TRANS MYOCARDIAL LASER REVASCULARIZATION

TMR

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Case # 1

- Male, 52 YO
- NIDDM, COPD, HLP
- CVD (TIA x 2 in 2008)
- CABG at Centenial in 1999
  - LIMA-LAD, RA-Y-D1
  - fRIMA-PDA
  - SVG-Y-$OM_{1/2}$

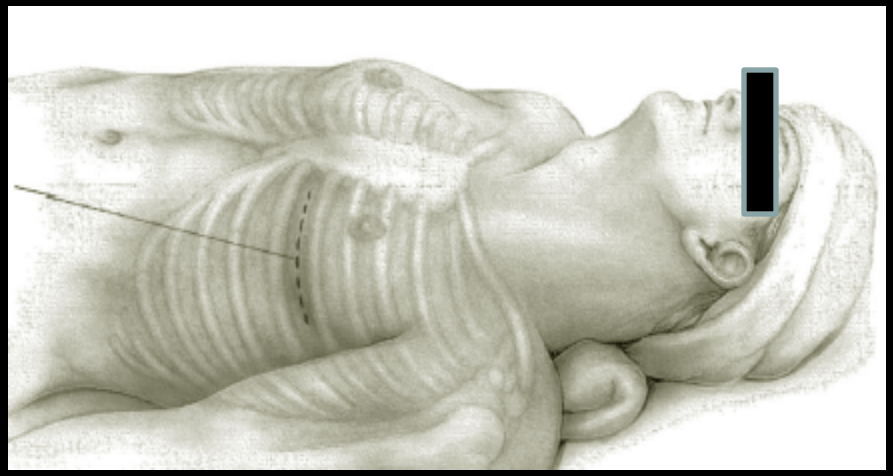
Case # 1

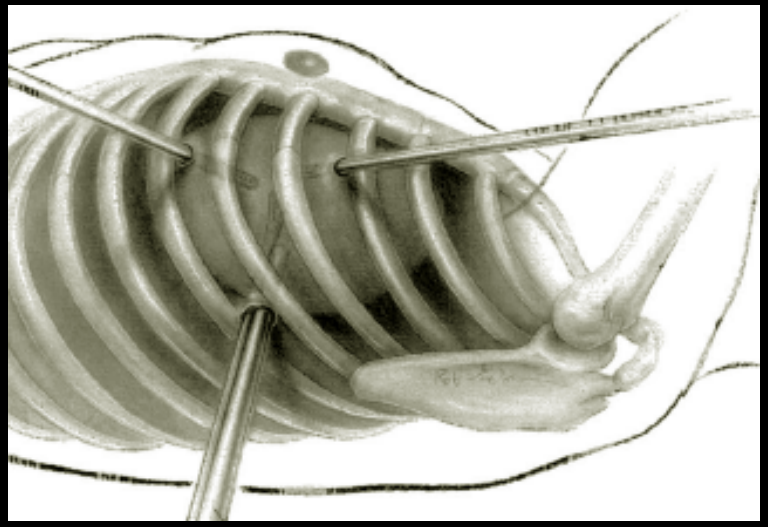
- Cath 2001 and 2003
  - Patent LIMA-RA/SVG-OM/fRIMA, occluded SVG-OM
- PCI in 2004
  - 80% distal RCA stenosis
  - 3.5 x 16mm Taxus Express-2 stent
  - No targets for bypass or PCI on lateral wall

Case # 1

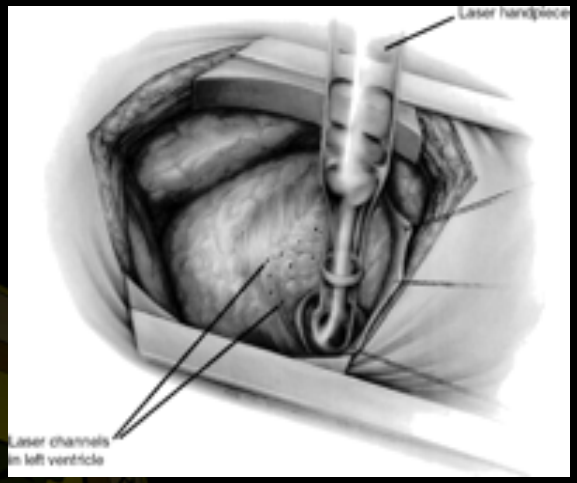
- Continue having angina after stenting
- Did well for a while
- Angina progressed to rest pain
- Nuclear study demonstrated viable myocardium on lateral wall

