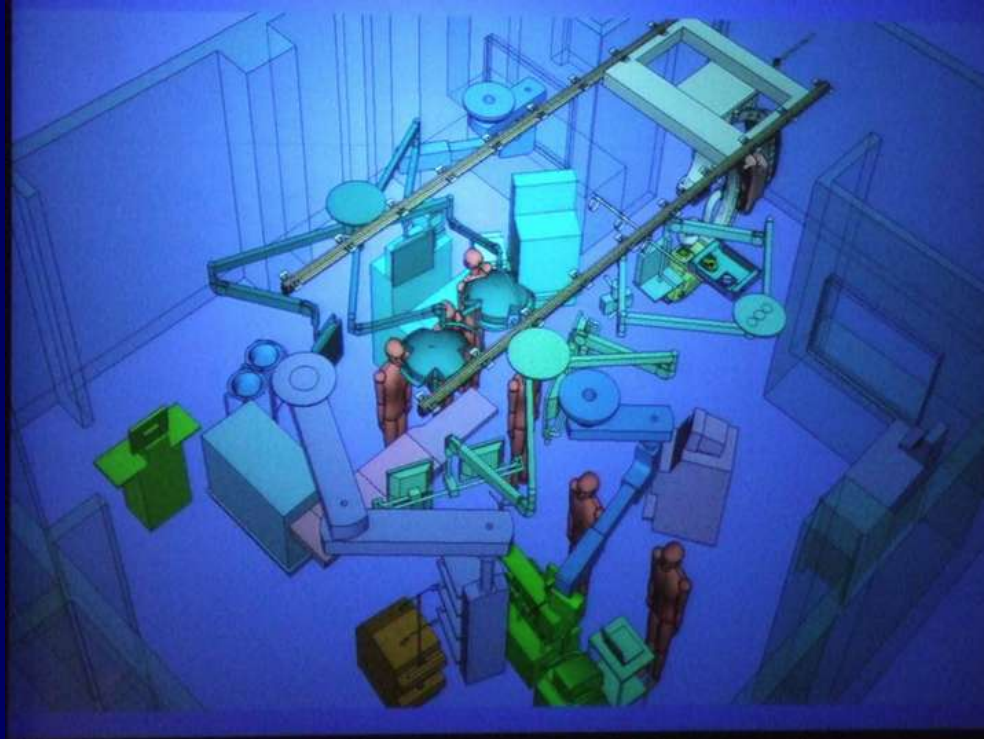


# **HYBRID CORONARY REVASCULARIZATION: IS THIS IN YOUR FUTURE?**



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# Objectives

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- Discuss details of hybrid OR
    - What is a hybrid OR
    - Why use a hybrid OR
  - Rationale for hybrid procedures
  - Current utilization of hybrid OR
    - Hybrid coronary revascularization
    - Hybrid coronary/valve surgery
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# Why talk about hybrid ORs

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- Healthcare is changing
    - > Delivery- what and how
    - > Reimbursements- MDs and hospitals
    - > Hospital/physician relationships
  - Our technology is changing
    - > Minimally invasive cardiovascular surgery
    - > Drug-eluting stents
    - > Stent grafts
    - > Percutaneous valves
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# Why talk about hybrid ORs

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- Patient populations continue to change
    - > Older
    - > Sicker-more comorbidities
    - > More advanced disease
  - Our physicians are changing
    - > Growing endovascular specialists
    - > Specialty boundaries are less defined
    - > Heart team is becoming a new paradigm
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# Hybrid Operating Room

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- A fully functional cardiac cath lab and cardiac surgery OR
  - Allows patients to undergo percutaneous interventions and cardiac surgery simultaneously
  - Ideal for treating a variety of conditions: CAD, valve disease, CHD, aortic disorders, CHF, arrhythmia
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# Components of a Hybrid OR/Cath lab

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- Fully functional Cath lab
  - Multipurpose table
  - Versatile imaging equipment: Fixed and mobile modes
  - Multimodality imaging:  
Cine/CT/IVUS/OCT/Echo
  - Multiple flat-panel monitors
  - Traffic/Air flow to maintain sterility
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# What makes a Hybrid OR successful?

