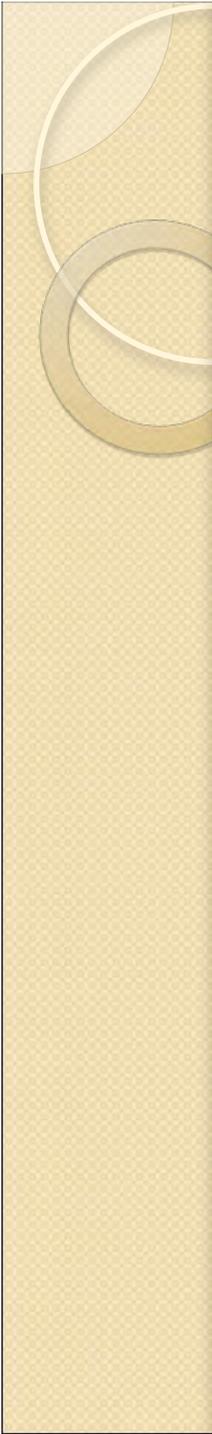




# Pre-Operative Services Teaching Rounds 4 Feb 2011

Deborah Richman MBChB FFA(SA)  
Director – Pre-Operative Services  
Department of Anesthesia  
Stony Brook University Medical Center, NY  
[drichman@notes.cc.sunysb.edu](mailto:drichman@notes.cc.sunysb.edu)



- **Coronary Artery Disease**

- Pre-operative work up using AHA guidelines (cont)
- Management options
- Stents
- Plavix and its management



# Case: 57 yr old male for left total mastectomy/ALND for breast cancer

- HPI – bloody discharge from nipple
- PMH –
  - CAD: MI age 44 treated with 1 stent
    - Current symptoms – chest pressure on exertion, monthly, relieved by rest.
  - Hypertension
  - DM for 15 years
  - Effort tolerance – 4 METs
- PSH –
  - Lap chole 15 years ago
  - Elbow surgery 18 years ago



## Case (cont)

- Current smoker
- Meds:
  - Aspirin
  - Metformin
  - Sitagliptin(januvia)
  - Glipizide
  - Nifedipine
  - Metoprolol
  - Isosorbide mononitrate
  - Rosuvastatin

## Case (cont)

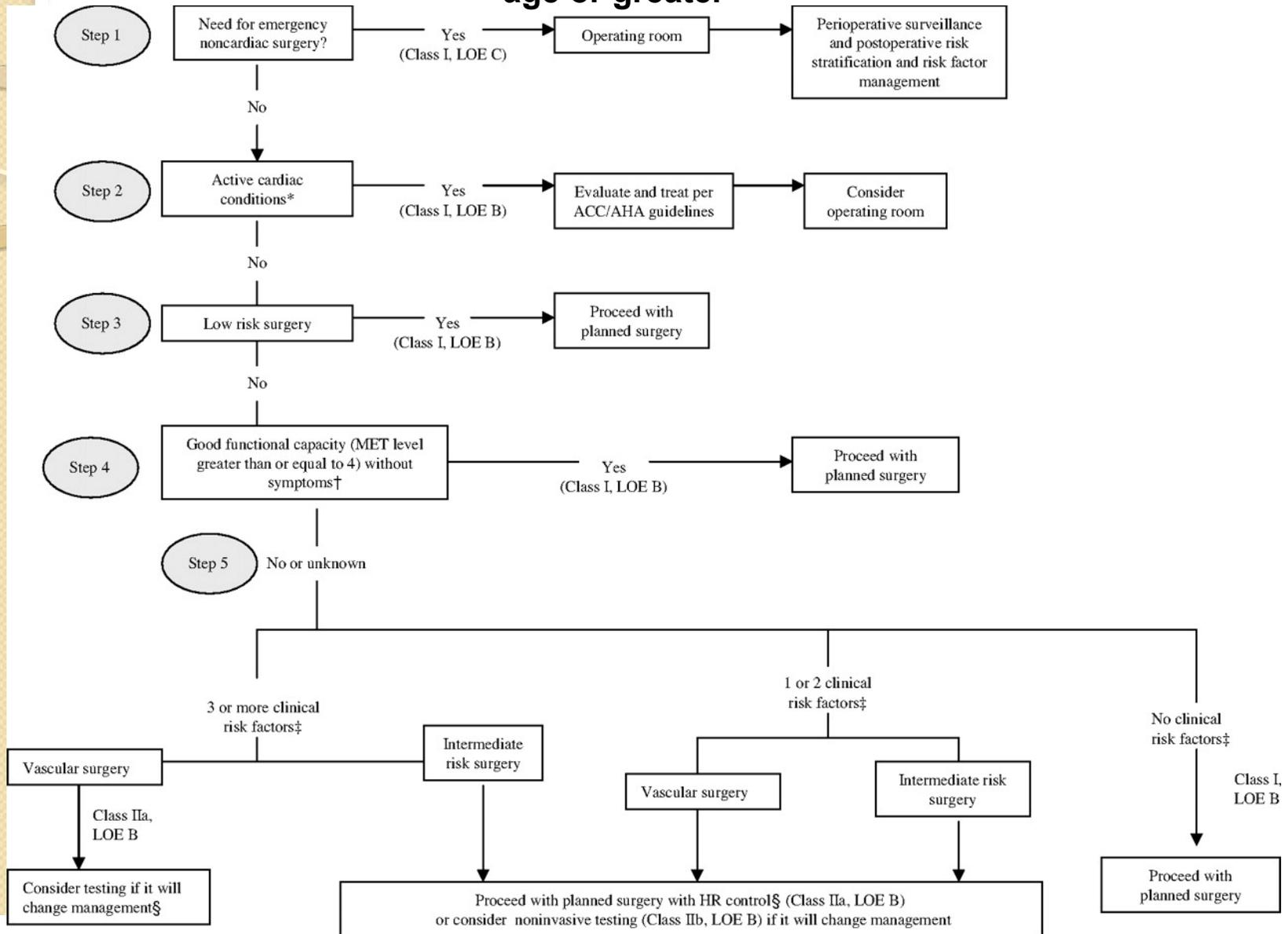
- Exam:
  - BMI 29
  - BPI 20/70 HR 72
- ECG: SR 70, inf Q's, poor R wave progression
- Followed by PMD only for 10 years.