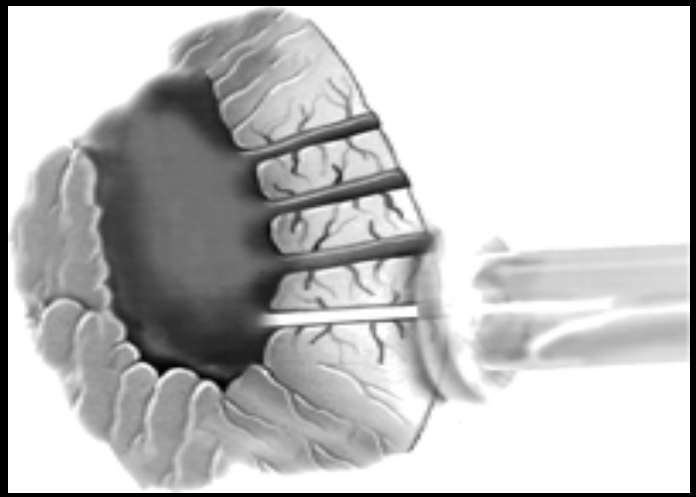
Surgical Technique



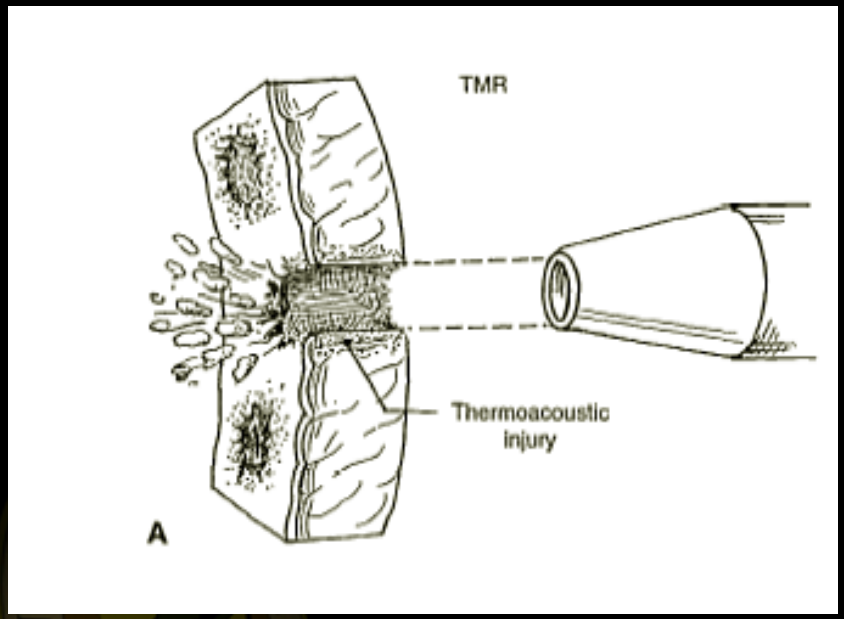


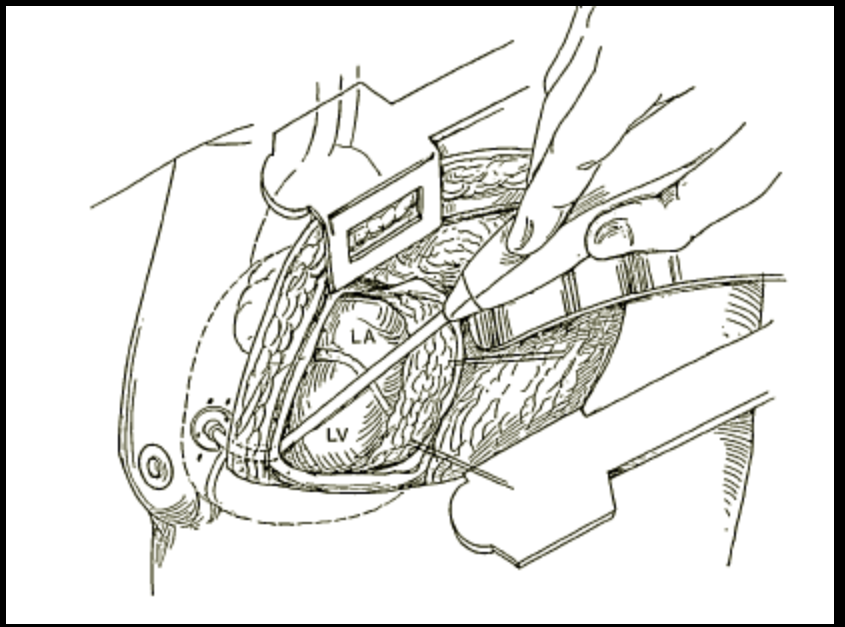
Surgical Technique





Surgical Technique





Survival

- Is there any survival benefit with TMR compared to medical management ?

