Non pharmacological management of acute heart failure

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Types of LVADS used in patients with acute heart failure

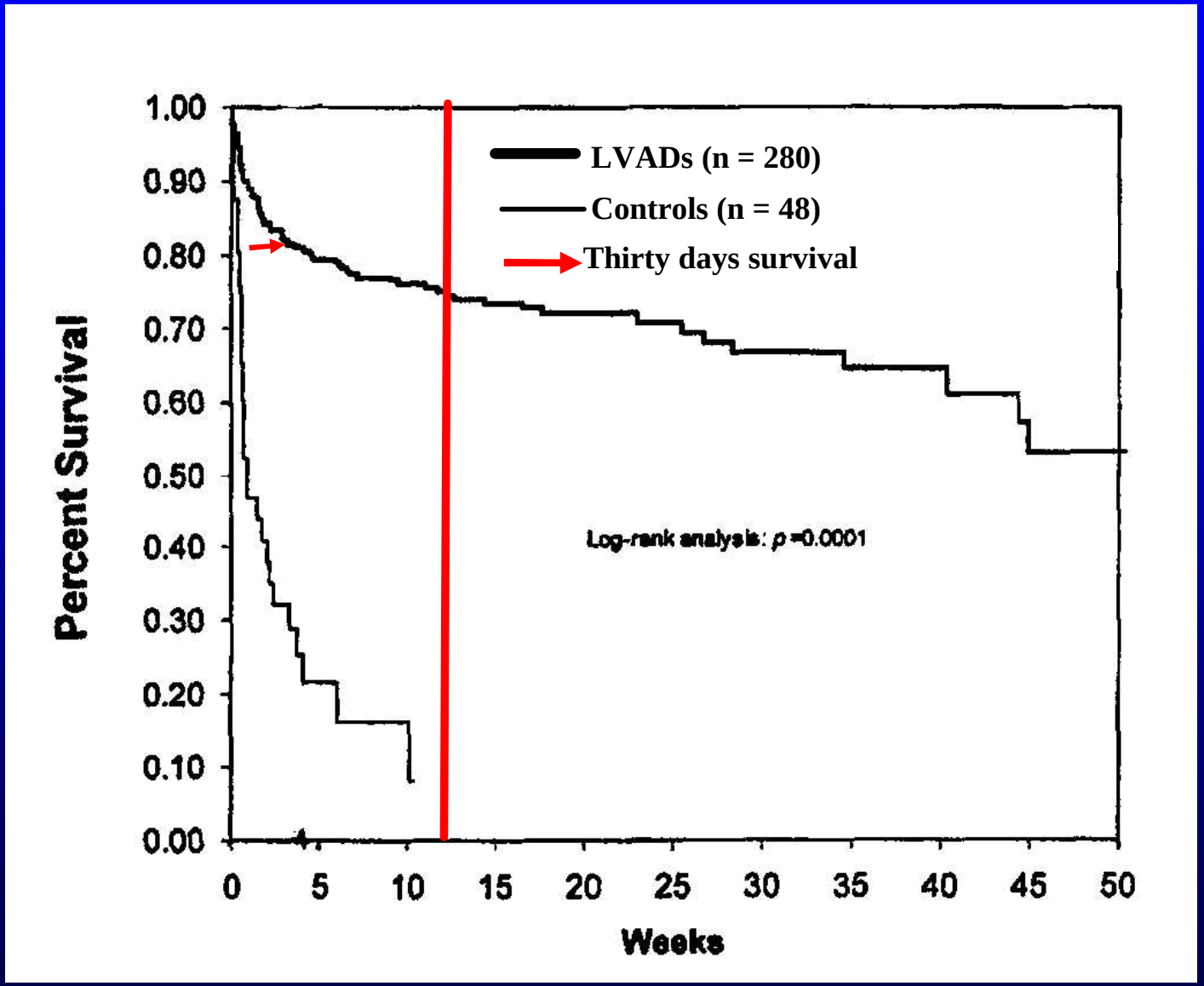
- ✓ **Pulsatile extracorporeal devices:**
  - **Suitable for limited-duration mechanical assistance**
- ✓ **Pulsatile internal devices:**
  - **Suitable for long-term mechanical assistance**

Driving systems:

Pneumatic ⇒ Limiting ambulation

Electrical ⇒ Ambulatory with almost total independence

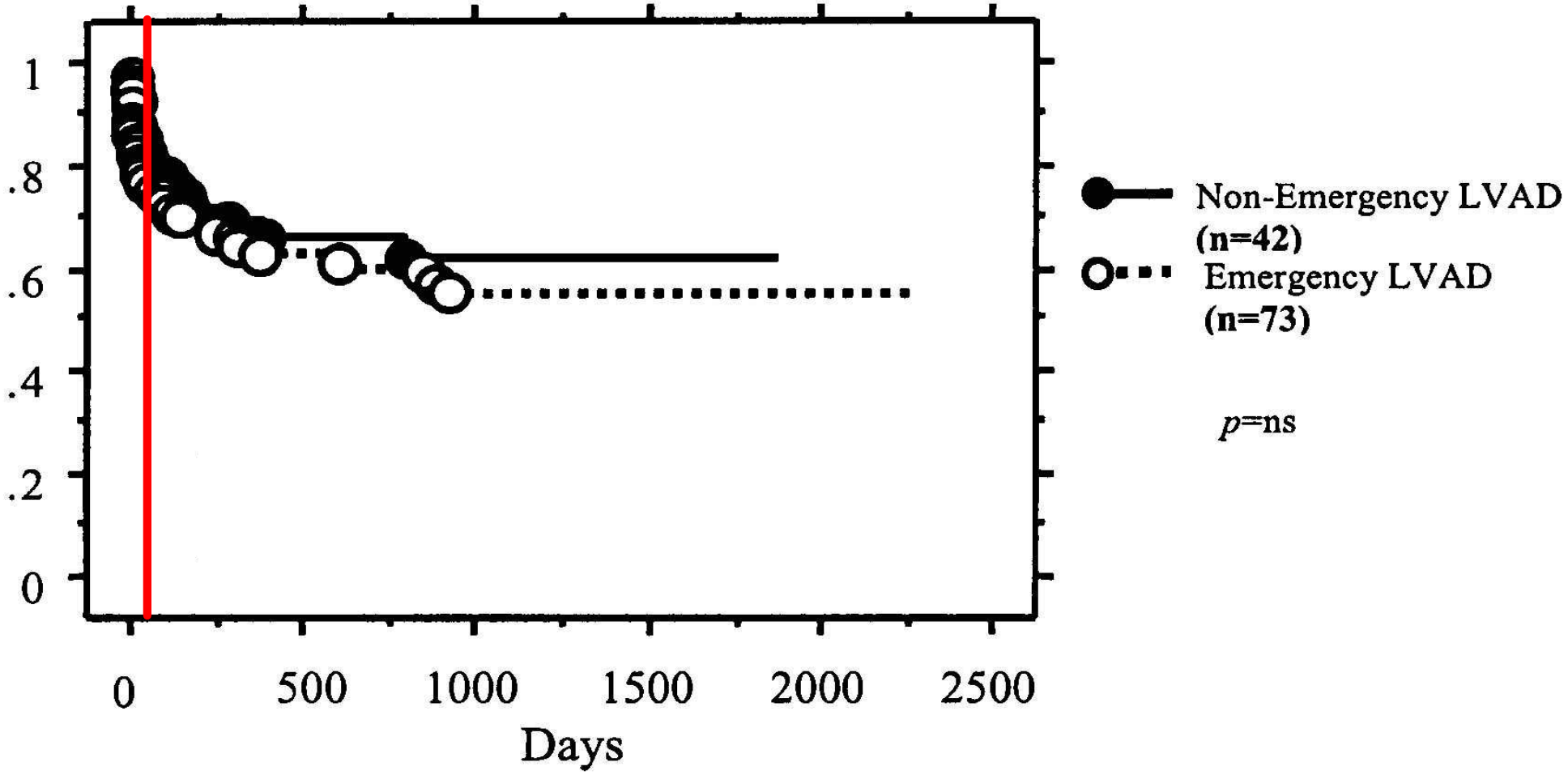
Survival to transplantation of patients supported by LVAD versus control patients (device unavailability or family refusal)