# Assessment

- No active cardiac conditions
- Low risk surgery – proceed to OR
  
- Continue care with cardiologist concurrently
- PCP felt differently and asked for a cardiac ‘clearance’

# Cardiac evaluation and care algorithm for noncardiac surgery based on active clinical conditions, known cardiovascular disease, or cardiac risk factors for patients 50 years of age or greater





# Cardiology consults

Of the cardiology consultations, 40% contained no recommendations other than "proceed with case," "cleared for surgery," or "continue current medications."

*But usually only after the obligatory echo and stress.*



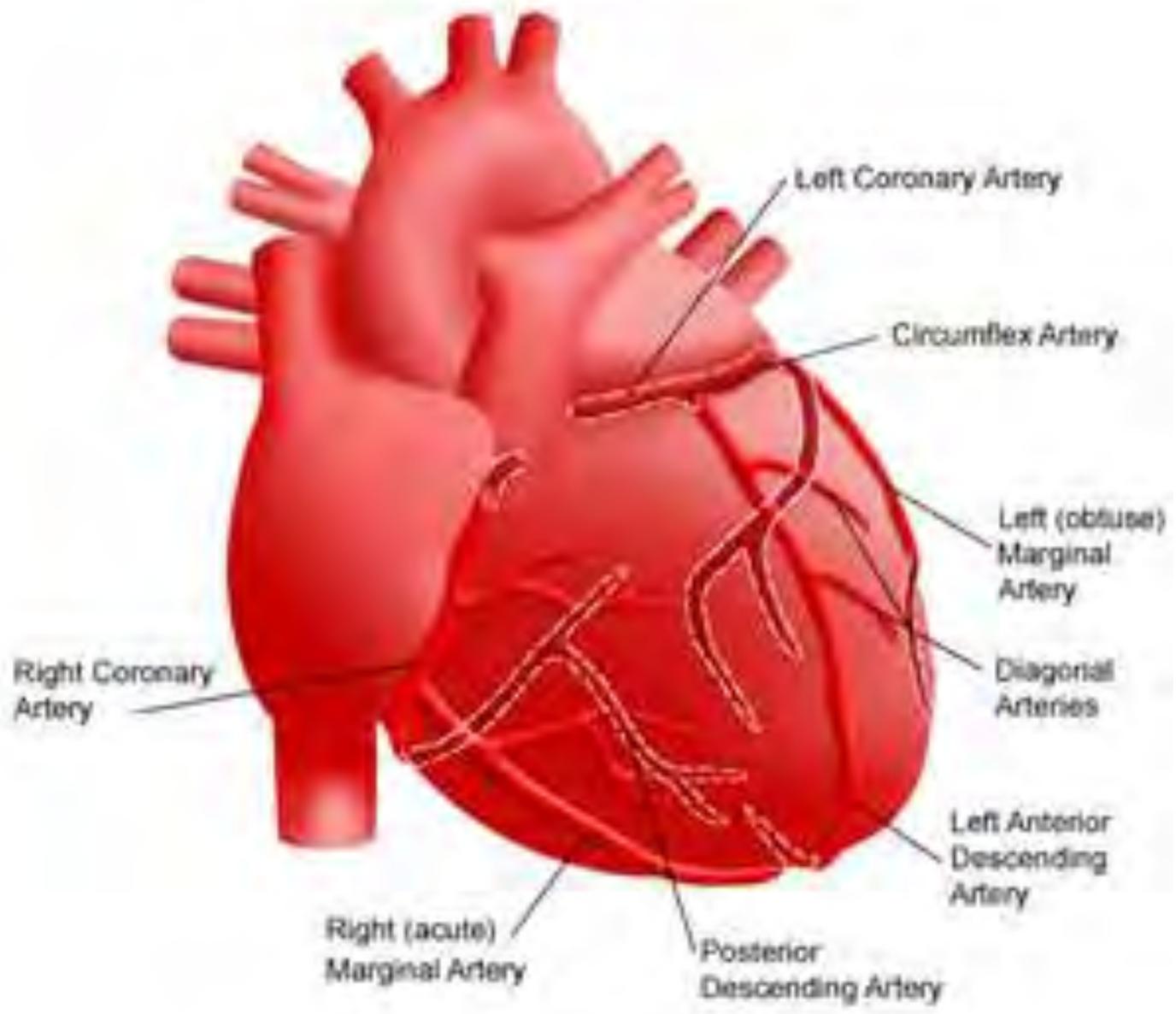
**Stress test was positive for ischemia**

