

SURGICAL INTERVENTIONS IN CORONARY ARTERY DISEASE

A Surgeon's Perspectives

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UERMMMC '71

Disclosures

None

- As nations become industrialized, economy progresses
- Improved sanitation, housing, health care, nutrition
- “unhealthy lifestyle” – tobacco, high fat diet
- environmental pollution

EPIDEMIOLOGIC TRANSITION

“shift of mortality from infectious diseases to chronic lifestyle related disorders”

DEMOGRAPHIC TRANSITION

“increasing life expectancy and declining infant mortality lead to large adult population”

GLOBAL PANDEMIC OF CARDIOVASCULAR DISEASES

- CORONARY ARTERY DISEASE

- #1 cause of death in the USA, and worldwide
- In 2010, 20% of adults in USA over 65 have CAD
- In 2015, CAD affected 110 million people with 9 million deaths (16% of all deaths)

SURGEON'S INTERVENTIONS

- 1920 Surgical sympathectomy to relieve angina
- 1930 Epicardial and pericardial abrasions to create collaterals
- 1940 Vascularized pedicles to the heart surface
- 1950 Retrograde perfusion of coronary veins
- 1960 Vineberg intramyocardial implantation of internal mammary artery

SURGEON'S INTERVENTIONS

- 1953 John Gibbon developed heart lung machine (cardiopulmonary bypass)
- 1957 Mason Sones selective coronary angiogram
- 1964 Garrett first to perform saphenous vein graft
- 1968 Favaloro popularized aortocoronary bypass graft

CORONARY ARTERY BYPASS GRAFT (CABG)

Effective operation

prolonged survival, relieved symptoms

improved quality of life

widely accepted by surgeons

CABG

• 1980 137,000

• 1985 203,000

• 1990 400,000

• 2000 500,000

• 2010 300,000

*refined in the '70s

*flourished in the '80s

LANDMARK STUDIES

CABG vs medical treatment of the '70s/'80s

- VACOOP Veterans Administration Cooperative Study
- ECSS European Coronary Surgery Study
- CASS Coronary Artery Surgery Study

CONCLUSIONS

Improved survival in
left main disease
proximal LAD or LM equivalent
triple vessel disease with LV dysfunction

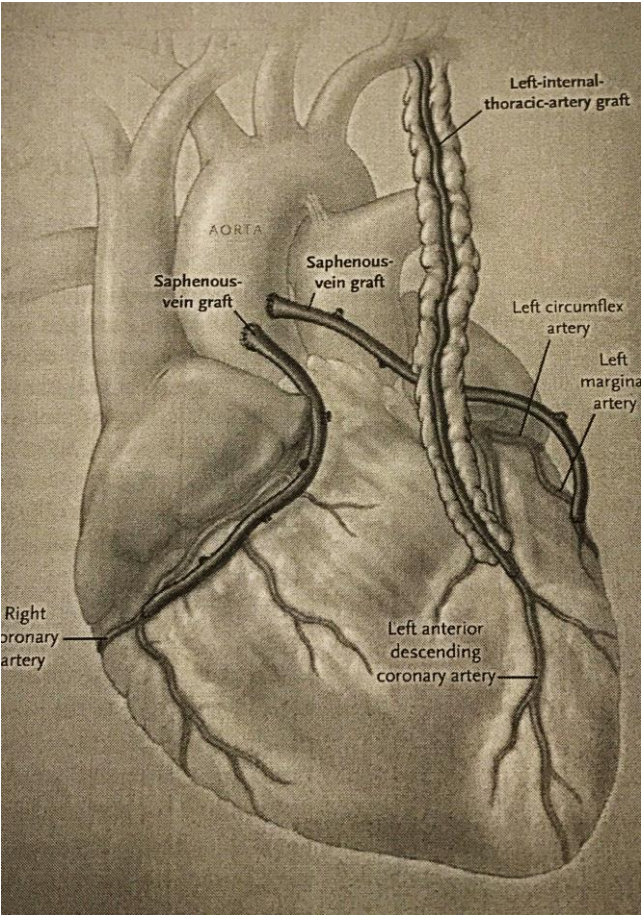
Improved quality of life
relief of angina
more functional capacity
less need for medications

STANDARD/CONVENTIONAL CABG

- Technique:
 - Median sternotomy
 - Cardiopulmonary Bypass
 - Aortic cross clamp
 - Cardioplegic arrest
 - Hypothermia