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- Infrastructure
  - Superior imaging/monitoring equipment
  - Integrated imaging equipment
  - Teamwork and convergence
  - Protocols
  - Trained ancillary staff: Cross-training
  - Supplies
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# Teamwork and Convergence

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- Bringing multiple specialists together to deliver the best care to the patient
  - Utilizing multiple technologies as appropriate
  - Realization that parallel procedures and technologies are often complementary, rather than competitive
  - Collaborative strategy: Patient centric approach
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# Advantages of Hybrid Surgery

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- Hybrid surgery minimizes hurt to patient from more invasive procedures
  - Maximizes treatment spectrum
  - For complex heart disorders, maximizes the advantages of catheter and surgery
  - Accelerates recovery time
  - Reduces hospital stay
  - Improves patient satisfaction
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# Hybrid Coronary Revascularization Background

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- The optimal revascularization strategy for multivessel coronary artery disease (CAD) remain controversial.
  - Controversy is especially remarkable when there is severe diffuse disease involving the proximal segment of the left anterior descending artery (LAD).
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# Hybrid Coronary Revascularization Background

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- CABG is still the gold standard for multivessel revascularization with a well established survival benefit.
  - CABG survival benefit is conferred by the LIMA to the LAD graft.
  - There is no incremental benefit of SVGs to non-LAD vessels.
  - The longevity of SVGs is poor with 1-year and 15-years failure rates of 20% and 70% respectively.
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# Hybrid Coronary Revascularization Background

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- In the present DES era, LIMA to LAD graft continuous to have unrivaled safety and efficacy.
  - Stent restenosis rates (DES) are now lower than reported rates of SVG failure.
  - PCI is probably a superior strategy to SVG for revascularization of non-LAD vessels.
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# Rationale of Hybrid Revascularization

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- Combining the benefits of LIMA to LAD graft with the benefits of PCI with DES implantation in non-LAD may minimize risk without diminishing the efficaciousness offered by each strategy in particular.
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# DES Restenosis and Thrombosis rate for Non-LAD Vessels

**Table 1. Data From Randomized Trials on Drug-Eluting Stent Restenosis Rate and Stent Thrombosis for Non-Left Anterior Descending Artery Revascularization (n=3631)**

Author (Trial)	Year	n	Restenosis ≥50% at 6–12 mo, %	Stent Thrombosis, %
Silber et al <sup>8</sup> (TAXUS II follow-up)	2009	536	2.3	0.1
Meredith et al <sup>9</sup> (ENDEAVOR I follow-up)	2009	100	5.4	1
Fajadet et al <sup>10</sup> (ENDEAVOR II follow-up)	2010	1197	9.4	0.5
Kandzari et al <sup>11</sup> (ENDEAVOR III follow-up)	2011	436	9.2	0
Serruys et al <sup>12</sup> (SPIRIT I)	2005	60	0	0
Serruys et al <sup>13</sup> (SPIRIT II)	2006	300	2.1	0.9
Stone et al <sup>14</sup> (SPIRIT III)	2008	1002	2.3	0.8
Average			4.39	0.47

# 1-year SVG Patency for Non-LAD Vessels

**Table 2. Data From Studies of 12-Month Postoperative Saphenous Vein Graft Patency With Coronary Angiography for Non-Left Anterior Descending Artery Revascularization (n=7919)**

Author	Year	n	SVG Imaged (SVG Occluded), n	SVG Occlusion Rate in the Study, %
Puskas et al <sup>5*</sup>	2004	153	306 (19)	6.2
Alexander et al <sup>4*</sup>	2005	1920	4537 (1198)	26
Sabik et al <sup>15</sup>	2005	4333	8733 (1921)	22
Cho et al <sup>16</sup>	2007	833	218 (70)	32
Desai et al <sup>17*</sup>	2007	440	440 (60)	13.6
Kim et al <sup>18</sup>	2008	240	121 (29)	24
			14 355 (3297)	20.63 (Average)

SVG indicates saphenous vein graft.

\*Randomized study.