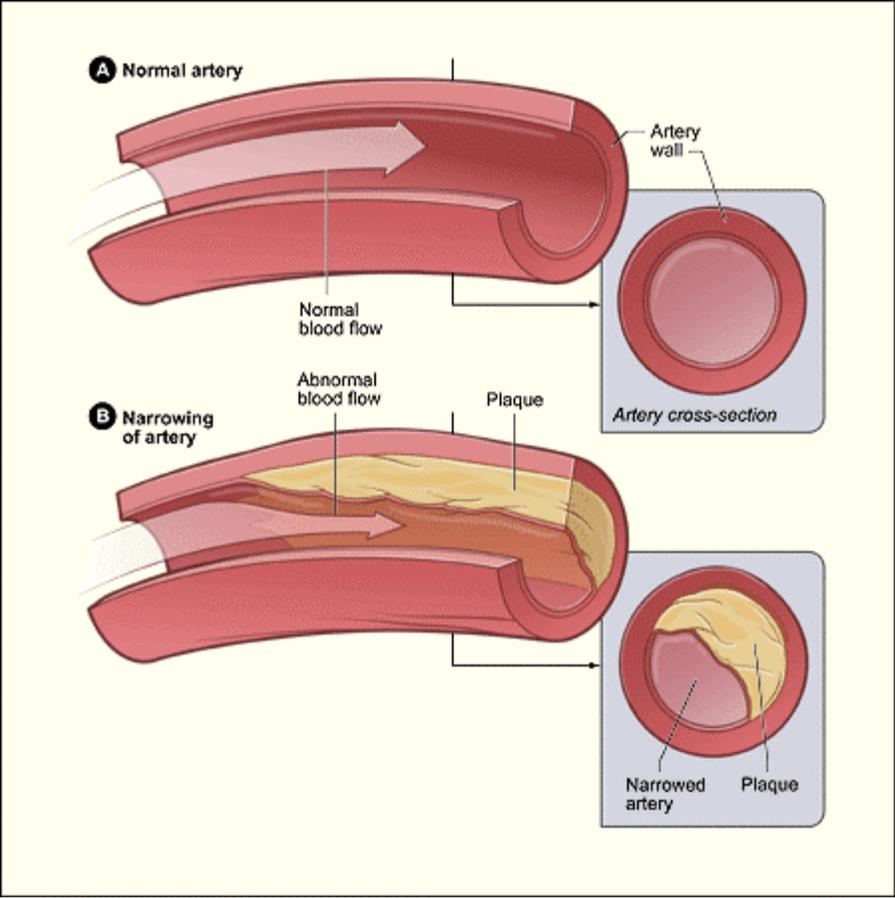


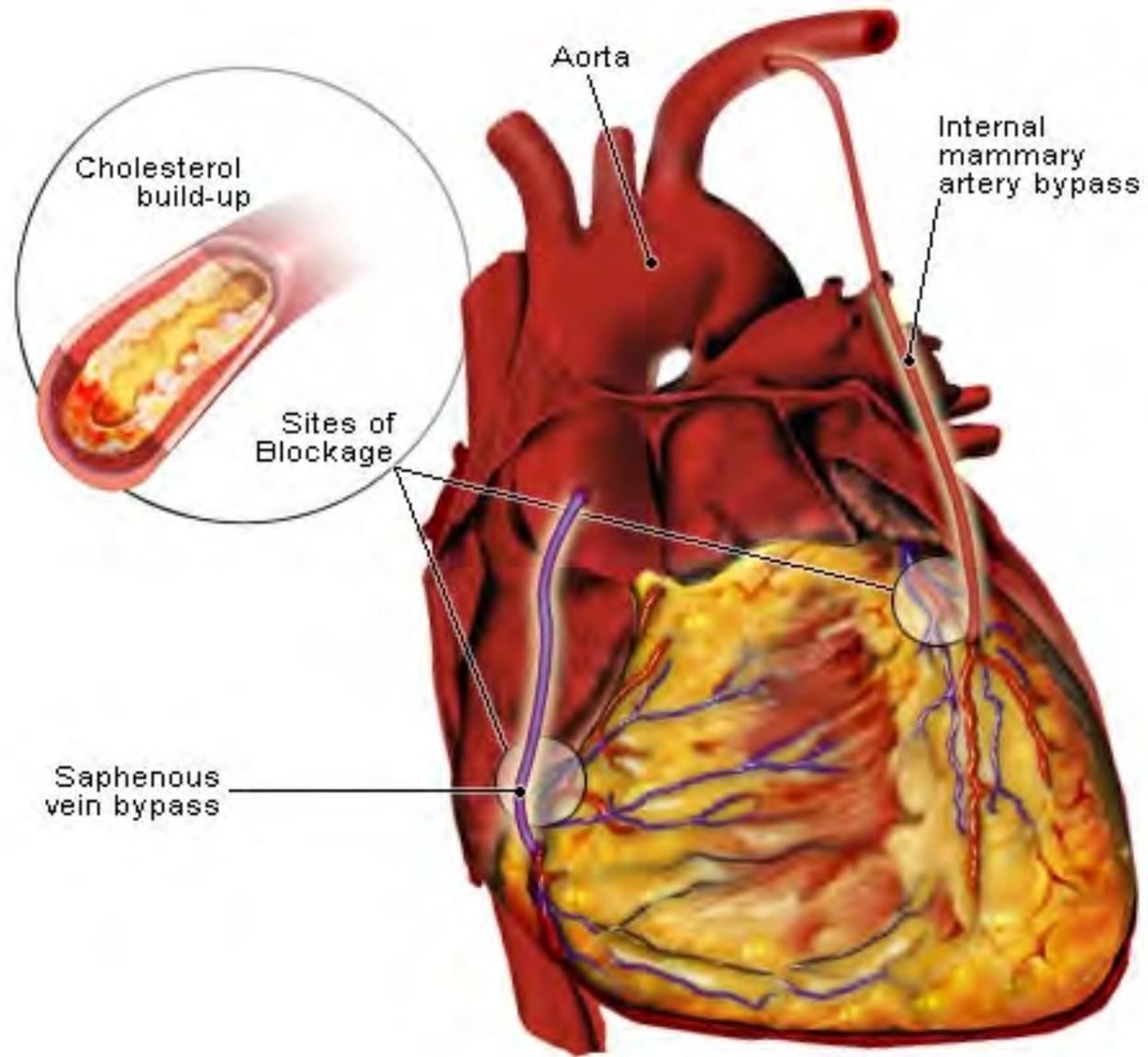
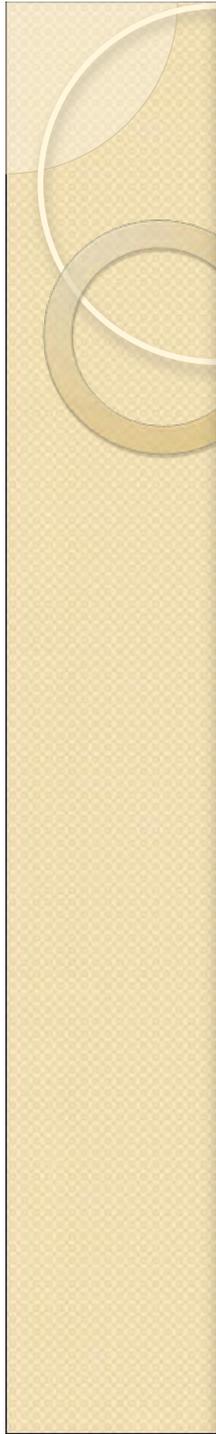
# Options

- Medical management
- CABG
- minimally invasive direct coronary artery bypass (MIDCAB)