STANDARD/CONVENTIONAL CABG

- Conduit:
 - LIMA – LAD
 - LIMA dissection – pedicle or skeletonized
 - SVG – CX and branches, RCA and branches
 - SVG harvest – open or endoscopic



STANDARD CABG

- COMPLICATIONS:
 - Mortality -- 1-5%
 - Morbidity
 - low output syndrome (perioperative MI)
 - stroke -- 1-5%
 - neurocognitive dysfunction – 40%

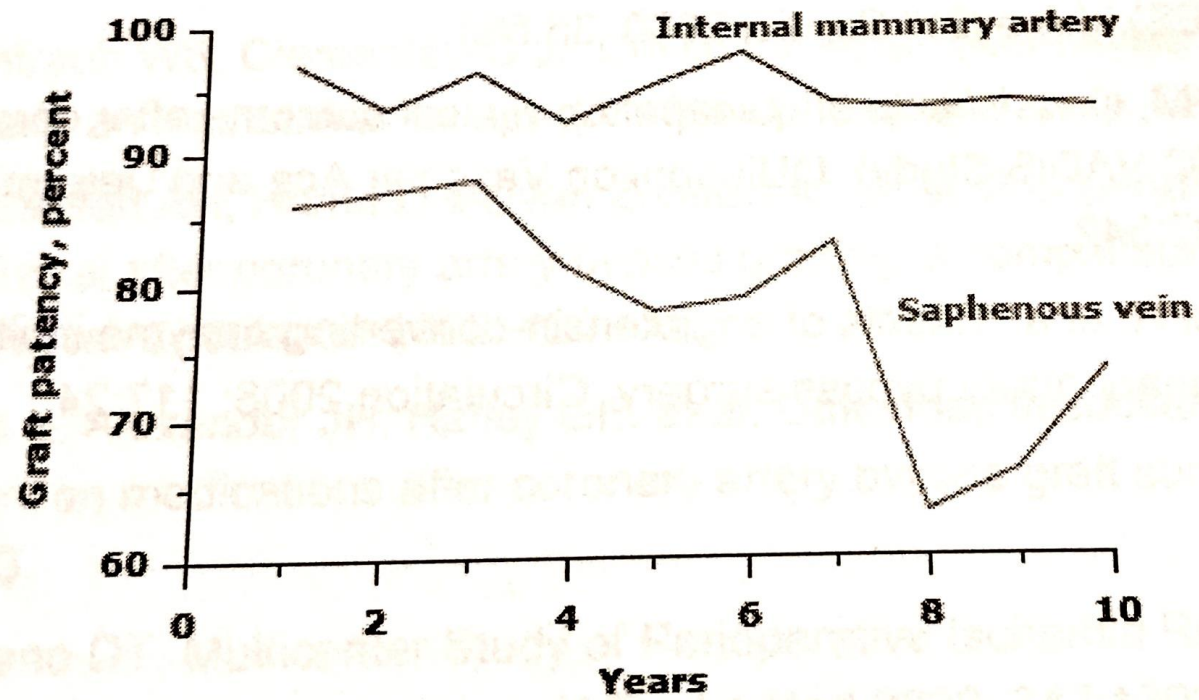
STANDARD CABG

- **COMPLICATIONS:**
 - arrhythmia
 - coagulopathy – transfusion requirements
 - infection
 - renal failure
 - respiratory failure
- CABG recuperation – 6 to 12 weeks

COMPLICATIONS: GRAFT FAILURE

	5 YEAR	10 YEAR
• LIMA	95%	90%
• SVG	75%	50%
•	early SVG graft failure are due to technical reasons	
•	< 3 years ----- intimal hyperplasia	
•	> 3 years ----- graft atherosclerosis	
•	* Re operations !! – carries higher mortality and morbidity!!	

Graft patency after CABG



SURGICAL INNOVATION

- PAN ARTERIAL BYPASS GRAFTS
- LIMA
- RIMA
- RADIAL ARTERY
- GASTROEPIPLOIC ARTERY

RIMA

Pedicle or skeletonized

In situ/free graft/T-graft

Smaller and shorter(?)