Survival

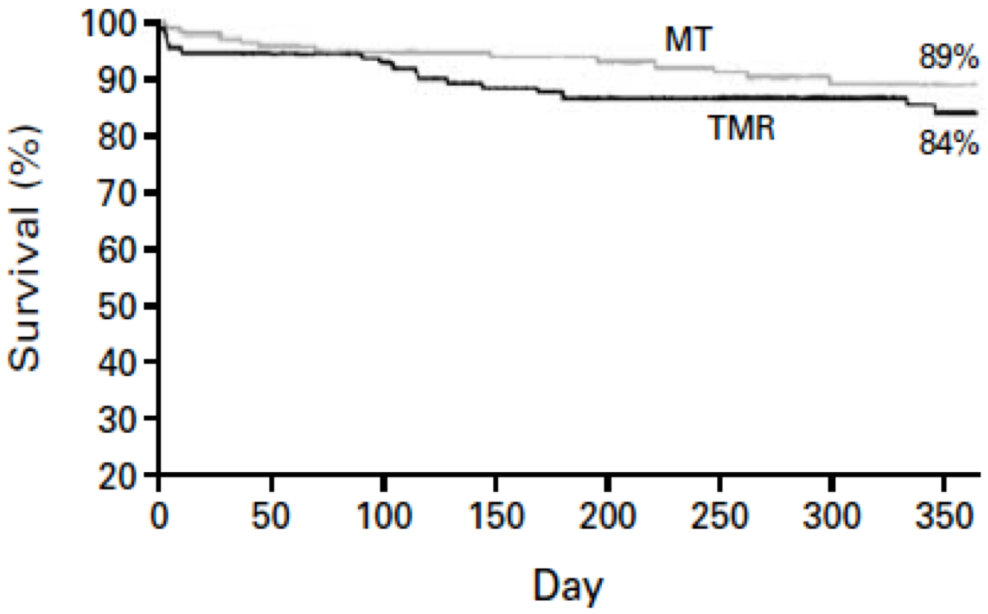


Figure 4. Kaplan–Meier Estimates of Survival at One Year in the Intention-to-Treat Analysis.

The difference in survival between the groups was not significant. TMR denotes transmyocardial revascularization, and MT medical therapy.

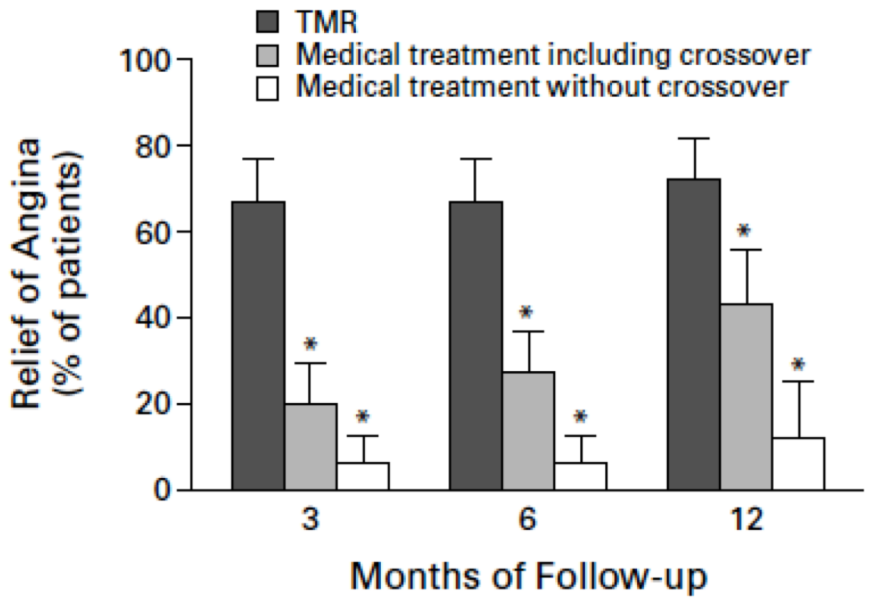
Allen et al. NEJM 1999

Relief of Angina

- Is TMR an effective treatment to relieve angina ?

Frazier et al. NEJM 1999

Relief of Angina



No. of Patients			
TMR	78	67	61
Medical treatment including crossover	77	67	54
Medical treatment without crossover	24	24	20

Figure 2. Relief of Angina According to Treatment Group.