MCS

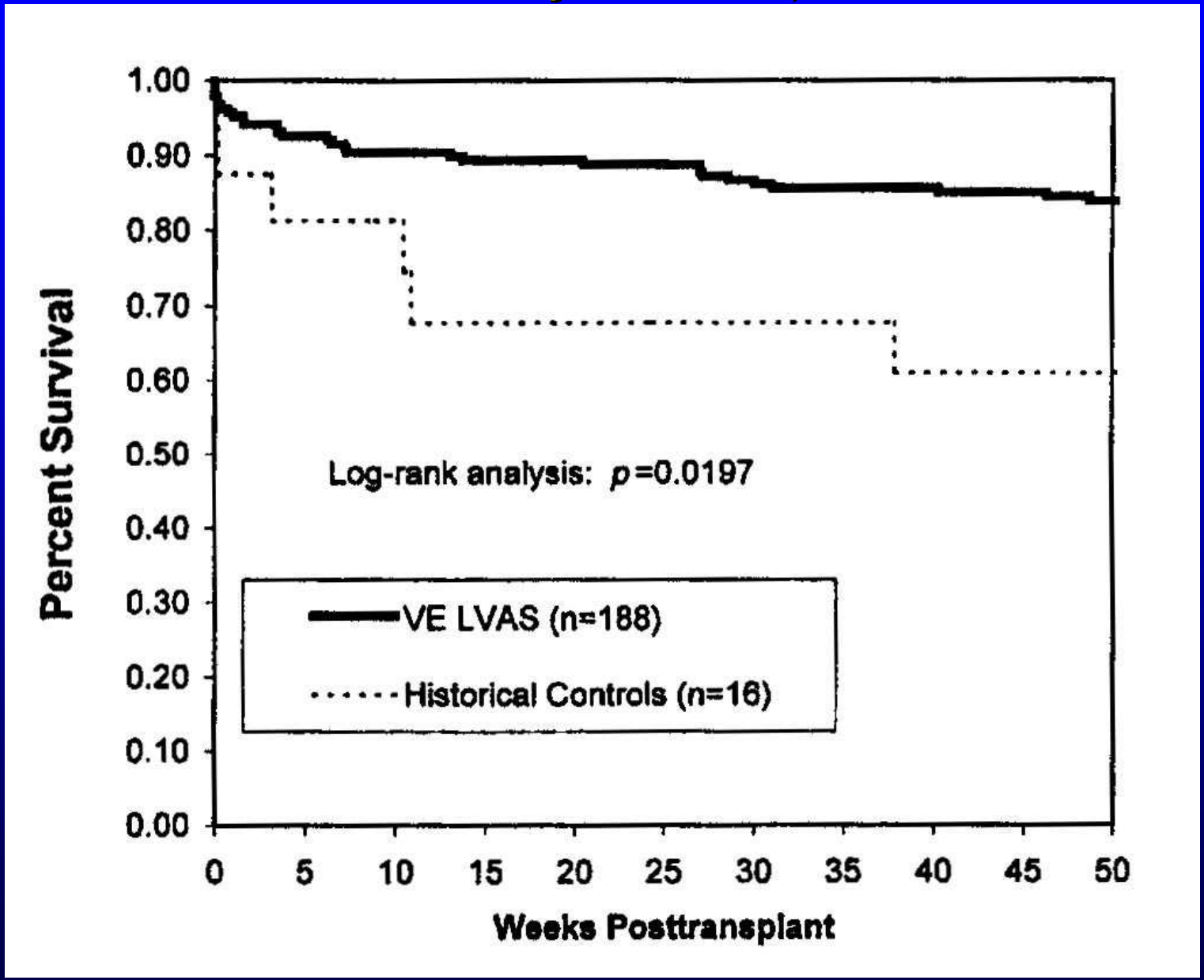
J Thorac Cardiovasc Surg 2001;122:1186--1195

Survival (irrespective of receiving a transplant) of the non-emergency and emergency LVAD recipients



J Thorac Cardiovasc Surg 2003;126:436-441

Post-transplantation survival for LVAD-treated patients versus control (device unavailability or family refusal)



HM - I

J Thorac Cardiovasc Surg 2001;122:1186--1195

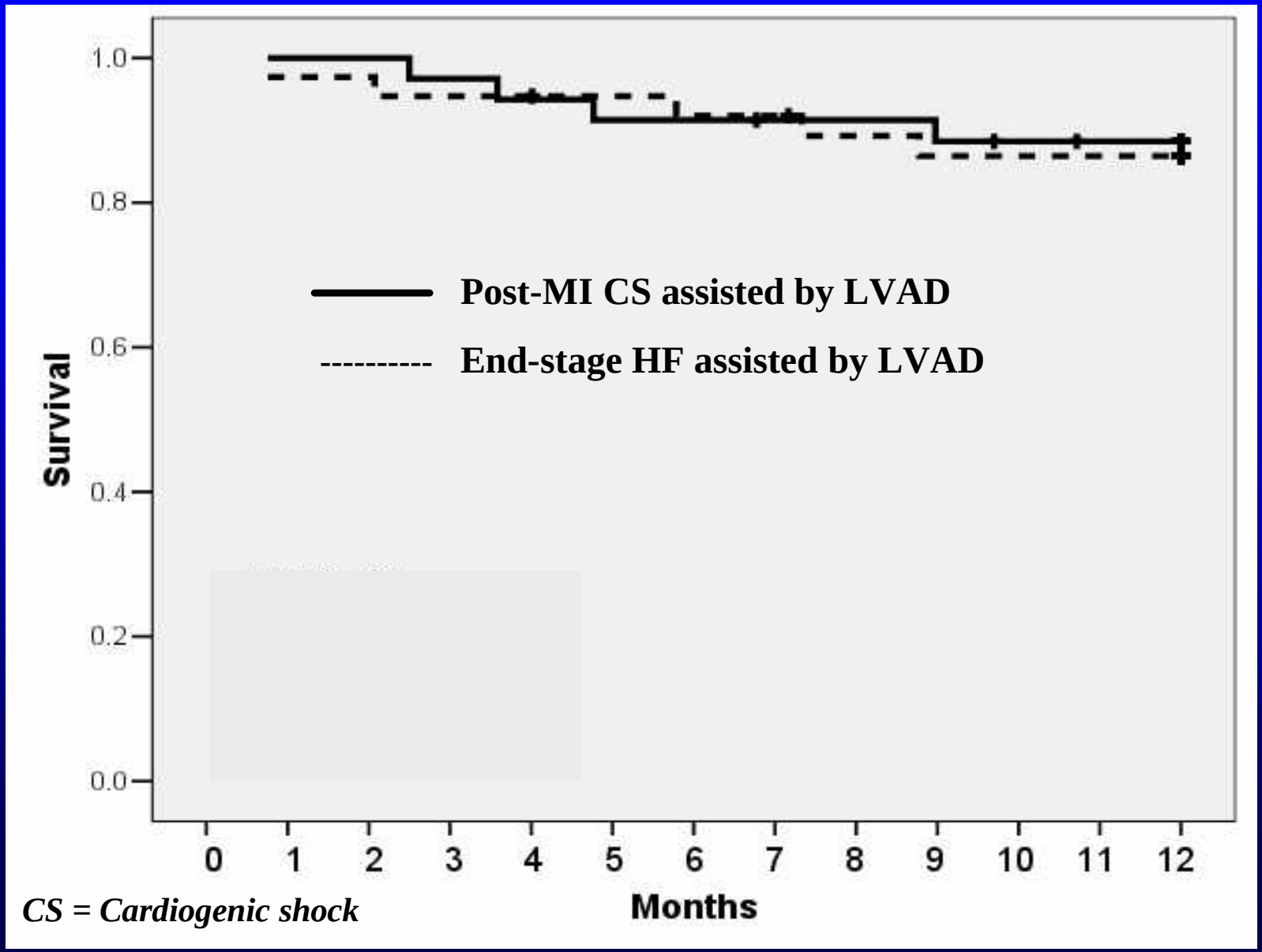
Survival to transplantation of patients assisted by LVADs

Device	No. of Patients	Survival to transplant (%) 1992	1995	2002
Thoratec PVAD	1333	65	63	67
IP	1301	64	66	63
VE	1905	-	-	65
Novacor	1600	63	65	-

IP = implantable pneumatic, PVAD = paracorporeal ventricular assist device,
VE = vented electric

Ann Thorac Surg 2003;75:S66-71

Post-transplantation survival of patients assisted by LVAD either because of intractable post-MI CS or end-stage HF



CS = Cardiogenic shock

Drakos S et al, J Cardiac Failure 2005

Complications in candidates for Tx assisted (n=280) by LVAD

Complication	% of all assisted LVAD patients
Renal dysfunction	56
Bleeding	48
Infection	45
Neurologic dysfunction	27
Thromboembolic events	12
Right heart failure	11
Mechanical failure	1

