years	7 days	Sepsis candida
13	1.1 year	108 days	Canula rupture

# Overall survival

FU (mos) = 19 months (4.1 to 72.4)



Survival at 1 month, 1 and 6 years was respectively 89%, 67 % and 55 %

## Post-VAD deaths : 3

- 1st graft dysfunction (day-6)
- Sepsis post-transpl (year-2)
- Uncontrolled VT (month-4)

- Learning period
  - Optimization of indication and timing
  - Choice of mechanical circulatory support type and its good technical execution and finally
  - ICU close monitoring and management
- 
- Stiller B and all.Pneumatic pulsatile ventricular assist devices in children under 1 year of age.  
Eur J Cardiothorac Surg. 2005
  - Sanjiv K and All.Biventricular Assist Devices as a Bridge to Heart Transplantation in Small Children.Circulation.2008

# Conclusion

- **High risk group :  $\leq 2$  years of age at VAD**
  - Thrombo-embolic events
  - Ventricle change
  - Death on VAD
  - But better results with experience
- **Encouraging experience**
  - Survival to VAD : 78%
  - Global Survival : 61%