## Coronary Arteries of the Heart









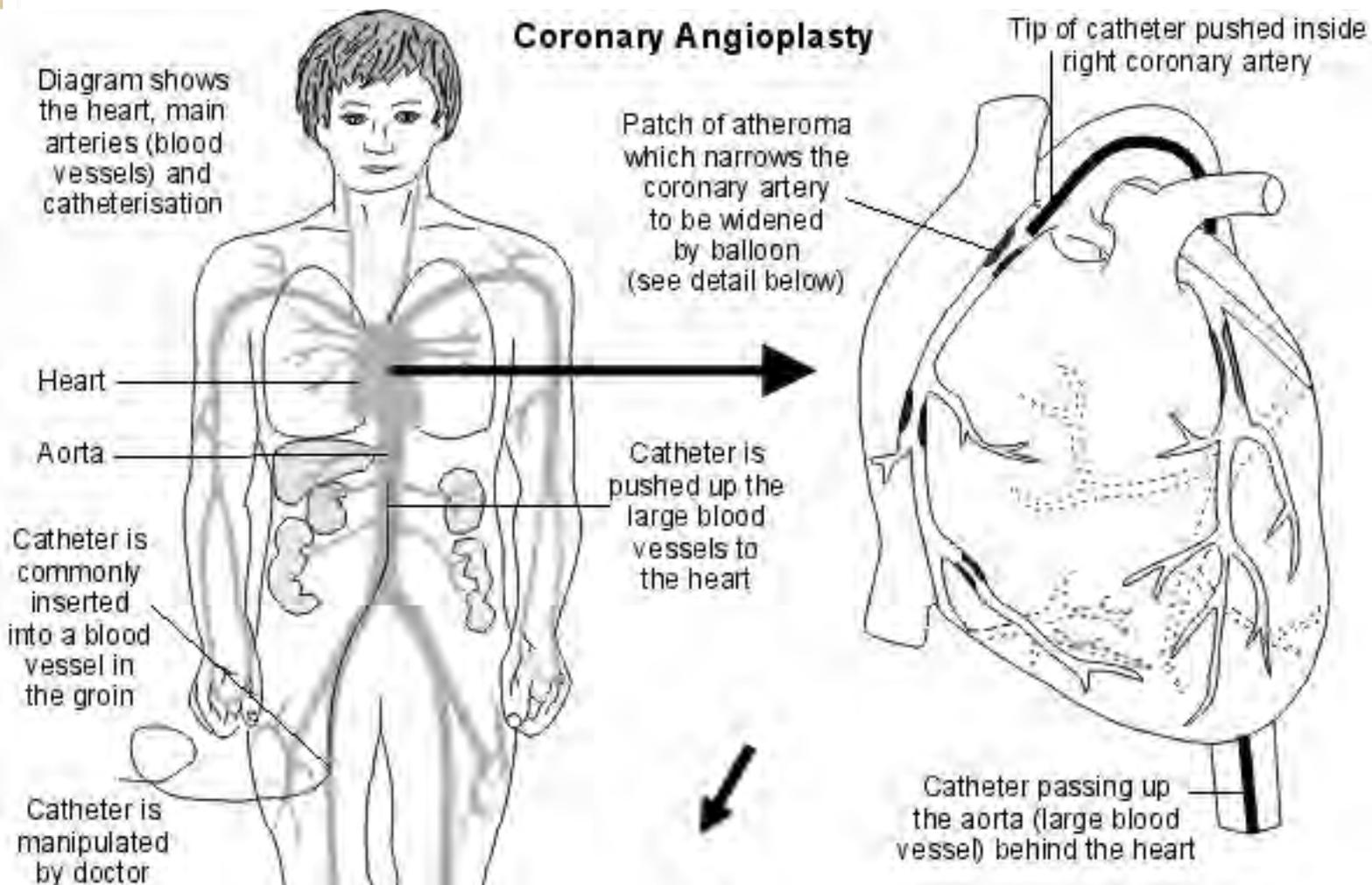
# Options(cont)

## Percutaneous intervention (PCI)

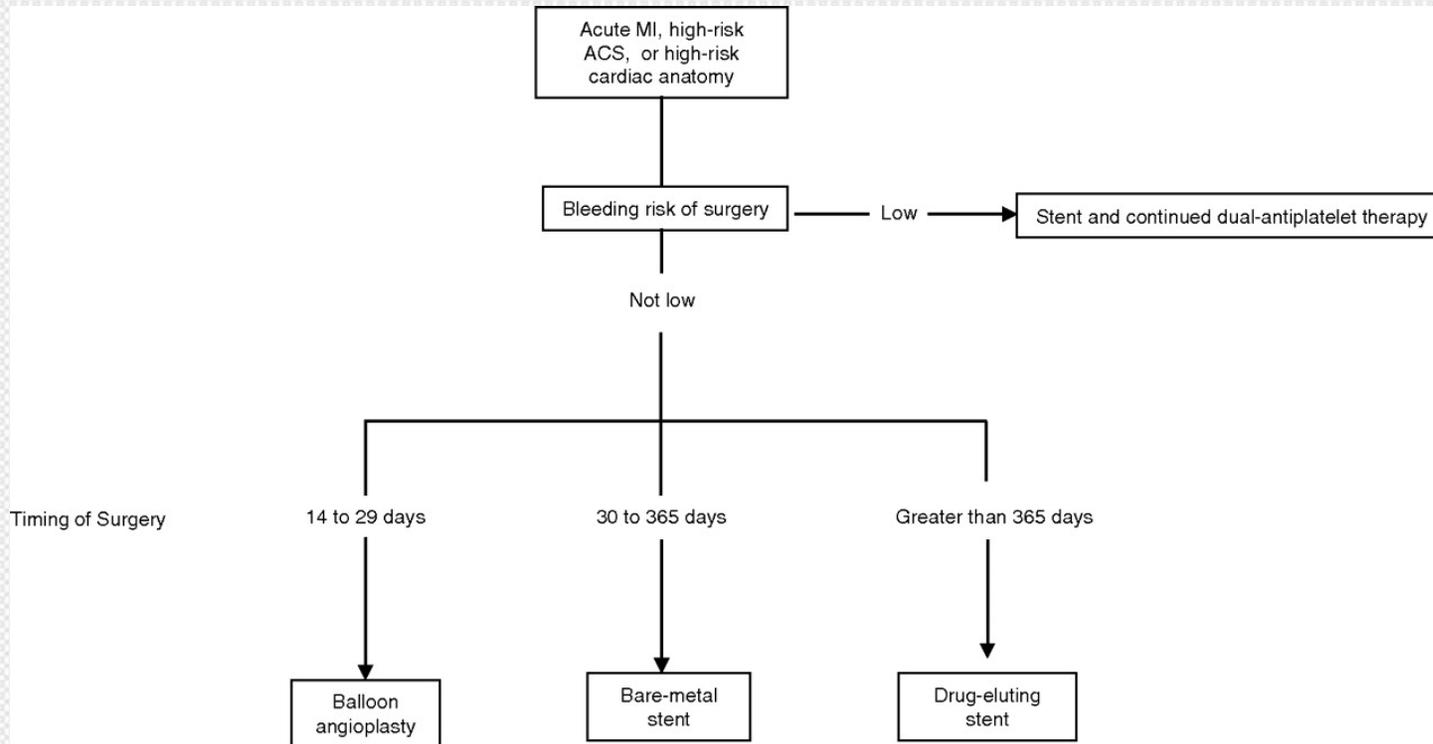
- Balloon angioplasty
- Bare metal stent
- Drug eluting stent