J Thorac Cardiovasc Surg 2001;122:1186-1195

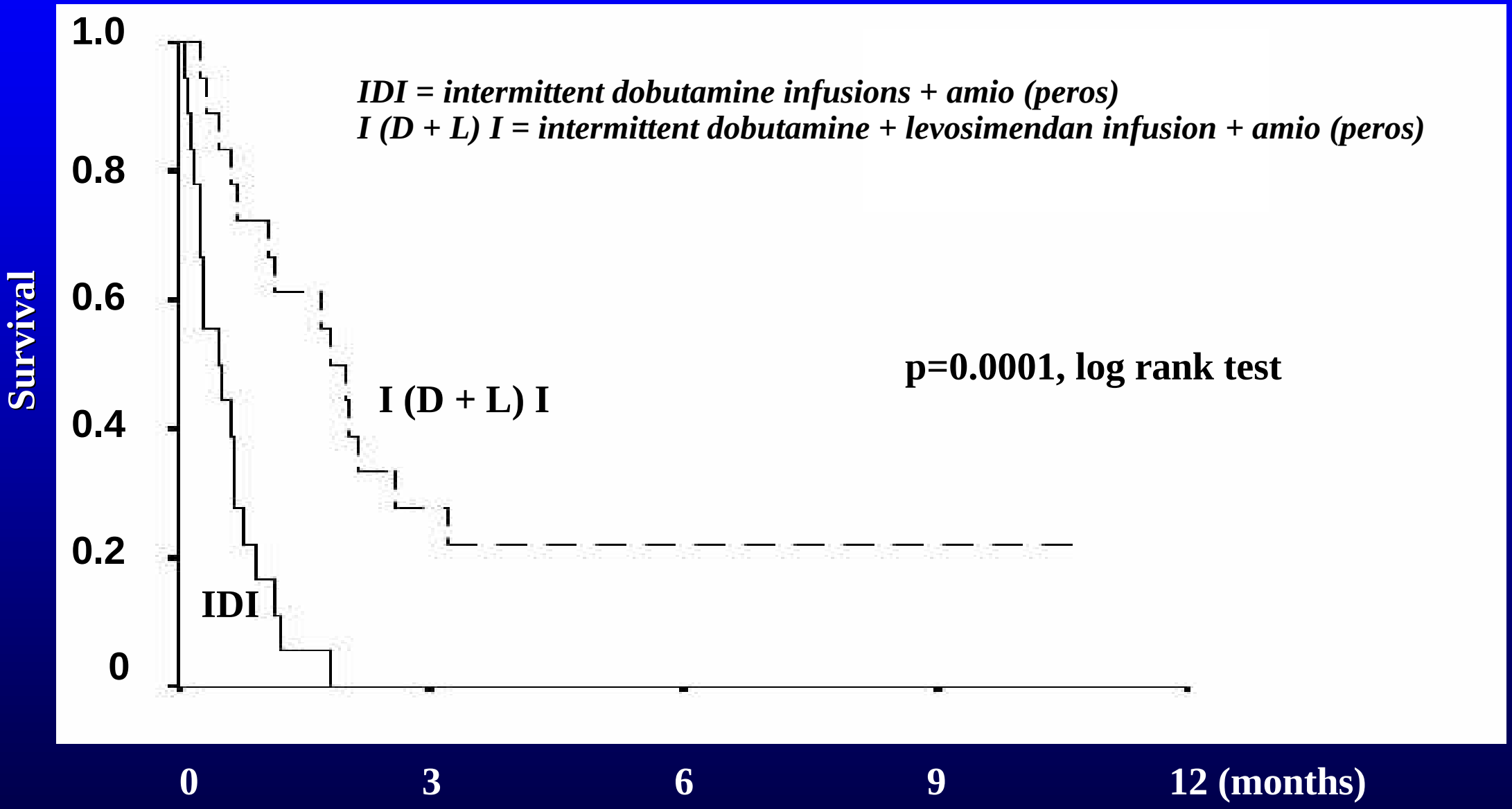
Risk factors in LVAD recipients for poor survival to transplantation

Variable	Hazard ratio	*P* value
Age (range, 11-72 y)	1.03	.0163
Prior heart surgery	1.69	.0366
Baseline creatinine (range, 0.4-8.9mg/dL)	1.38	.0005
Baseline total bilirubin (range, 0.1-23.0 mg/dL)	1.08	.0043

J Thorac Cardiovasc Surg 2001;122:1186-1195

HM -I

Long term survival of acute decompensated end-stage HF intractable to initial 24 hrs aggressive treatment including inotropes



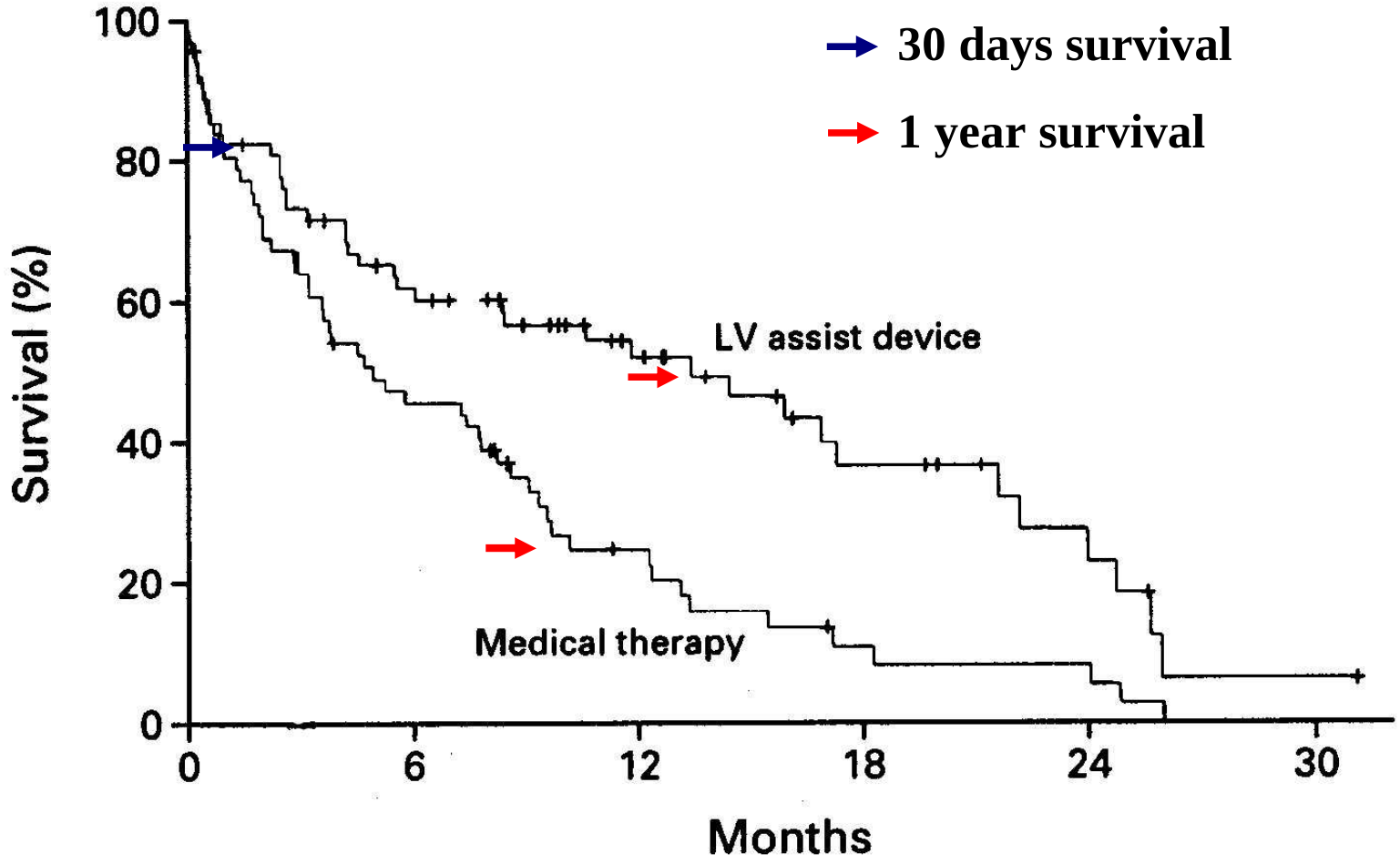
Nanas JN et al, Am J Cardiol 2005;95:768

Benefits and risks of LVAD implantation as a bridge to transplantation

Benefits	Risks
✓ Increased survival to transplantation	✓ High perioperative mortality rate
✓ Increased post-transplantation survival	✓ High frequency of complications
✓ Improved quality of life	✓ Unpredictable outcome for an individual patient

(Compared to inotrope dependent patients)

Survival of end-stage HF supported by LVAD versus medically treated patients



No. at Risk						
LV assist device	68	38	22	11	5	1
Medical therapy	61	27	11	4	3	0

REMATCH study, N Engl J Med 2001;34:1435

Survival benefit in end – stage HF randomized studies

Study (Therapy)	Control vs therapy 1 year survival (%)	Relative Benefit, %	Absolute benefit No, Patients/100
SOLVD (ACEI) *N Engl J Med 1991;325:293-302*	86 vs 89	3.5	3
CONSENSUS (ACEI) *N Engl J Med 1987;316:1429-35*	38 vs 55	45	17
COPERNICUS (β-blocker) *N Engl J Med 2001;344:1651-8*	81.5 vs 89	9	7.5
RALES (spironolactone) *N Engl J Med 2002;346:1845-53*	75 vs 83	11	8
REMATCH – (LVAD) *N Engl J Med 2001;345:1435-43*	25 vs 52	108	27