RIMA-RCA

Sternal wound complications due to devascularization, obesity, COPD, DM

Patency rate less than LIMA-LAD

RADIAL ARTERY

Graft failure in early experience in the '70s

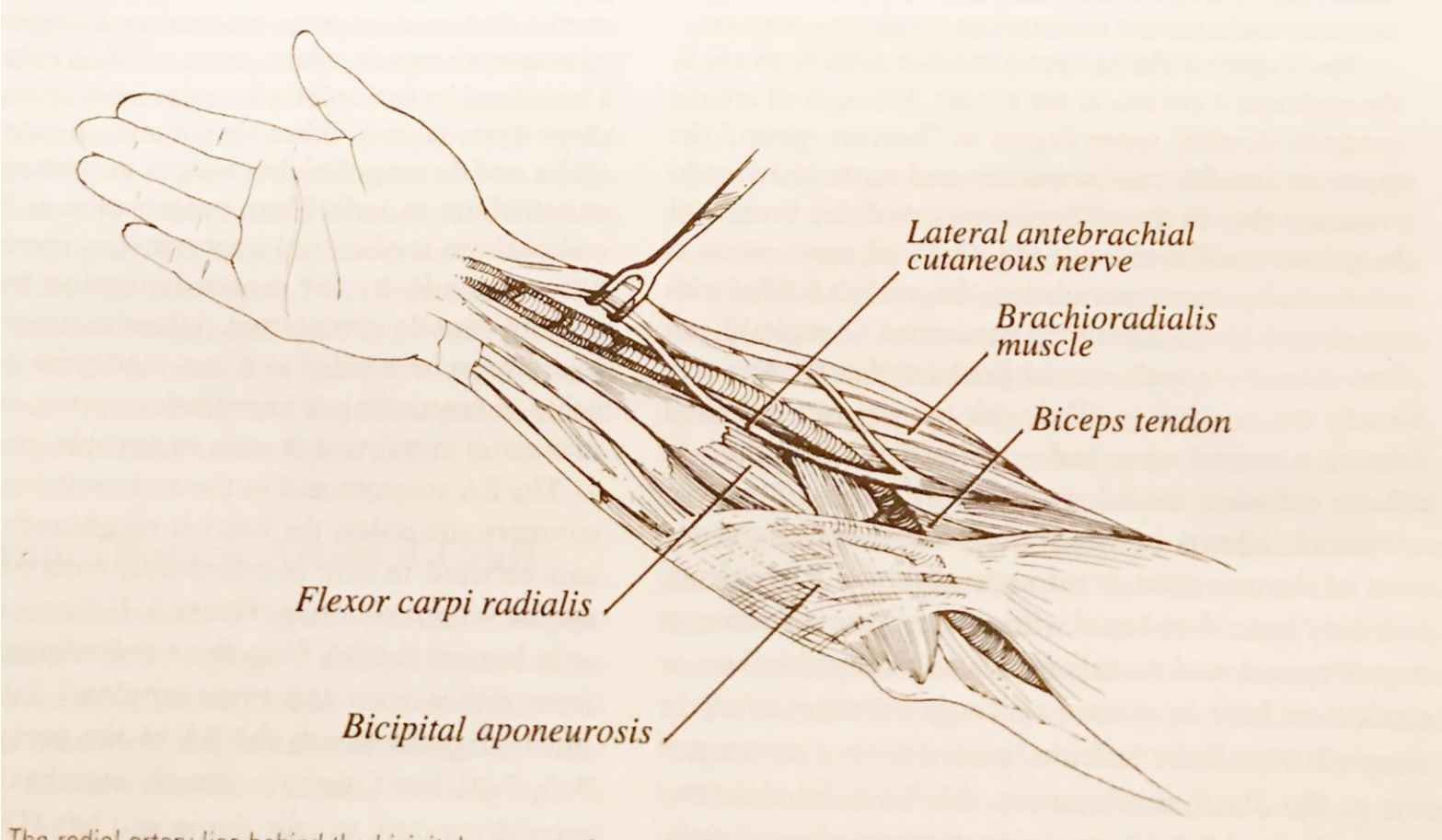
Prone to vasospasm, Rx with cardizem

Check ulnar circulation (Allen's test)