# LIMA to LAD Graft Patency

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- With PCI, the location of the lesion in the proximal LAD has been identified as an independent risk factor for in-stent restenosis with rates between 19% and 44%.
  - The LIMA–LAD graft has excellent patency rates, which correlates with increased event-free survival.
  - 5-year patency rate ranges between 92% and 99% and at 10 years between 95% and 98%.
  - The LIMA-LAD graft may be responsible for the majority of the benefit of CABG surgery. Whether non-LAD vessels are treated with SVGs or PCI may be less important.
  - This is the premise on which the modern era of hybrid coronary revascularization is based.
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# Results of Hybrid Revascularization

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- No randomized trials so far
  - Multiple small nonrandomized studies have shown hybrid coronary revascularization is safe with low mortality rates (0% to 2%), low morbidity, and shorter intensive care unit and hospital stay. Other clear advantages are superior cosmetic results and faster recovery
  - Largest single center case series (Vanderbilt University Heart Center) showed no meaningful differences between risk adjusted outcomes
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# MY PRACTICAL FLOWCHART

ULM or 3VD with any of the following unfavorable features:

- True bifurcational disease of ULM
- 1 or > clinically relevant CTO
- LV dysfunction (LVEF < 40%)
- Inexperienced operator (< 1000 PCI)
- Diabetes mellitus
- Other surgical indications

CABG as first choice!

Attempt PCI if:

- CABG contraindicated
- Patient/family and cardiac surgeon agree on PCI

ULM or MVD without any of above unfavorable features

CABG favored, but Hybrid or PCI reasonable

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ULM or MVD without any of above unfavorable features

CABG favored, but PCI reasonable

Protected LM or 2VD with any of these "favorable" features :

- Ostial LAD ok
- Lack of diffuse disease
- No true bifurcations
- No CTO
- No diabetes
- Ongoing ACS

Risk-benefit balance fine for PCI, but CABG or hybrid can still be appropriate and thus should be discussed with patient and family

# MY PRACTICAL FLOWCHART

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- Lack of diffuse disease
- No true bifurcations
- No CTO
- No diabetes
- Ongoing STEACS

Risk-benefit balance fine for PCI, but CABG can still be appropriate and thus should be discussed with patient and family

1VD without other surgical indications

PCI recommended (CABG should be considered only for proximal LAD)



# Types of Hybrid Revascularization

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- **1-stage hybrid:** CABG/PCI performed in a hybrid room and in 1 setting, staged by minutes. The appeal of the latter is multifold: improved logistics, lower cost, and better patient satisfaction.
  - **2-staged hybrid procedures:** PCI before CABG
    - Allows aggressive stenting because if a complication arises or PCI is unsuccessful, CABG can be performed later.
    - **Main disadvantage:** Performing PCI in an unprotected environment without the benefit of a LIMA–LAD graft, and later performing CABG under aggressive antiplatelet agents.
    - **Additional disadvantage:** No completion angiogram of the LIMA–LAD graft unless a third procedure is done.
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# Types of Hybrid Revascularization

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- 2-staged hybrid procedures: PCI after CABG
    - Avoids antiplatelet-related bleeding complications during CABG
    - Has the advantage of a protected environment with a LIMA–LAD graft
    - LIMA graft patency can be verified at the time of PCI.
    - **Disadvantage:** In the event of PCI complication/failure, however, a second, higher-risk operation needs to be performed. The latter should be rare, however, as emergent CABG after PCI has a low incidence ( <1%)
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# A.1<sup>ST</sup> STEP IN CRISIS MANAGEMENT IS PREVENTING IT: Selection (Choose the right patient)