(In stable angina PCI not superior to medical management. COURAGE and other trials.)

## Coronary Angioplasty



## Proposed treatment for patients requiring percutaneous coronary intervention who need subsequent surgery

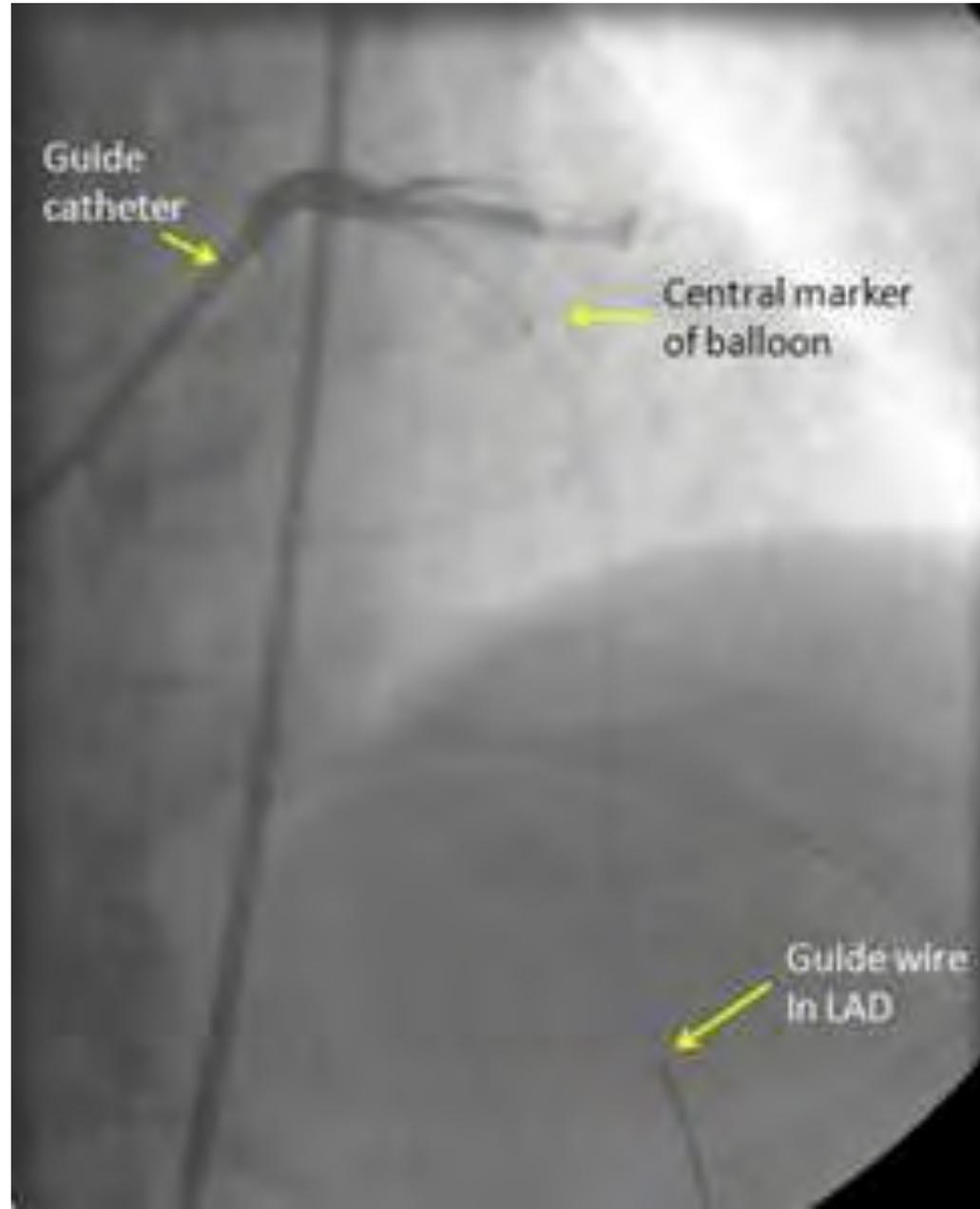


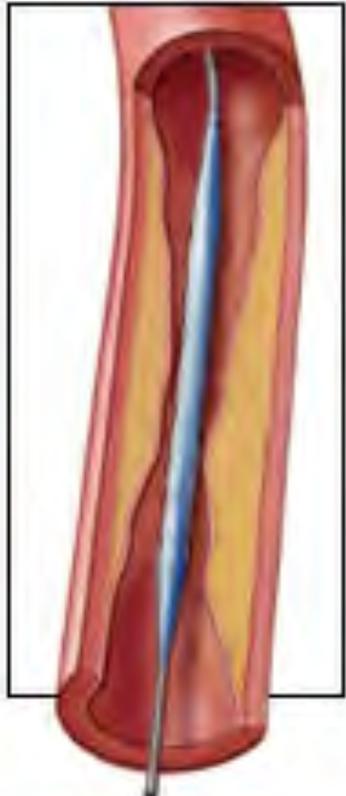
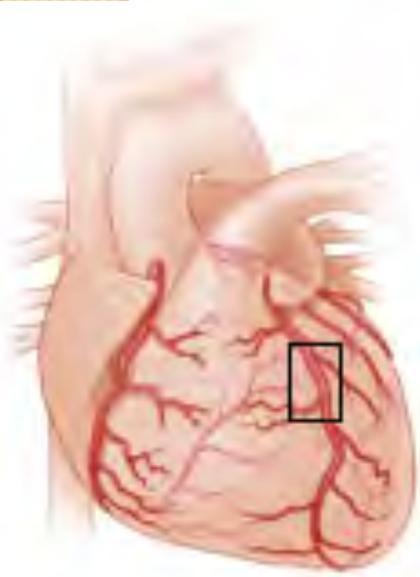
Fleisher, L. A. et al. *Circulation* 2007;116:1971-1996