Bilateral harvest ; dialysis access

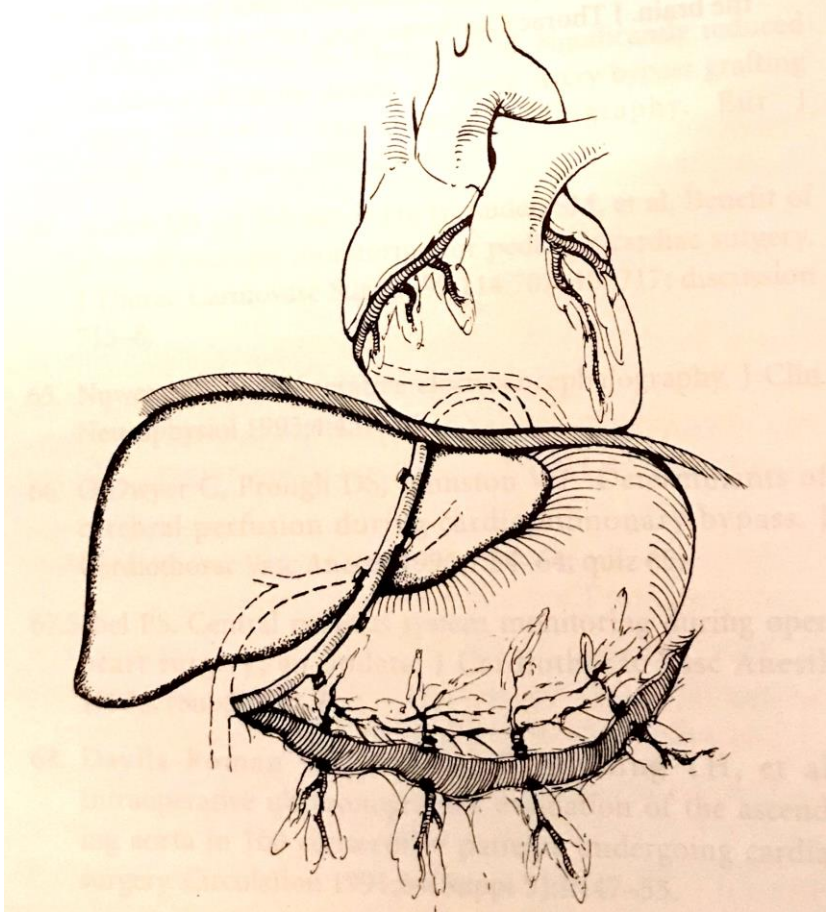
Good patency rate

Second choice arterial graft



GASTROEPIPLOIC ARTERY

- Abdominal operation
- Traverse the diaphragm anterior to stomach and liver
- Limited target vessels – inferior surface of myocardium
- Beware of future abdominal surgery
- GEA patency – 85% at 5 years, 70% at 10 years



ARTERIAL GRAFTS

- *Arterial grafts have better patency rate than SVGs, but not routinely used*
- Standard CABG remains cornerstone of surgical revascularization
- LIMA-LAD, SVG-CX, SVG-RCA or arterial graft in selected patients