Frazier et al. NEJM 1999

Angina Class Pre and post TMR

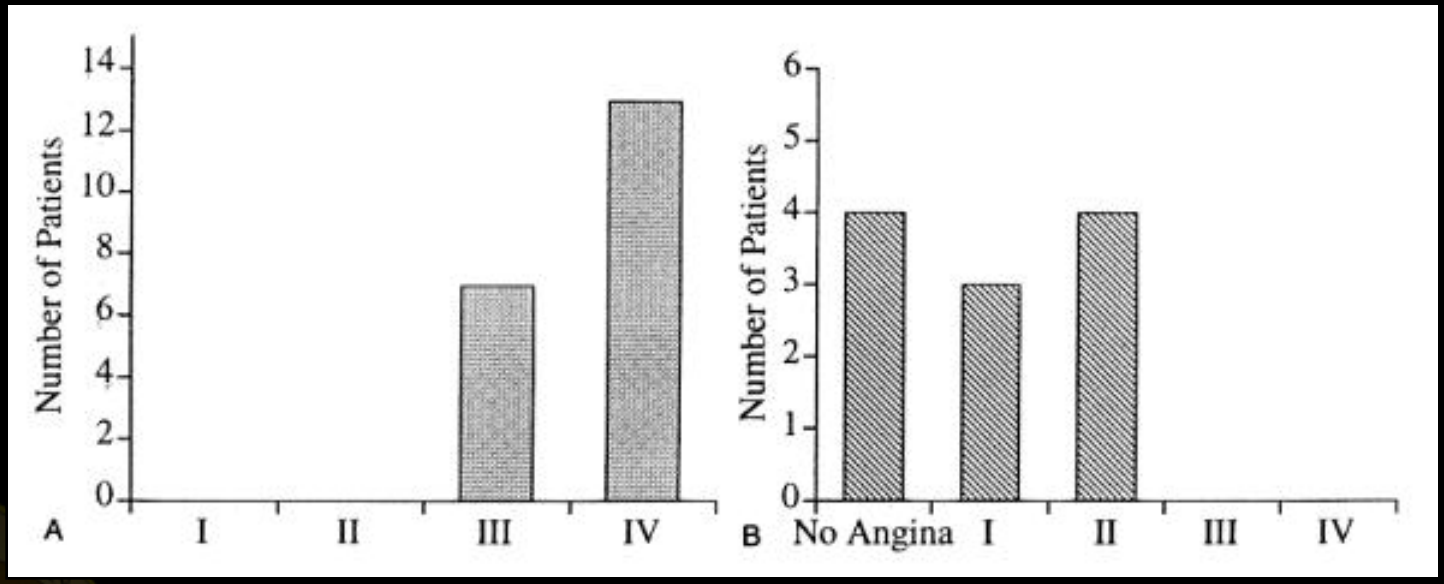


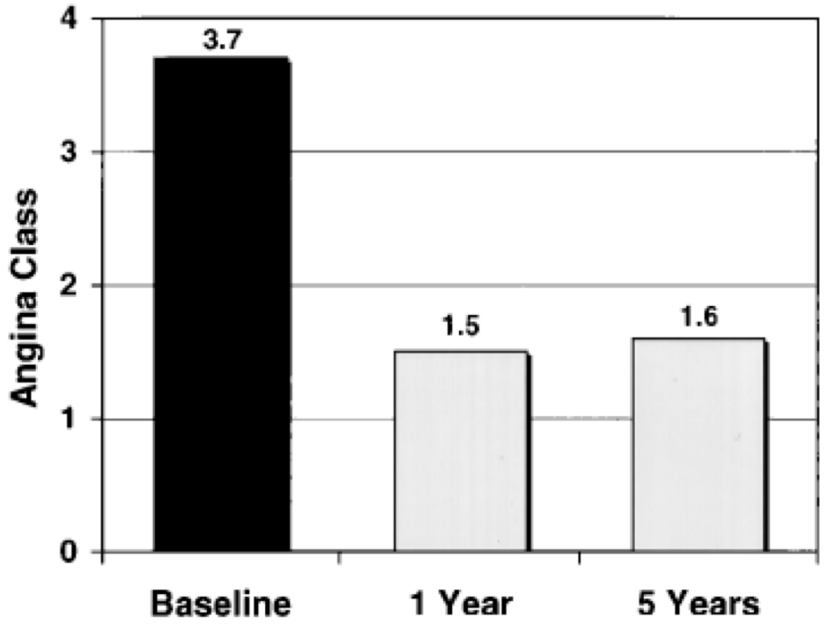
Fig. 1. A, Preoperative Canadian Angina Class in 20 patients. B, Postoperative Canadian Angina Class in 11 patients with at least 3 months' follow-up.

Horvath et al. JTCV Surg 1997

Angina class at follow-up

- How durable is the relief of angina in patients treated with TMR ?

Angina class at follow-up



CO2 Laser

Figure 1. Average CCS angina class at baseline and 1 and 5 years of follow-up. *P*=0.0001 for baseline vs 1 or 5 years. *P*=NS for 1 vs 5 years.