Circulation 2003;108:3059-63

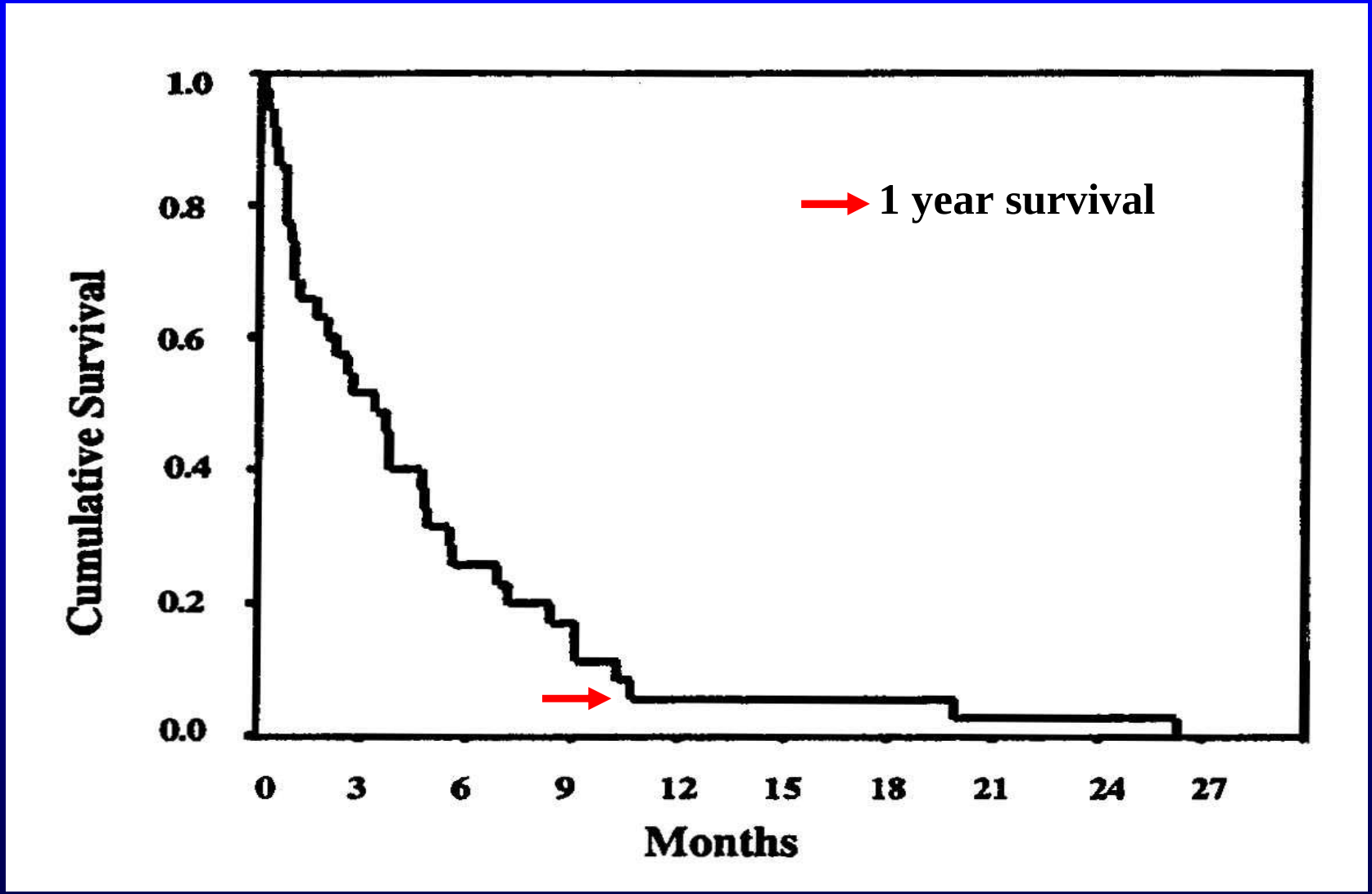
Usual causes of death in patients assisted by LVAD in the *REMATCH study*

Cause of death	LVAD group
	% of the total deaths
Sepsis	42
LVAD Failure	17
Non-cardiac	12
Cerebrovascular disease	10
Pulmonary embolism	5
Perioperative bleeding	3
Total	89

In the medical therapy group, 92% of the total deaths were due to LV dysfunction

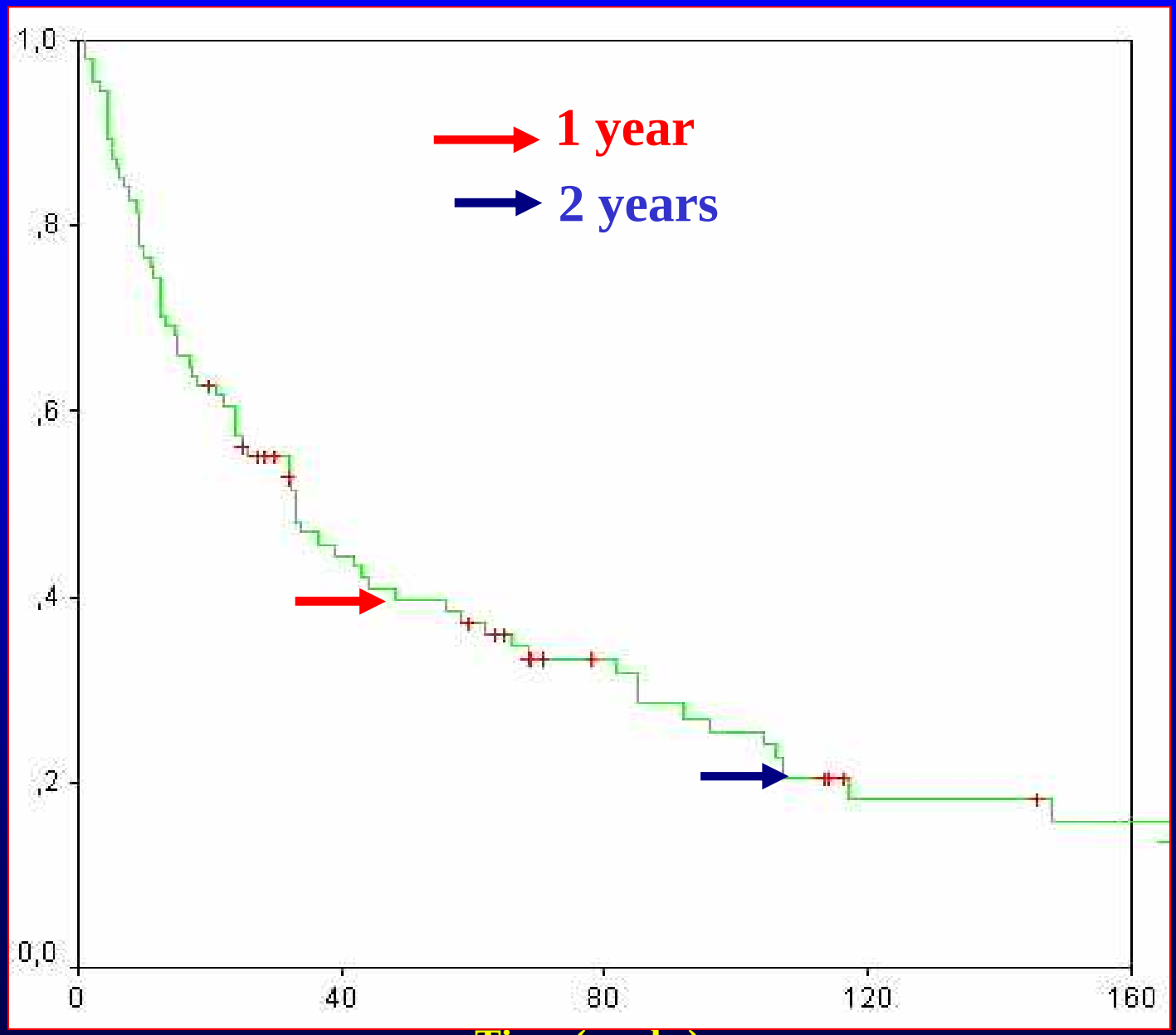
NEJM 2001;345:1435-1443

Survival of patients with persistent decompensated HF dependent on inotrope infusion