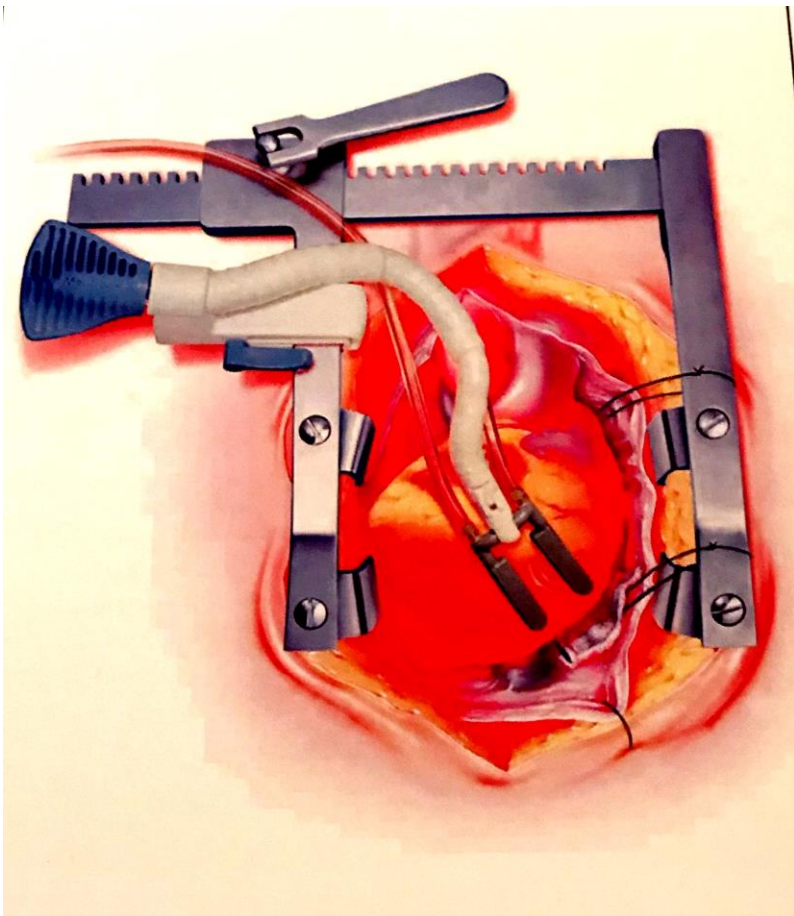
SURGICAL INNOVATION

Minimally Invasive Procedures

- MIDCAB --- minimally invasive direct coronary artery bypass
- Port Access --- (Heartport)
- OPCAB --- off pump coronary artery bypass
- *steep learning curve*

MIDCAB

- Small thoracotomy incisions
- No CPB – warm beating heart
- Avoid deleterious effects of CPB
 - systemic inflammatory response, organ dysfunction, renal,
 - respiratory failure, blood trauma, coagulopathy
- Avoid aortic cross clamp = less emboli, less stroke, less neurocognitive disorder