Horvath et al. Circulation 2001

Quality of life

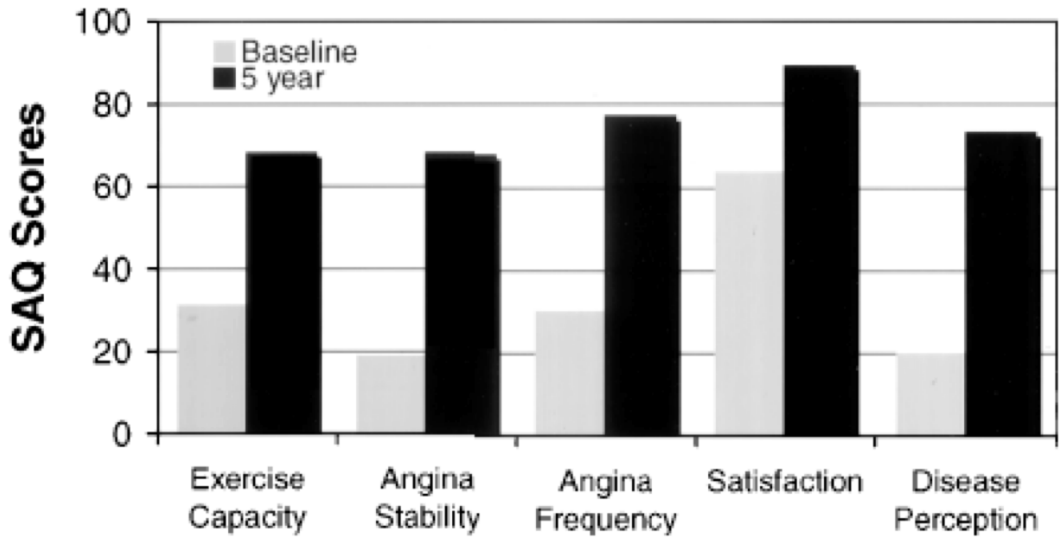


Figure 3. Seattle Angina Questionnaire Scores at baseline vs 5 years. $P<0.0001$ for all scores for baseline vs 5 years.

Horvath et al .Circulation 2001

Event Free Survival

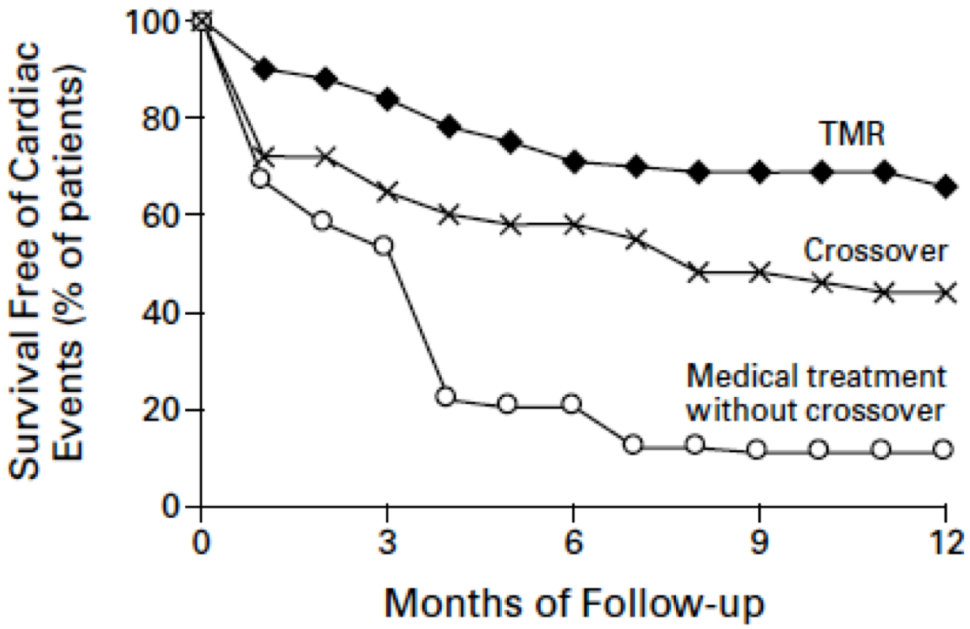


Figure 4. Event-free Survival According to Treatment Group.
Cardiac events were defined as acute myocardial infarction, unstable angina, or class IV angina. TMR denotes transmyocardial revascularization.