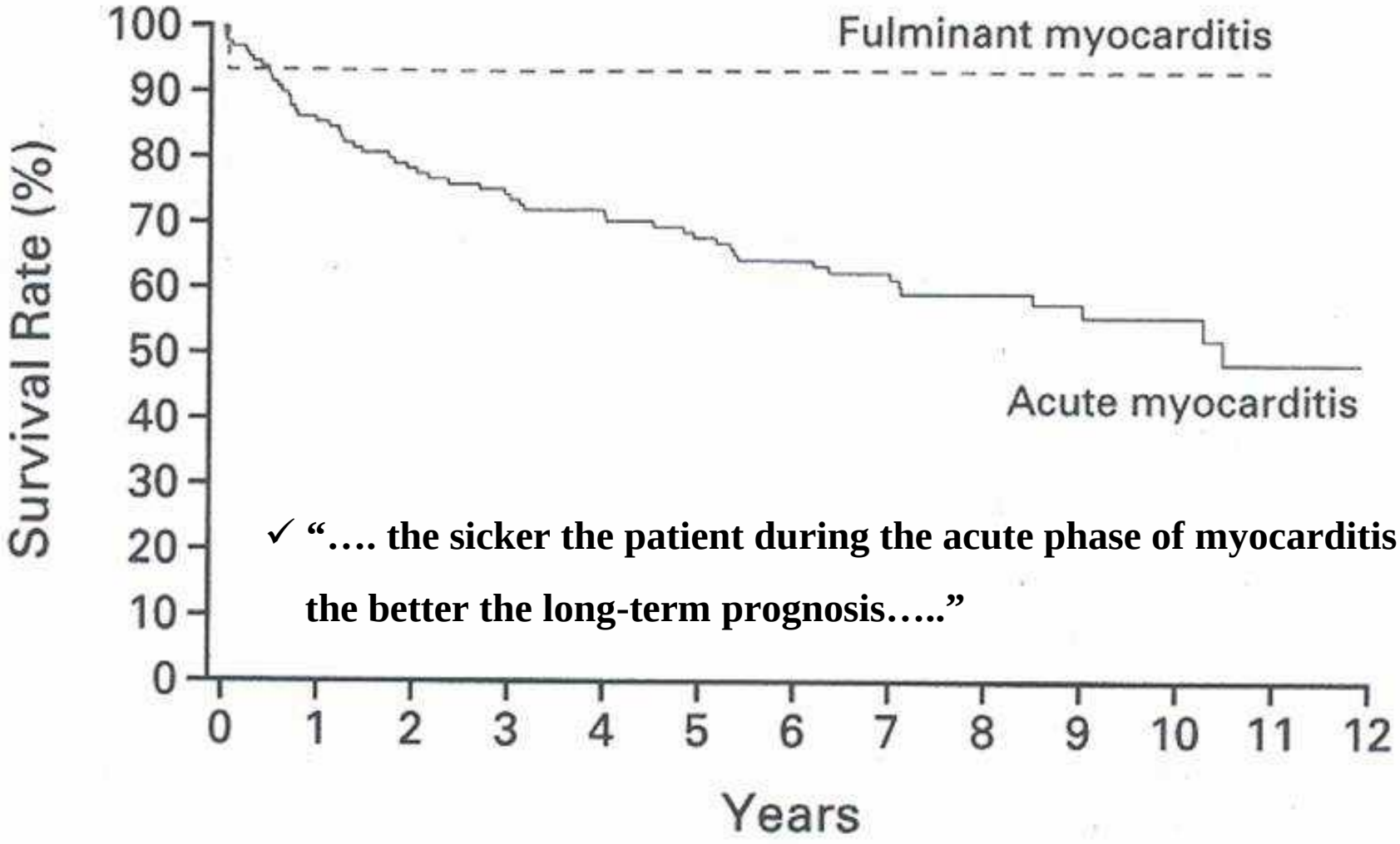
J Cardiac Failure 2003;9:180-187

Survival of patients (n=101) with acute decompensated end stage HF clinically responded to initial 24-72 aggressive treatment including inotropes



J. Nanas, Dept Clin Therapeutics, University of Athens, Athens, Greece (Unpublished Data)

Transplantation-free survival in patients with fulminant and acute myocarditis



✓ **"…. the sicker the patient during the acute phase of myocarditis the better the long-term prognosis….."**

NEJM 2000;342:690-95

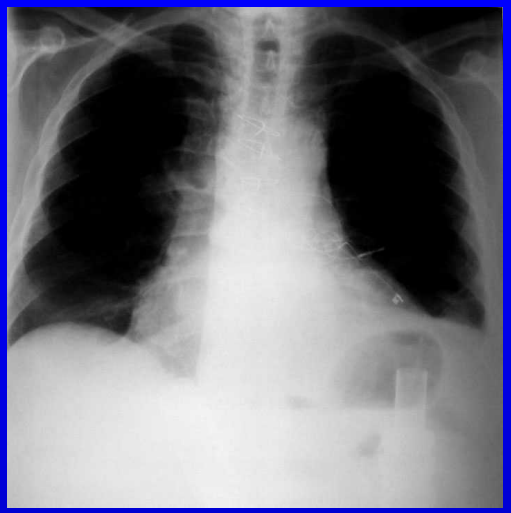
Brief History and Hemodynamics of patients with fulminant myocarditis complicated by CS

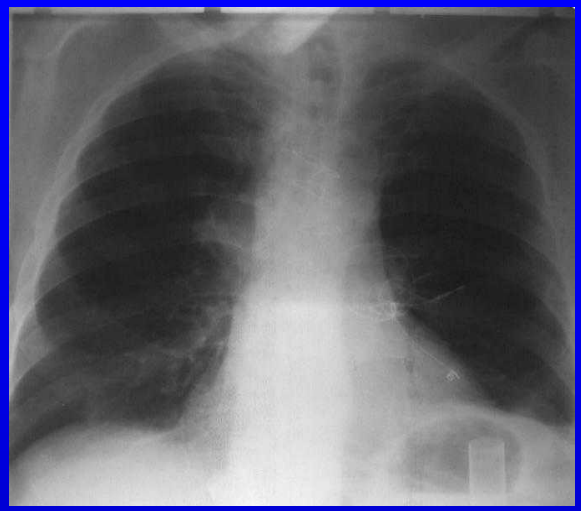
Dept of Clin Therapeutics, Univ of Athens

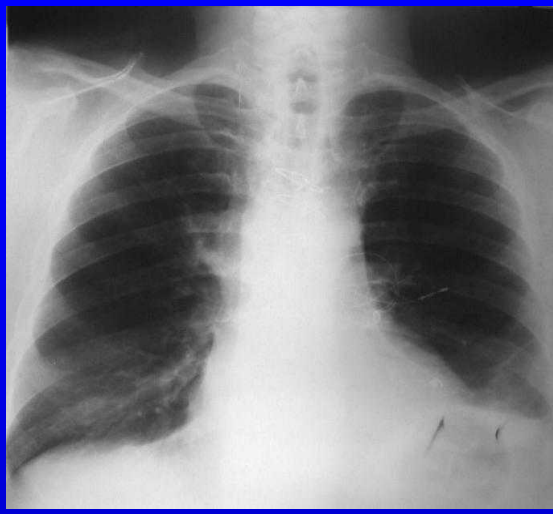
	Patient #1	Patient #2
Sex	F	F
Age	48	43
HR (bpm)	125	120
BP (mmHg)	90/60	100/80
LVEF	23%	36%
EMB	AM	AM
RAP (mmHg)	9	13
PCWP (mmHg)	15	25
CI (L/min/m^2)	2.0	2.1
Treatment	IABP + I + MV	IABP + I $\Rightarrow$ LVAD
Outcome	Alive	Death

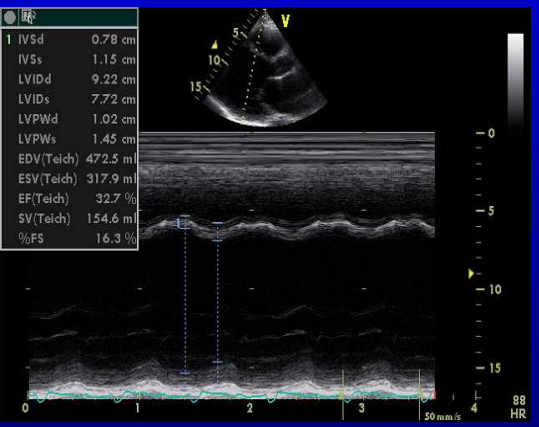
AM = Acute myocarditis, I = Inotrope, EMB = Endomyocardial biopsy, MV = Mechanical ventilation, CS = Cardiogenic shock