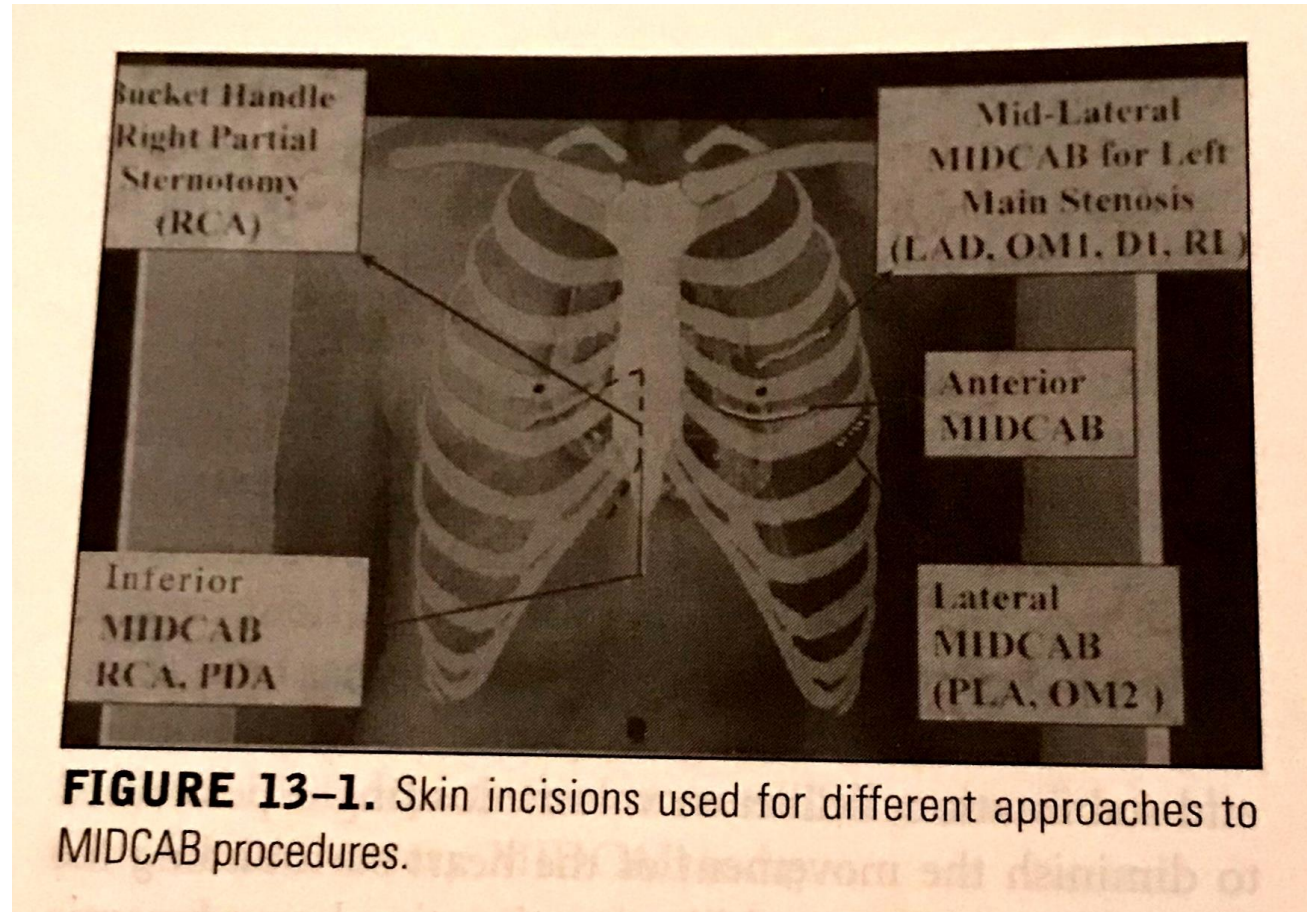


FIGURE 13-1. Skin incisions used for different approaches to MIDCAB procedures.

MIDCAB

- Special instruments – stabilizers, intraluminal shunts,
- blower, suction
- Target vessels usually anterior surface – LAD, RCA
- Exposing side or inferior vessels cause hemodynamic
- instability
- Less precise anastomosis
- Incomplete revascularization

PORT ACCESS (HEARTPORT)

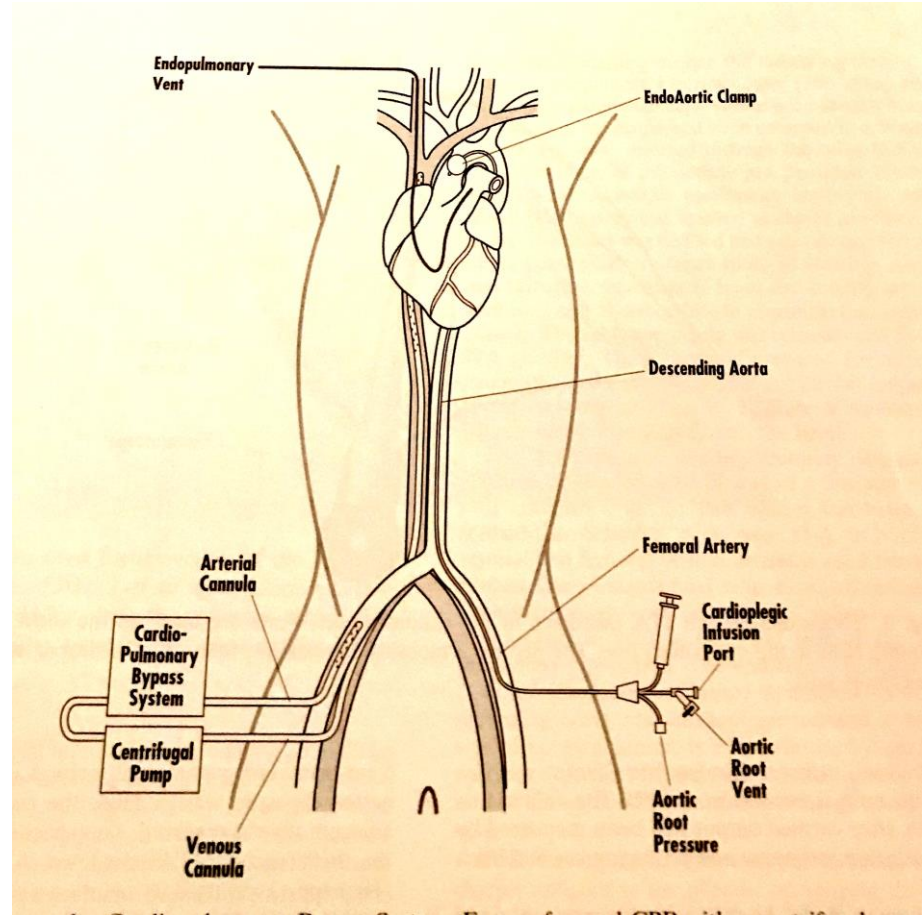
Small thoracotomy ports/incisions

On CPB

Femoral cannulation, endoaortic balloon occlusion, cardioplegic arrest

Steep learning curve

Longer operation



OPCAB

- Similar to MIDCAB, except median sternotomy,
- access to all coronary arteries
- No CPB, warm beating heart surgery
- Same instrumentations
- Same benefits
- Same limitations