# Balloon angioplasty

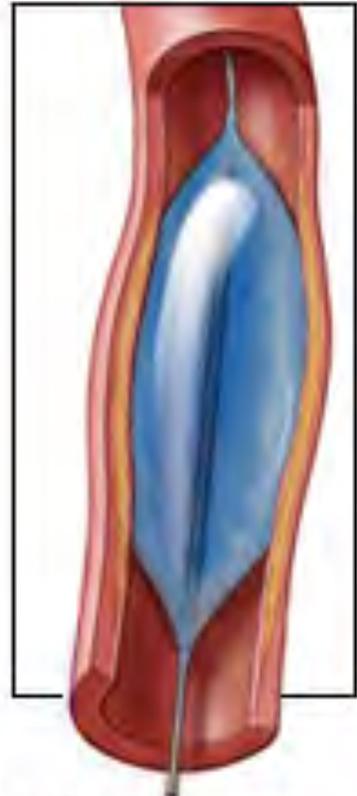
- Mid 1970s
- Artery wall weakened and collapsed after balloon angioplasty which led to 3% to emergent CABG
- 30% re-stenosis rate
- Needed stenting



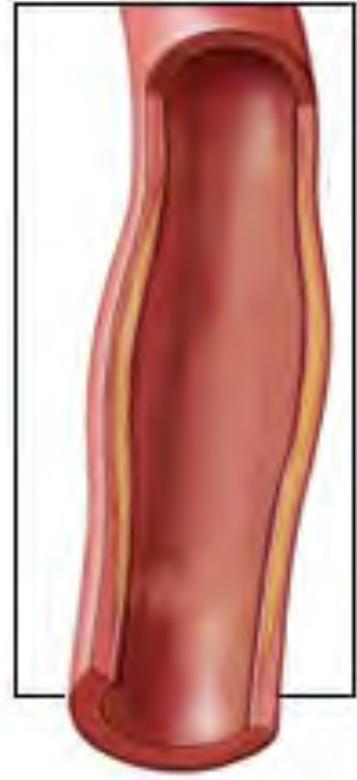




Deflated balloon in artery

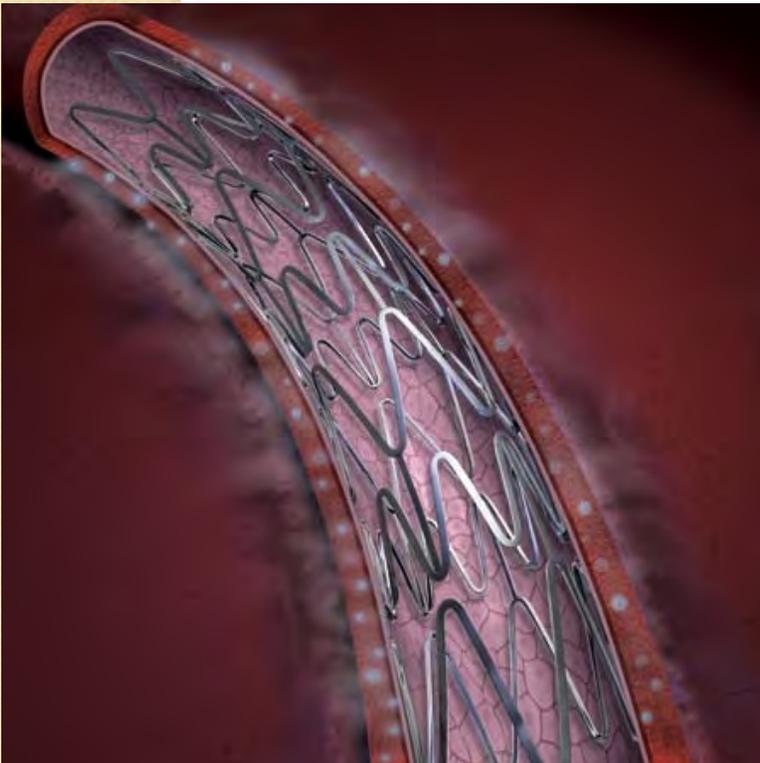


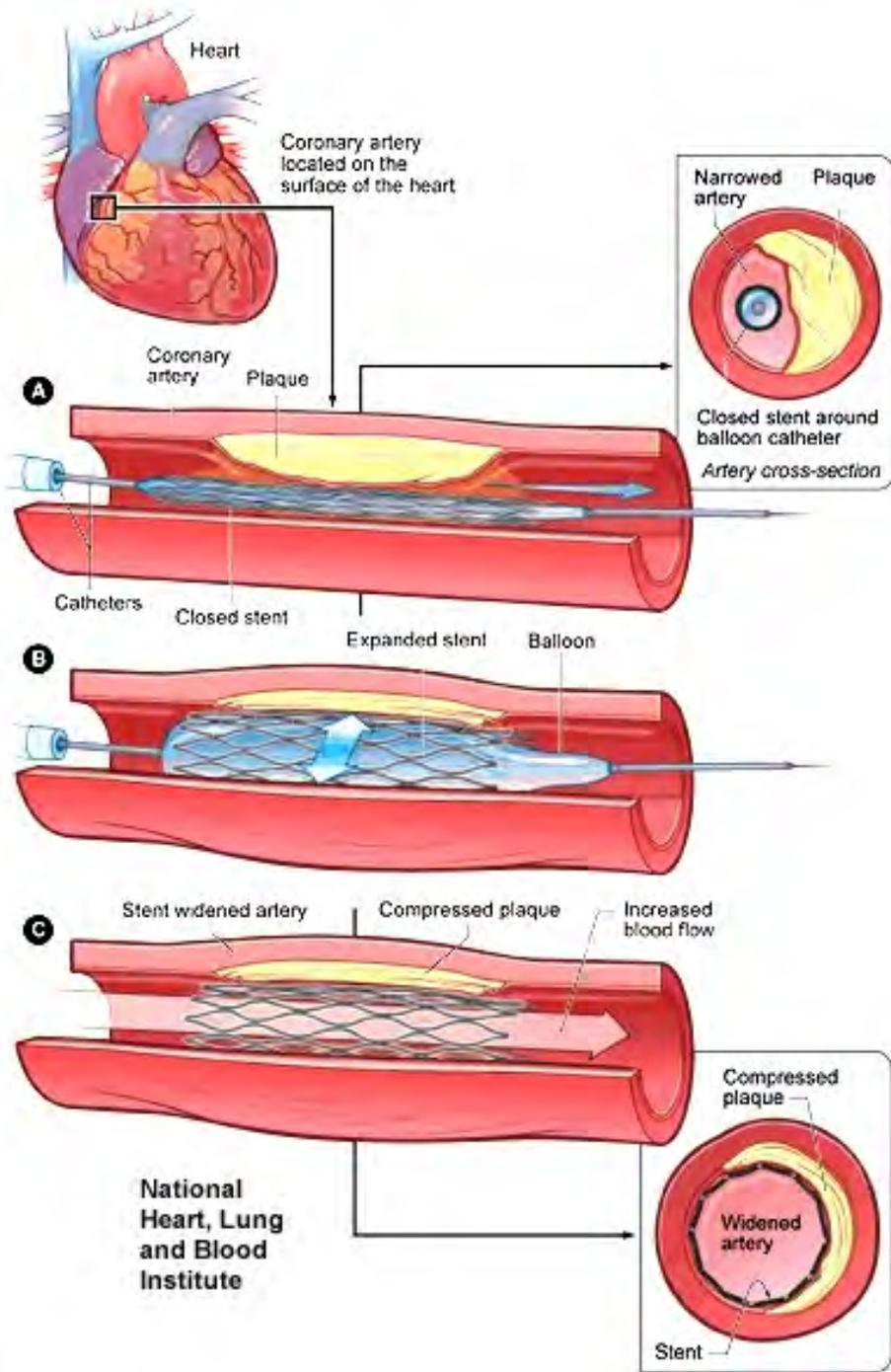
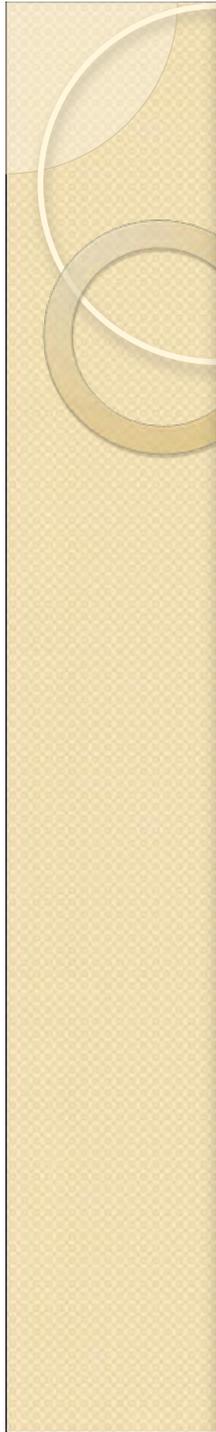
Inflated balloon compresses plaque against artery walls



# Bare Metal stent

- 1986 in Europe(1994 in USA)
- Solved the weak wall/collapse
- Re-stenosis persisted in 25% usually by about 6 months
  - Not recurrence of atherosclerosis
  - But re-stenosis by smooth muscle proliferation – as part of healing/scar of the injury of angioplasty.







# Drug eluting stents (DES)

- Approved by FDA 2003/4
- 2003 sirolimus (cypher®)
  - Antifungal rapamycin (Easter island bacteria)
  - potent immunosuppressive (renal transplant often used later because of poor wound healing.)
  - Antiproliferative – stents
  - Anti cancer treatment

Neste local foram obtidas em janeiro de 1965 as amostras de solo que permitiram obter a rapamicina, substância que inaugurou uma nova era para os pacientes submetidos a transplantes de órgãos.