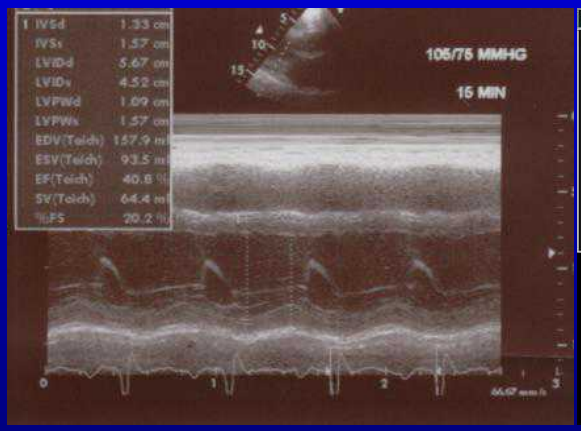
1st 2nd 3rd 4th

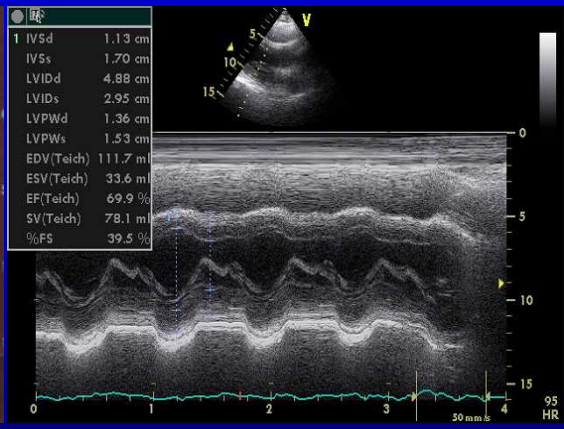












Pre-implantation

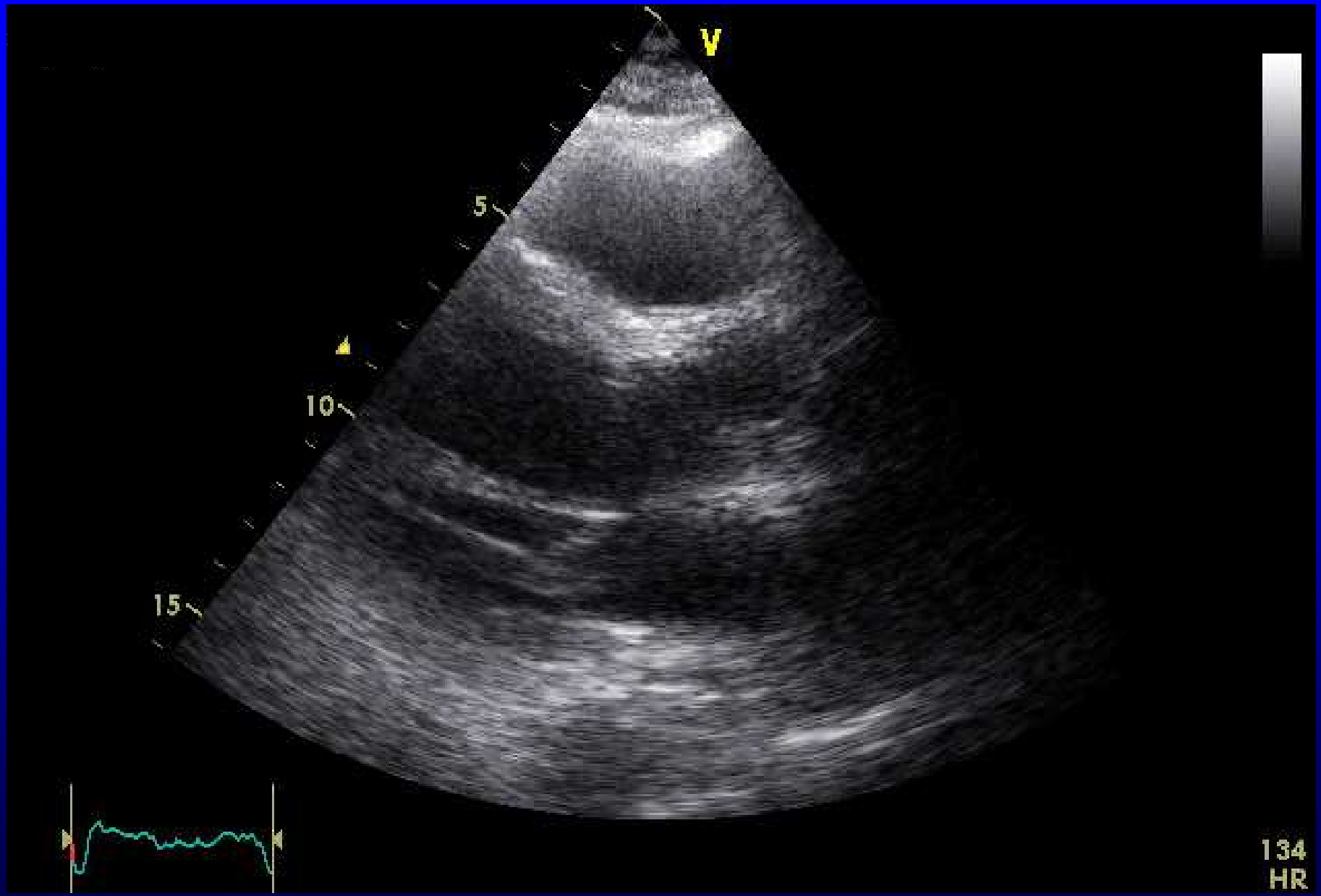
8 weeks post implantation, pre-clenbuterol initiation, LVAD off 15 min

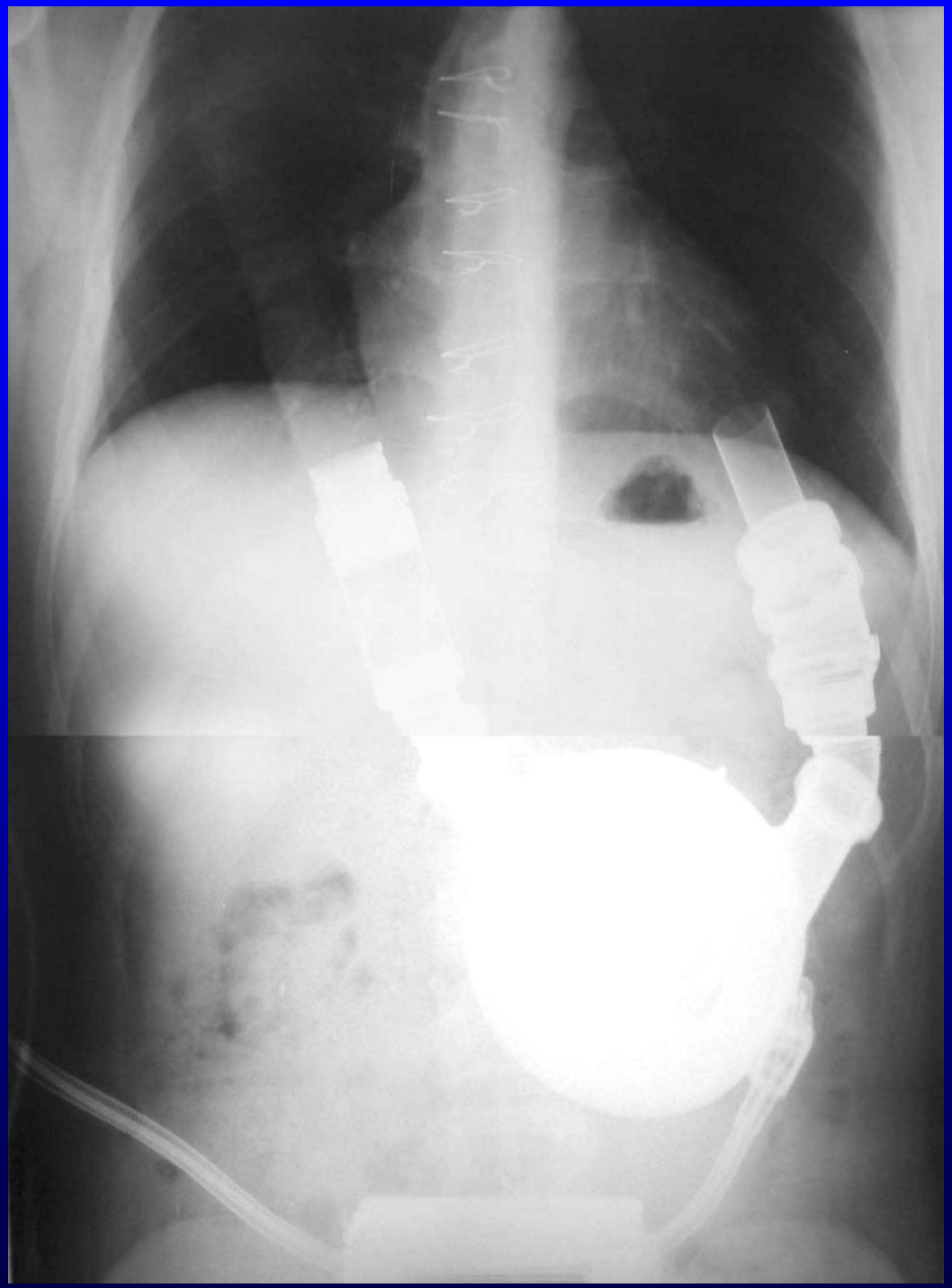
14 weeks post implantation, 6 weeks on clenbuterol, LVAD off 15 min