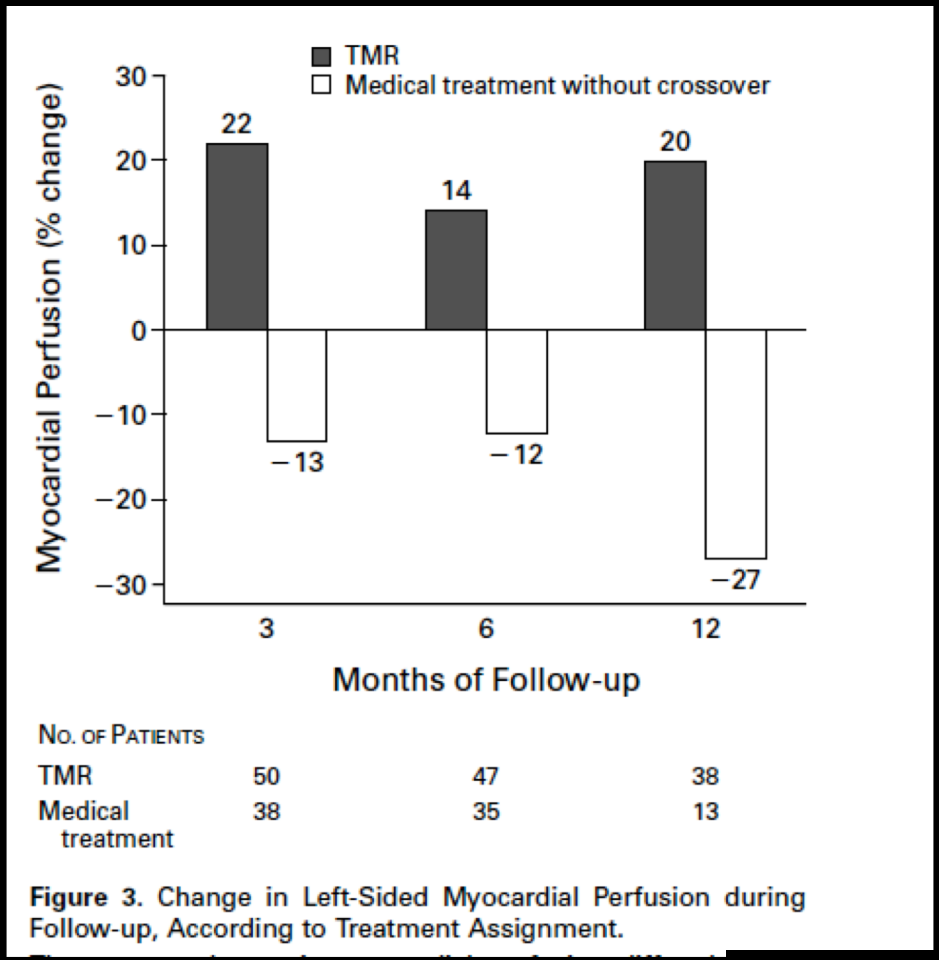
- MI
- Unstable Angina
- Class IV Angina

Frazier et al. NEJM 1999

Perfusion Scans Reversible Ischemia

- Can TMR improve perfusion in ischemic myocardial segments?

Perfusion Scans Reversible Ischemia



No. of Patients			
TMR	50	47	38
Medical treatment	38	35	13

Figure 3. Change in Left-Sided Myocardial Perfusion during Follow-up, According to Treatment Assignment.

CO2 Laser: Yes

YAG Laser: No

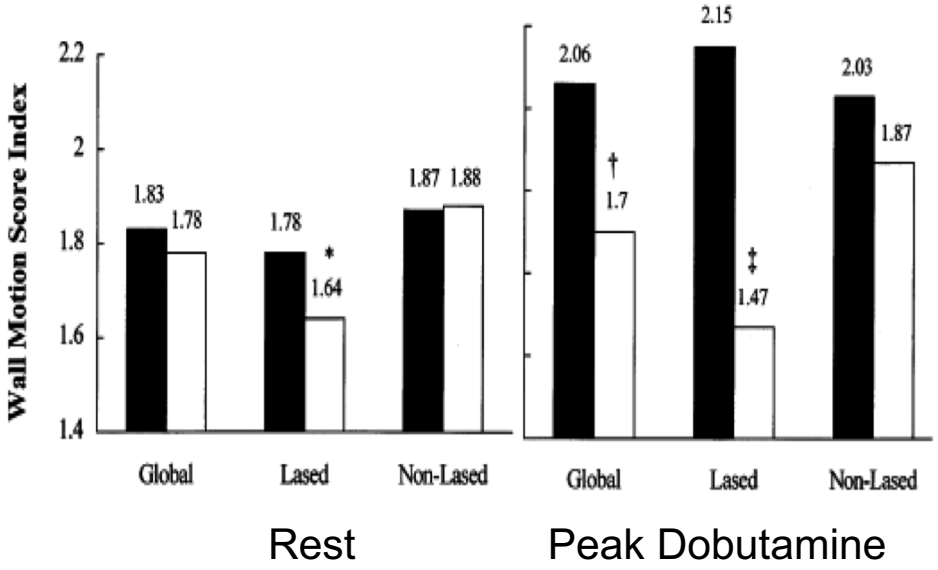
Frazier et al. NEJM 1999

Improved Wall Motion

- Is there any improvement in myocardial contractility treated with TMR ?