Homenagem dos investigadores  
brasileiros.

Novembro de 2001.



**WYETH BRASIL**



## DES(cont)

- 2004 paclitaxel (Taxus®)
- Bark of Pacific Yew tree
- Mitotic inhibitor
- Stabilization of microtubules
- Cancer chemotherapy



## DES (cont)

- Prevents neo-intimal growth / scar tissue and endothelium
- Initially 3 (sirolimus) or 6 (paclitaxel) months of clopidigrel
- 650 000/year
- Restenosis - < 10%

Newer: Xience® - everolimus 2008 – Medtronic  
Biodegradable coating/stent



## DES (cont)

- AHA advisory January 2007 – risk of late in-stent thrombosis. (>30% mortality)
- What happened?
- On label vs. off label use of stents
  
- Length
- Diameter
- Fitting snugly in arterial wall



On label:

- sirolimus-eluting stents were de novo lesions no longer than 30 mm in native coronary arteries with reference vessel diameters of at least 2.5 mm to at most 3.5 mm
- paclitaxel-eluting stents de novo lesions no longer than 28 mm in native coronary arteries at least 2.5 to at most 3.75 mm in diameter.

- 
- Non-diabetics
  - Preserved renal function
  - Not bifurcations
  - Single vessel
  - Native coronaries only

Today 70% at SBUMC are off label usage.