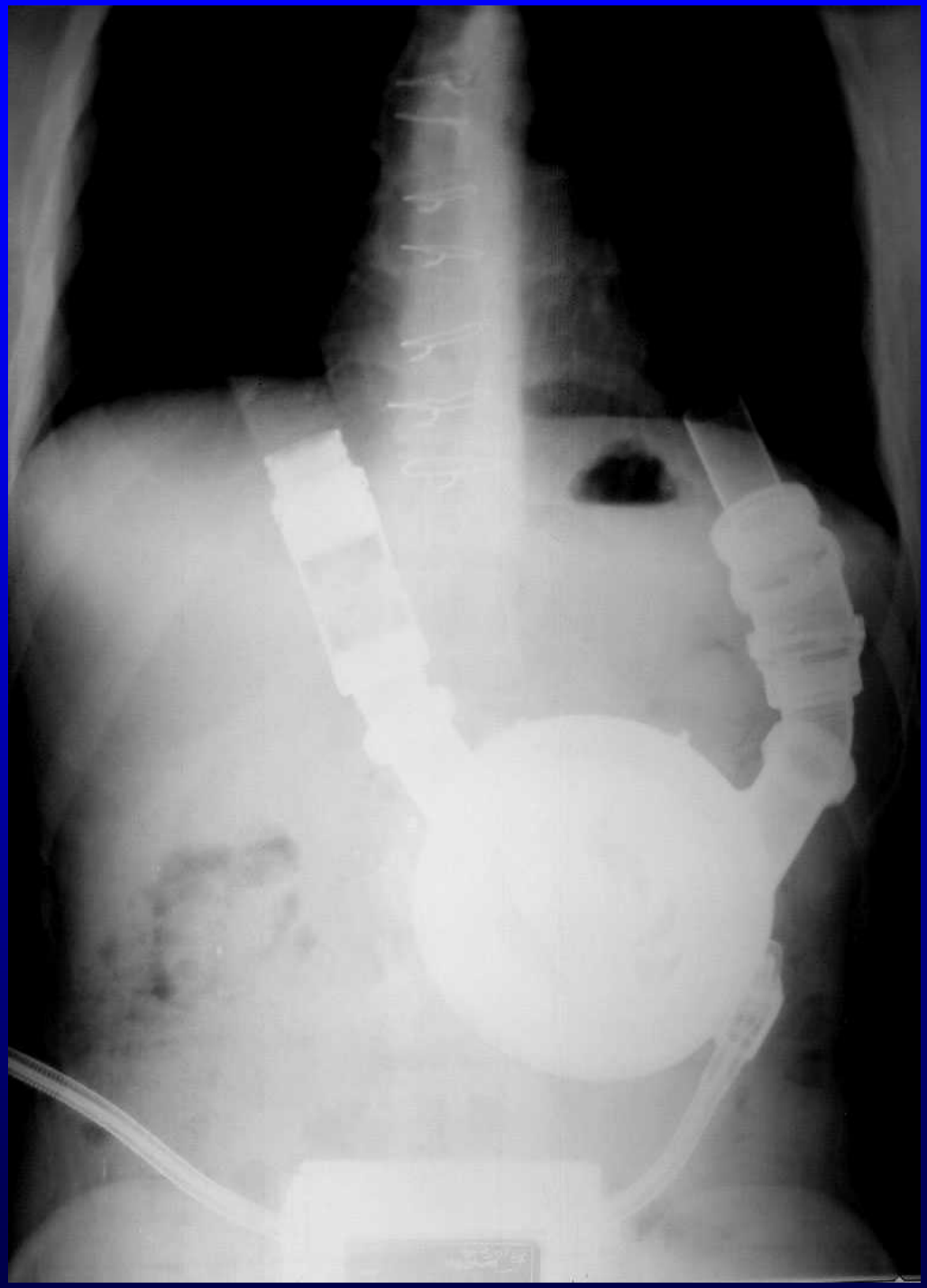
6 months post- explantation

Harefield *(Prof M Yacoub)* – Athens *(Dr S Theodoropoulos/Prof J Nanas)* Recovery Program (HAPR)

Post-explantation







Problems that need to be solved

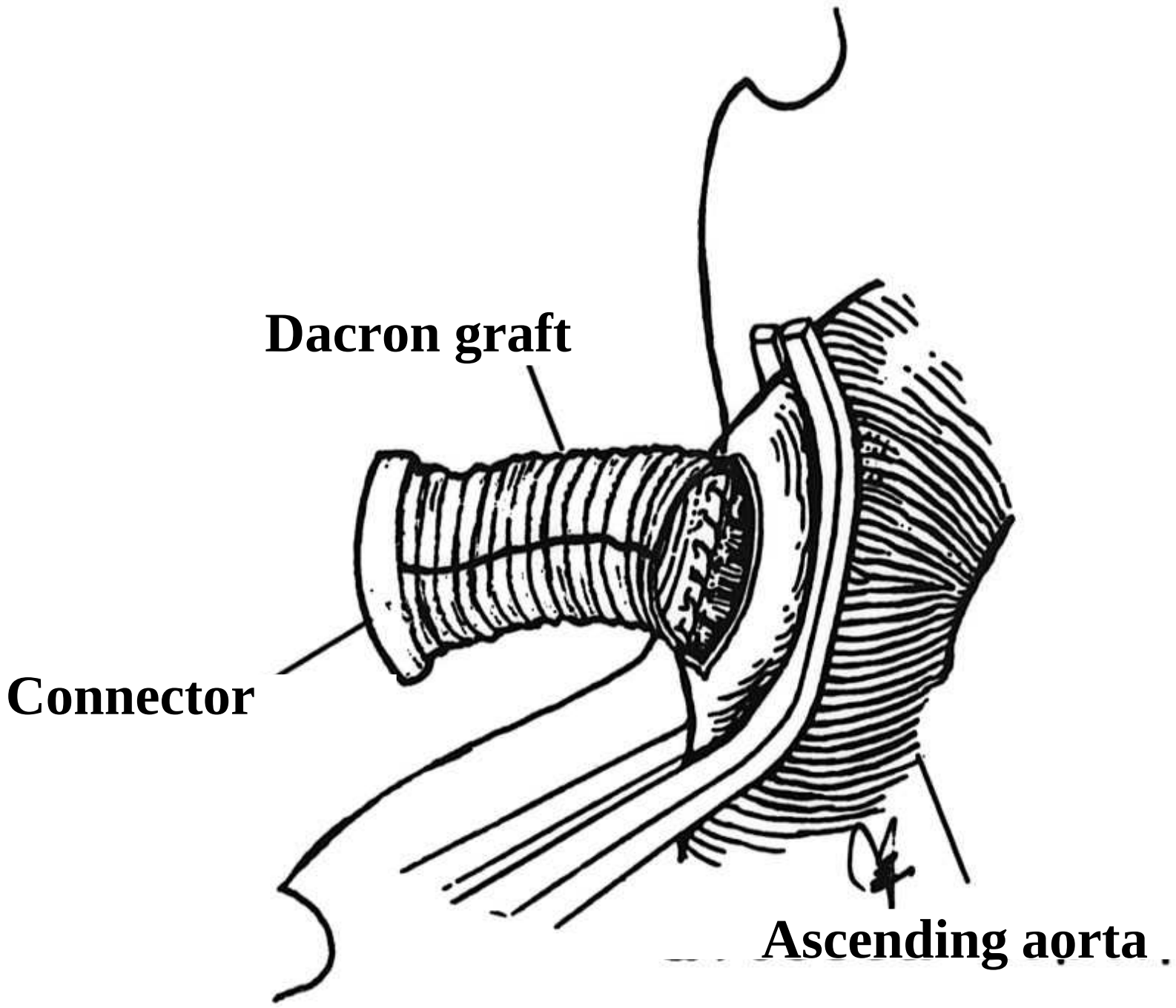
- High peri-operative mortality rate even in experienced surgical teams
- High frequency of complications in specialized centers
- Large number of potential candidates > 150000 (Europe + USA)
- Need for more than 3000 centers (Europe + USA)

New Directions

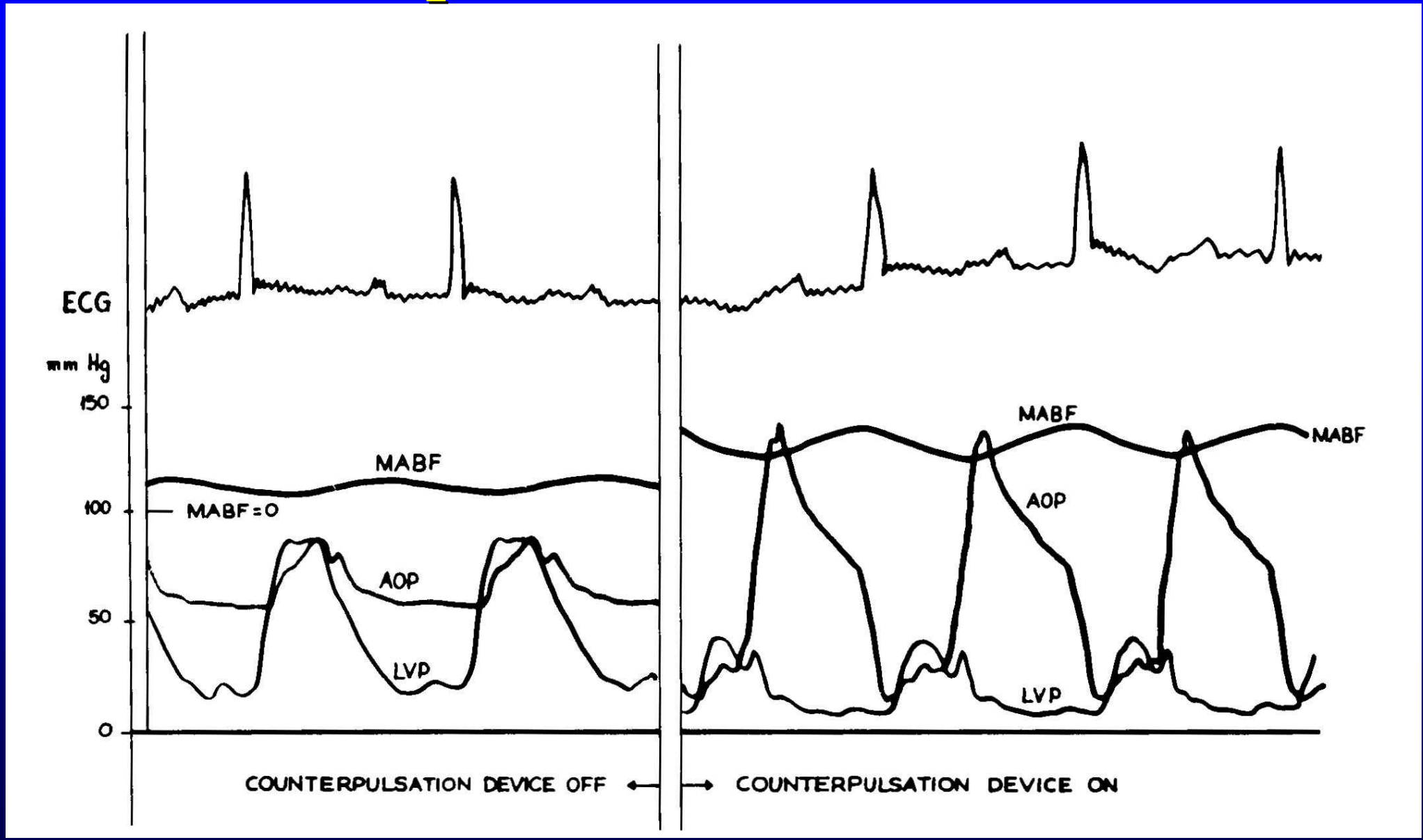
- Simple device for its implantation and follow up