OPCAB

Less morbidities related to CPB

Less organ dysfunction

Earlier extubation and ambulation

Less cost, less blood utilization

Less length of stay

- but -

Incomplete revascularization, less graft patency

MINIMALLY INVASIVE CORONARY ARTERY BYPASS SURGERIES

- Despite advances in minimally invasive coronary artery procedures, standard CABG remains the cornerstone and the gold standard for surgical revascularization of the ischemic myocardium.
- Only about 20% of surgeries are being done with minimally invasive procedures

PTCA/PCI

Across the OR suite to the Cardiac Cath Lab

- 1968 Favaloro CABG
- 1977 Gruntzig PTCA
- CABG has a decade long headstart /experience / data over PCI

PTCA/PCI

1977 Gruntzig PTCA in humans

slow start, improving results

40% re stenosis in 6 months

30% re PTCA in 12 months

*acute recoil, dissection, thrombosis

*surgical team standby, rescue CABG

PTCA / PCI

- 1986 Bare metal stent (BMS)
- 2003 Drug eluting stent (DES)
 - first generation
 - second generation

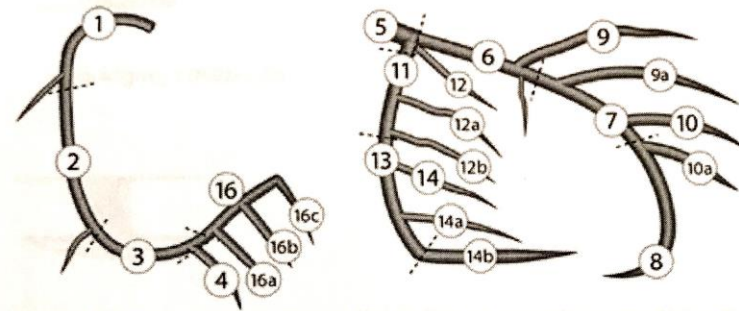
PCI AND CABG

- Both are effective revascularization approaches
- Higher stroke rate with CABG
- Higher reintervention rate with PCI
- Higher long term survival with CABG

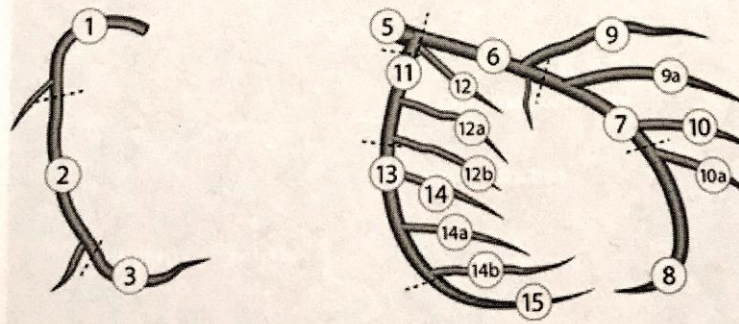
SYNTAX I SCORING

- Based on lesion characteristics, e.g. dominance, length, number, bifurcation, etc.
- Low complexity
- Intermediate complexity
- High complexity

Right dominance: the posterior descending coronary artery is a branch of the right coronary artery (segment 4).



Left dominance: the posterior descending artery is a branch of the left coronary artery (segment 15). Co-dominance does not exist as an option in the SYNTAX score.



PCI OR CABG

Intensive risk modification

Team approach – patient/family, FMD, cardiologist, surgeon

- One vessel = PCI
- Two vessel non LAD = PCI
- Two vessel LAD + Cx/RCA + DM = CABG
- Three vessel = CABG
- Three vessel + low SYNTAX + no DM = PCI