**Table 1. Frequency of Off-Label Criteria\*.**

**Table 1.** Frequency of Off-Label Criteria\*

| <b>Criteria for Off-Label Use</b>                 | <b>No. (%)<br/>of Patients<br/>(n = 1817)</b> |
|---|---|
| >1 Lesion treated                                 | 1073 (59.1)                                   |
| Total stent length $\geq$ 36 mm                   | 975 (53.7)                                    |
| Bifurcation lesion                                | 473 (26.0)                                    |
| Lesion in coronary artery<br>bypass graft surgery | 173 (9.5)                                     |
| Baseline creatine kinase-MB<br>>3 ULN             | 118 (6.5)                                     |
| Stenosis preprocedure,<br>100%                    | 112 (6.2)                                     |
| Maximum balloon diameter<br>>4 mm                 | 76 (4.2)                                      |
| Ejection fraction <25%                            | 77 (4.2)                                      |
| Unprotected LM intervention                       | 20 (1.1)                                      |

Abbreviations: LM, left main coronary artery; ULN, upper limit of normal.

\*Criteria are not mutually exclusive.

Win, H. K. et al. *JAMA* 2007;297:2001-2009

**JAMA**



# Eluting the drug

Drug needs to be washed out before endothelium can cover stent

Normal endothelium is needed for coagulation hemostasis.

Wash out is related to:

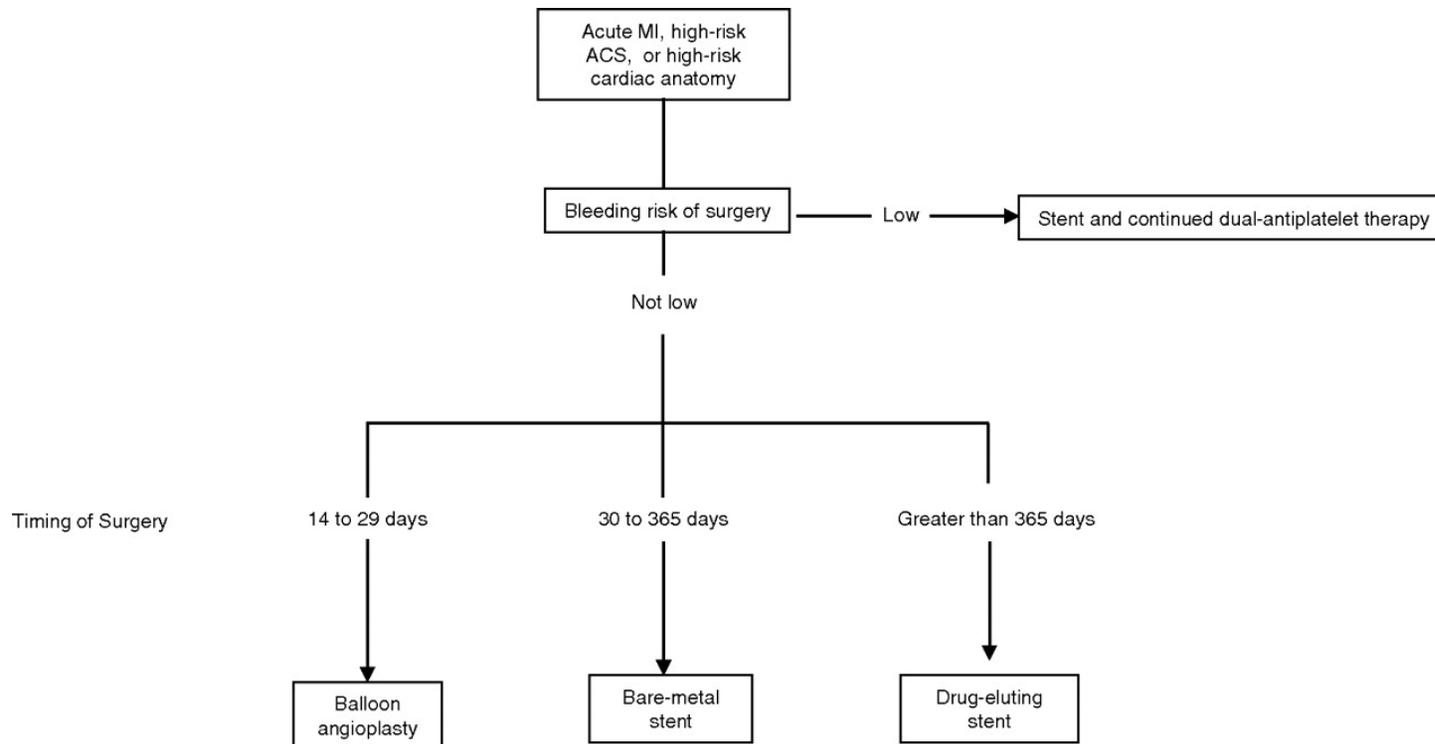
- Cardiac output vol/min
$$\text{HR} \times \text{SV}$$
- Concentration gradient
- Flow through the stent
  - Length
  - Diameter
  - Turbulent flow vs laminar
- ***Unpredictable***



# What did the cardiologist do with the positive stress test?

- Cardiac Cath
- PCI
- Stent
- Drug eluting stent
- Clopidogrel and aspirin for life

## Proposed treatment for patients requiring percutaneous coronary intervention who need subsequent surgery



Fleisher, L. A. et al. *Circulation* 2007;116:1971-1996

# Clonidogrel(plavix)

## Clonidogrel

- thienopyridine class antiplatelet
- prodrug
- ADP(adenosine diphosphate) receptor on platelet cell membranes
- Irreversible inhibition
- Prevents aggregation of platelets / fibrin cross linking
- Slow onset(2 hours) loading dose preferred
- Effect 7-10 days
- Aspirin
  - COX2 inhibitor – also irreversible –platelet inhibition

# Clopidogrel and Anesthesia implications

- No antidote
- No quick/cheap or easy lab test
- Platelet transfusion
- Common recommendations:
  - Delay elective surgery for one year
  - If have to proceed: hold for 4 days, stay on aspirin

ASRA guidelines neuroaxial blockade can only be done after holding clopidogrel for 7 days



# Our patient

- DES
- Surgery on aspirin and plavix
- Increased bleeding
- Hematoma
- Returned at 2 months for ALND
- Same problem

# Summary

## Drug Eluting Stents

- Avoid surgery in first year
- Lifetime aspirin and long term plavix
- Significant risk of in-stent thrombosis

## Plavix instructions

- Ideally from the interventionalist
- If have to stop:
  - As short as possible (3-4 days)
  - Stay on aspirin
  - Stay on Statin
  - Loading dose of 300mg of clopidogrel in PACU or as soon as possible after surgery.