LVADs under clinical investigation

- Axial flow LVADs (various types) > 300 pts
- Counterpulsation LVADs
  - Cardio VAD (KCV) 8 pts
  - Sunshine Heart 2 pts
  - Paraaortic CD 5 pts


Dacron graft
Connector
Ascending aorta

Hemodynamic effects of the PACD in experimental acute HF



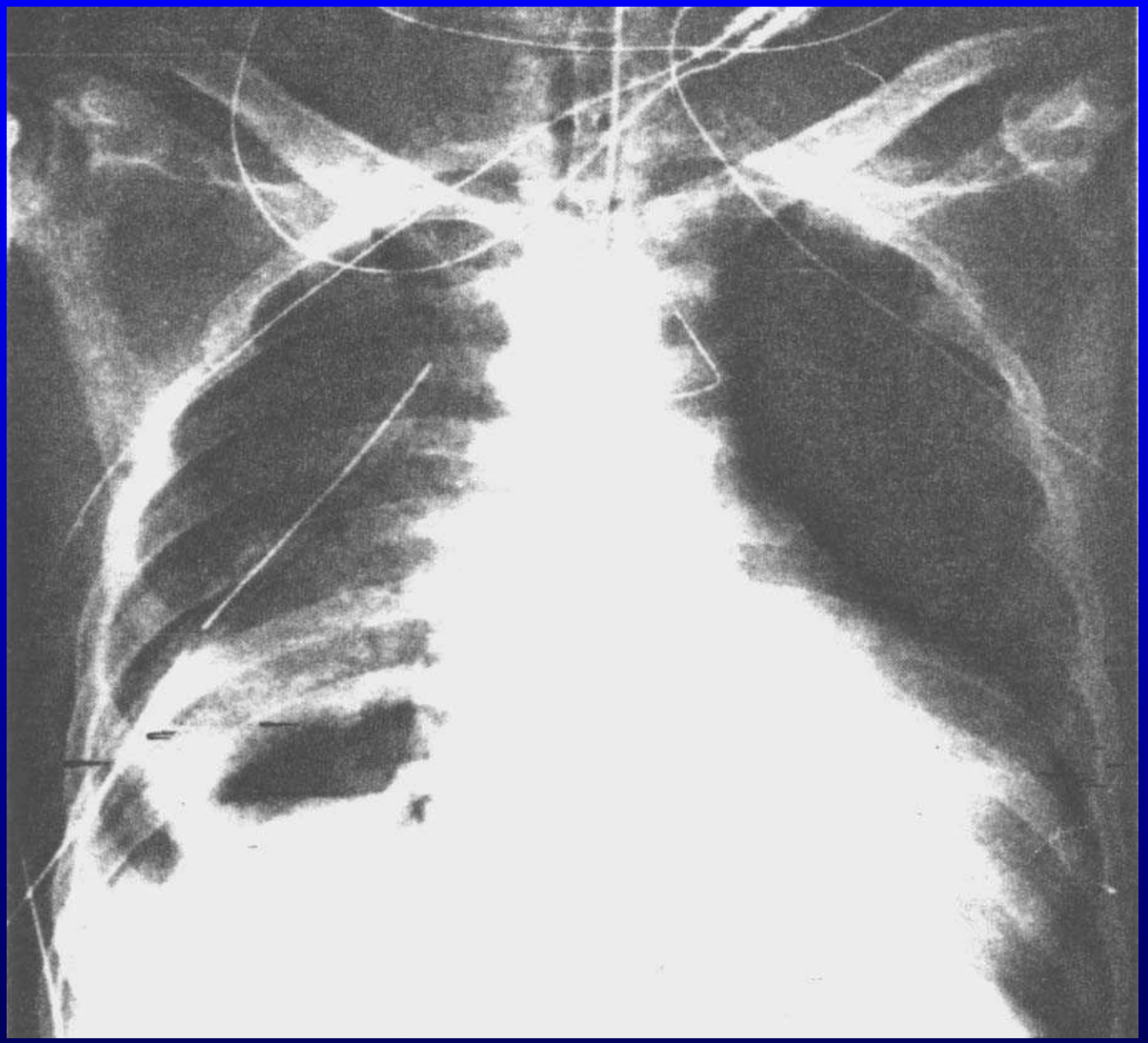
Nanas JN et al, ASAIO 1987;10:203-206

Clinical and laboratory pre-implantation data of a patient assisted by the PACD for 54 days

Age (yr)	33
Diagnosis	IDC
LVEF (%)	6
RAP (mmHg)	17
PCWP (mmHg)	35
BP (mm Hg)	90/60
CI (L/min/m^2)	1.3
Na (mEq/L)	120
Cr (mg/dl)	3.6

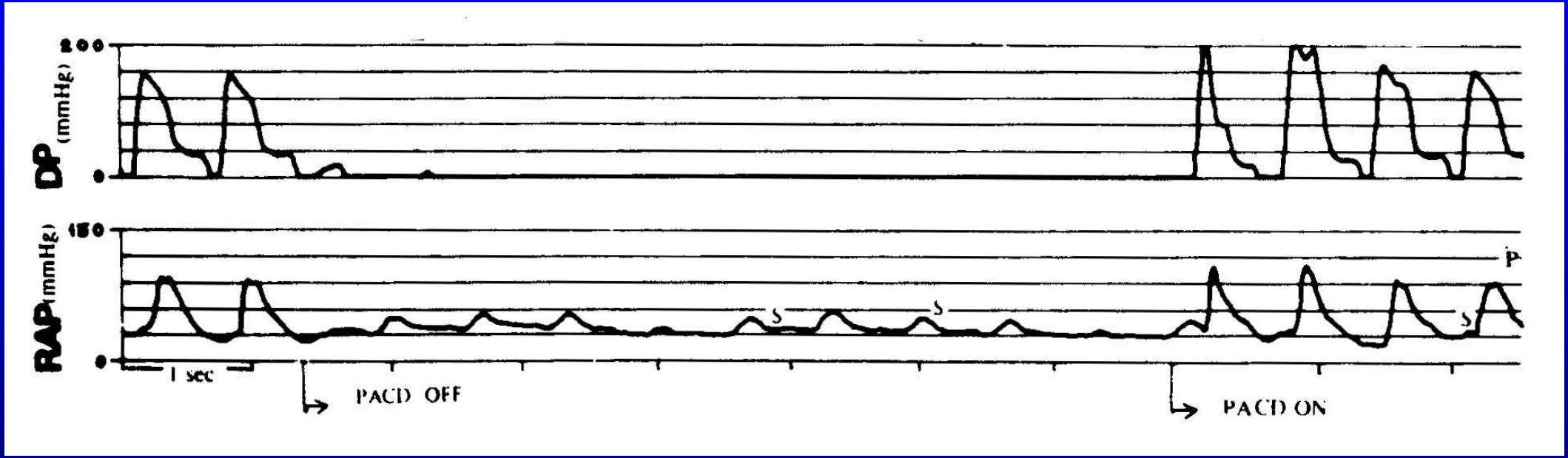
Nanas J et al, J Thorac Cardiovasc Surg 1996;111:55-61

After the PACD implantation



Nanas J et al, J Thorac Cardiovasc Surg 1996;111:55-61

Recordings of the driving and radial arterial pressures of a patient assisted by the PACD for 54 days



Nanas J et al, J Thorac Cardiovasc Surg 1996;111:55-61

Conclusion (1/3)
Management of potential candidates for LVAD among patients with acute decompensated end-stage HF or de-novo acute HF

- ✓ Exclude reversible causes
- ✓ Tailor medical therapy to exclude adequate response
- ✓ Determine candidacy for assistance by LVAD as:
  1. Bridge to transplantation
  2. Bridge to recovery
  3. Destination therapy

Conclusion (2/3)
Therapeutic targets according to etiologies of acute heart failure in potential candidates for LVAD assistance

- ✓ **Bridge to Transplantation**
  - **Acute decompensation of end-stage HF in patients listed for Tx**
  - **Post–MI Cardiogenic Shock**
- ✓ **Destination**
  - **Persistent decompensation of CHF in patients ineligible for Tx**
- ✓ **Bridge to Recovery**
  - **Fulminant myocarditis**
  - **Acute decompensation of end-stage HF due to IDC**

Conclusion (3/3)

The new LVADs require a far less traumatic procedure for their implantation and are likely to be beneficial for patients with less severe HF.