## B. COLLABORATIVE DECISION-MAKING IN ALL BUT CLEAR-CUT CASES: INVOLVE



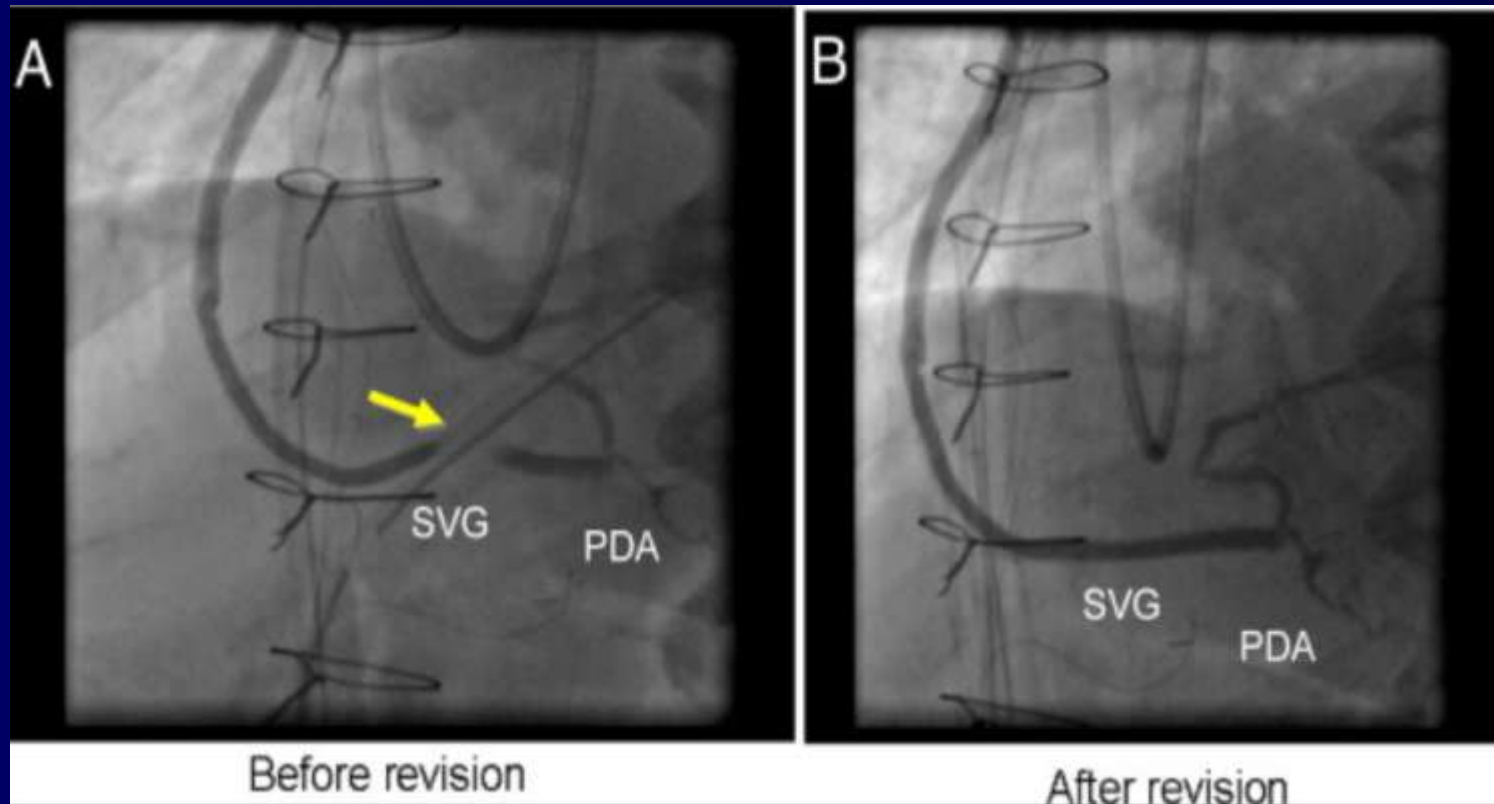
C. NEVER FORCE TOO MUCH...  
EITHER INDICATIONS, DEVICES, TECHNIQUES,  
OR





# Routine Intraoperative Completion Angiography After Coronary Artery Bypass Grafting

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# **Routine Intraoperative Completion Angiography After Coronary Artery Bypass Grafting**

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- > Routine completion angiography detected 12% of grafts with important angiographic defects.
  - > One-stop hybrid strategy is reasonable, safe, and feasible.
  - > Combining the tools of the cath lab and OR greatly enhances the options available to the surgeon and cardiologist for patients with complex coronary artery disease. (J Am Coll Cardiol 2009;53:232–41)
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# Hybrid Valve/PCI

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- The rationale behind hybrid valve surgery is to substitute PCI for CABG (typically substituting PCI for SVG) to convert a combined valve/CABG procedure requiring sternotomy into an isolated valve procedure, which can be performed using minimally invasive techniques.
  - There are 3 settings in which this may be of benefit.
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# Hybrid Valve/PCI

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- CABG patient with poor conduit for CABG surgery
  - Convert high-risk valve/CABG surgery into a lower-risk isolated valve
  - Convert reoperative valve/CABG into reoperative isolated valve surgery.
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# Conclusions

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- The hybrid OR facilitates a whole new spectrum of cardiac surgical/invasive therapies
  - The trend toward hybrid techniques will continue to evolve and is becoming an essential resource of every cardiovascular center
  - All areas of cardiovascular care are becoming deeply affected
    - Requires a highly organized and fully cooperative multidisciplinary team
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# Clinical Implications

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- Decision making for hybrid procedures is complex, should be individualized and take into account not only the short-term risk but also the long-term benefit.
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# THANK YOU

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