- PCI

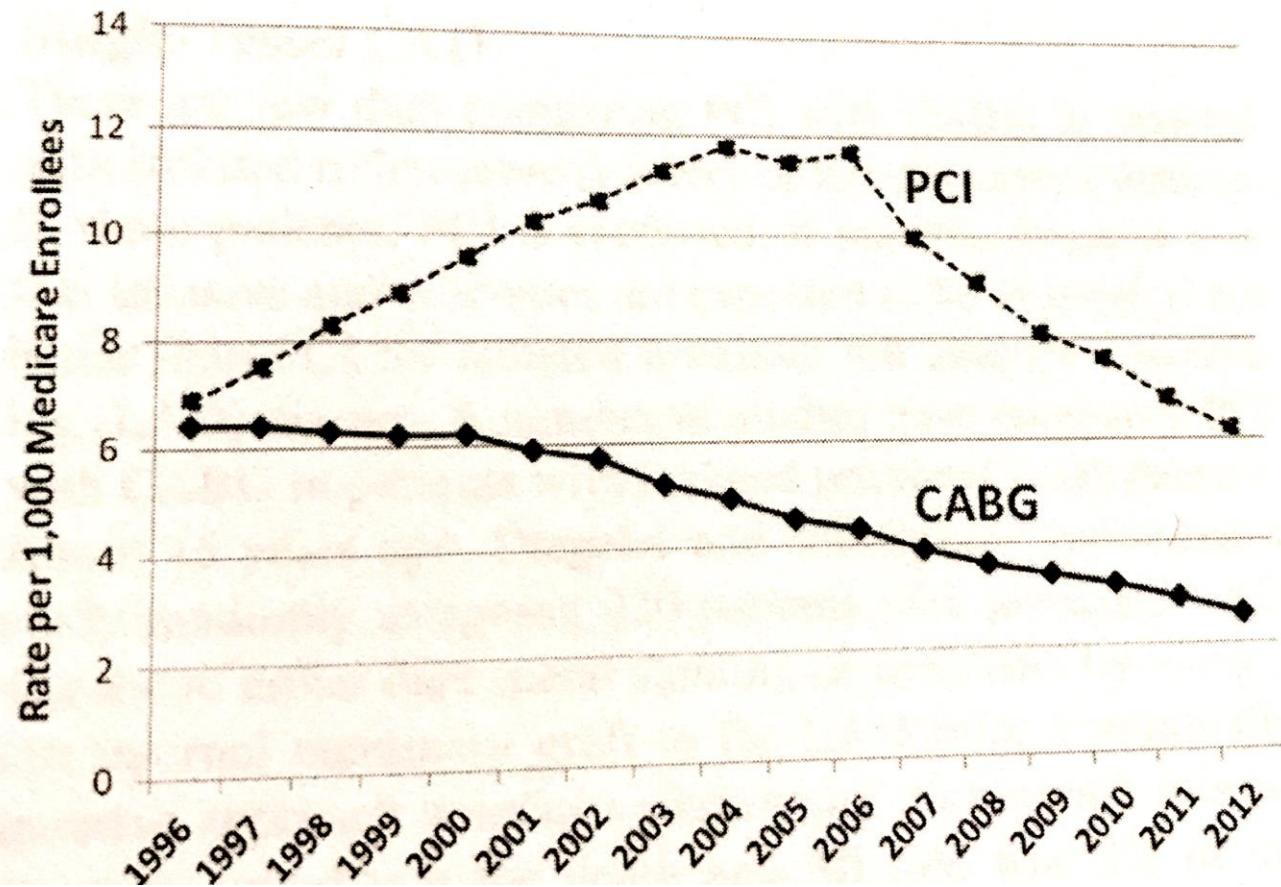
IMPACT OF PCI ON CABG

Decline in CABG – 30% in past decade

Changing indication for CABG

LM lesion + low SYNTAX score + no DM=

PCI has comparable results with CABG



HYBRID CORONARY REVASCULARIZATION (HCR)

- Combining the best of both worlds
- MIDCAB + DES
- MIDCAB LIMA-LAD
- PCI (DES) to non LAD territories
- Hybrid Operating Room

HCR – TIMING AND STAGING

- Staged MIDCAB before PCI
 - antiplatelet agent, imaging of LIMA
- Staged PCI before MIDCAB
 - rarely done, delay MIDCAB for months
- Single stage – done in hybrid OR
 - one stop revascularization

STANDARD / CONVENTIONAL CABG

Gold standard / cornerstone of surgical intervention in coronary artery disease

Has not changed much in decades

Arterial grafts in selected cases

About 20% are minimally invasive procedures

Less than 1% are HCR

EPILOGUE