Improved Wall Motion

Figure 1. WMSI at rest (**left**) and peak dobutamine stress (**right**) for all segments (Global) and lased and nonlased segments before (**solid bars**) versus after TMLR (**open bars**), demonstrating postoperative improvement in WMSI of the lased segments at rest and improvement in global and lased segment WMSI at peak stress. *p = 0.05. †p = 0.002. ‡p = 0.0004.



Before TMR

After TMR

- Increased contractile reserve
- Increased ischemic threshold

Donovan et al. JACC 1997

Randomized Trials

Table 1. Results of Randomized Clinical Trials of Transmyocardial Revascularization as Sole Therapy

Author	Patients	Centers	Laser	Perioperative Mortality (%)	F/U (y)	Channels	Significant Angina Decrease	Significant Hospitalization Decrease	Increase Perfusion	Increase Survival
Allen et al 1999 [45]	275	18	H-YAG	5	1	39	Y	Y	N	N
Frazier et al 1999 [47]	192	12	CO_2	3	1	36	Y	Y	Y	N
Burkhoff et al 1999 [46]	182	16	H-YAG	2	1	18	Y	Y	N	N
Schofield et al 1999 [35]	188	1	CO_2	5	1	30	Y	Y	…	N
Aaberge et al 2002 [44]	100	1	CO_2	4	3–5	48	Y	Y	…	N

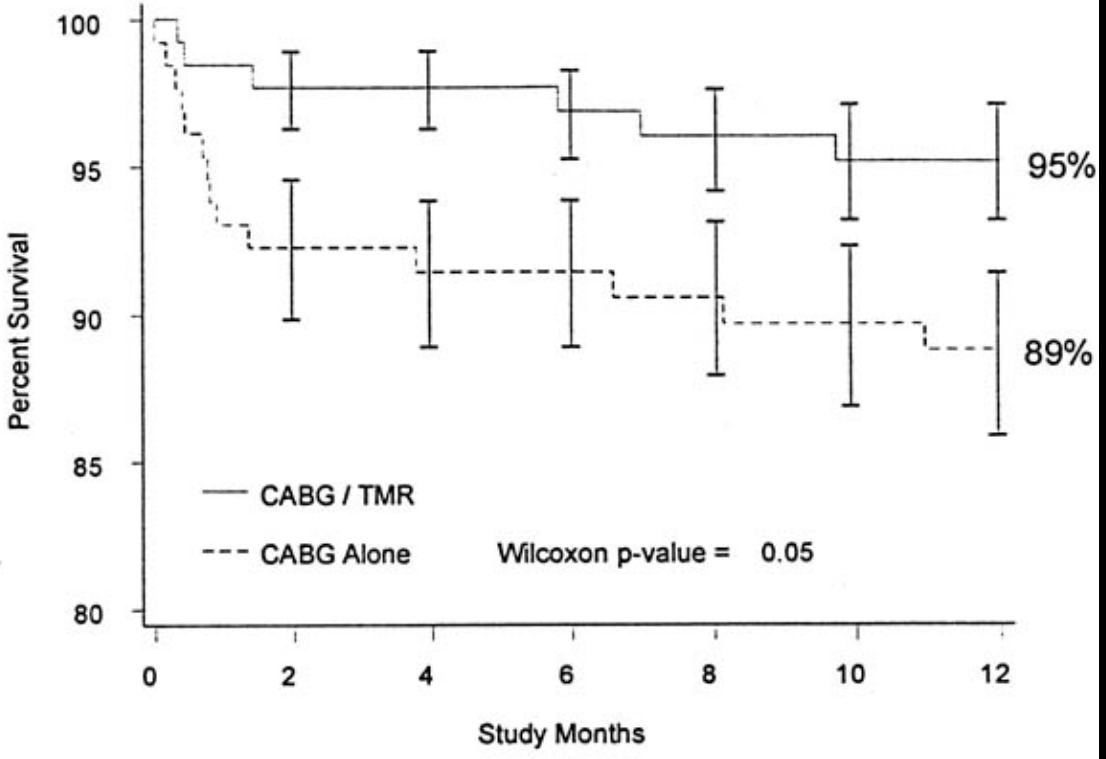
CO_2 = carbon dioxide; F/U = follow=up; H-YAG = holmium:yttrium-aluminum-garnet.

Bridges et al. Ann Thorac Surg 2004

CABG + TMR

- Can we perform a CABG combined with TMR (same procedure) in an area where a bypass graft can not be done because of a poor surgical target?

CABG + TMR

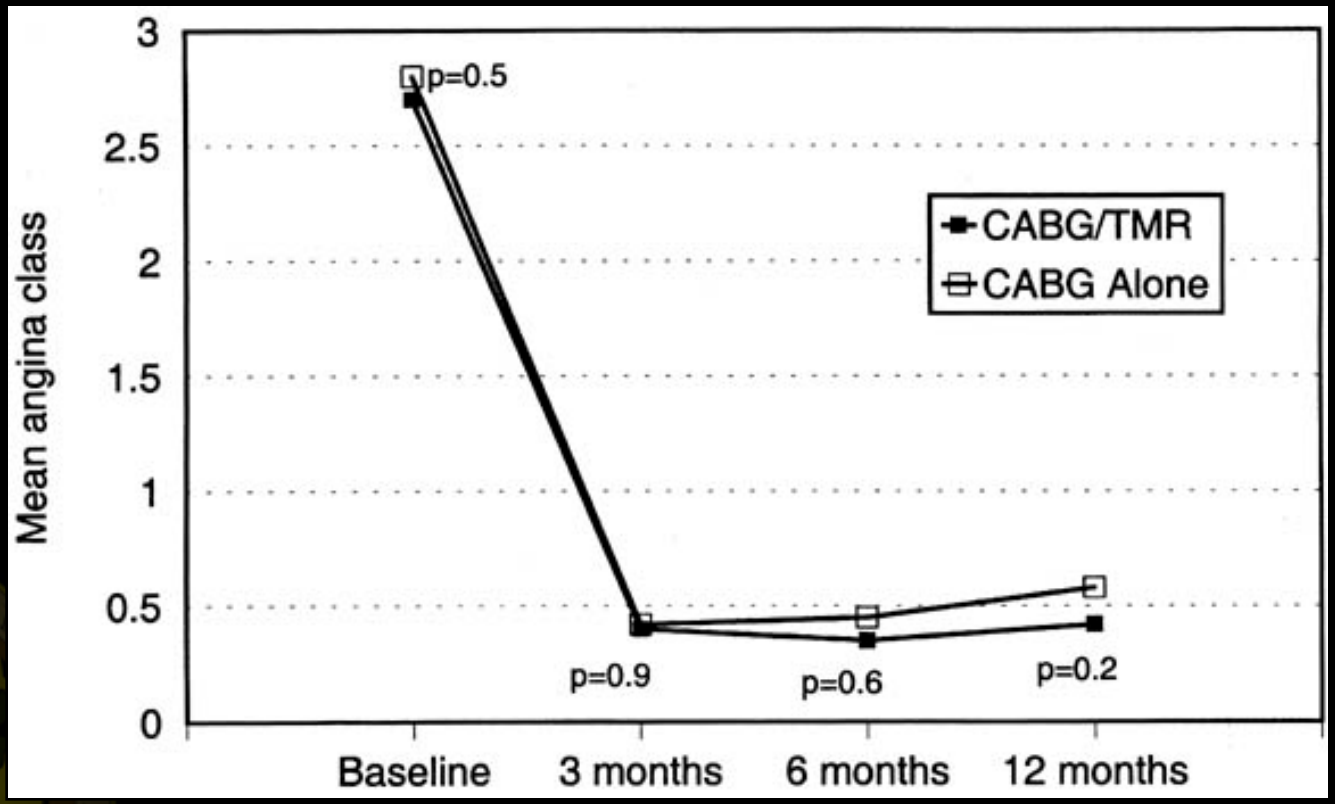


Eligible patients

Months	0	2	4	6	8	10	12
CABG / TMR	132	125	122	120	113	111	84
CABG Alone	131	118	109	108	104	103	80

Allen et al. JTCV Surg 2000

CABG + TMR



Allen et al. JTCV Surg 2000

Recommendations for TMR

- TMR as Sole therapy:
  Level I, Level of evidence A
- TMR as adjunct therapy
  Level IIa, Level of evidence B

Bridges et al. Ann Thorac Surg 2004

TMR : Indications

- Chronic Stable Angina (Cass III or IV)
- Reversible ischemia on Stress Test
- Failure of medical therapy
- Anatomy not amenable to
  - CABG
  - PCI

TMR: Contraindications

- Low EF (< 25%)
- Recent MI
- Unstable Angina
- AMP = 0
- Cardiogenic Shock

Thank you

Dr. Balaguer has no disclosures