MANAGEMENT OF THE CARDIAC SURGERY PATIENT AFTER DISCHARGE

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DISCLOSURE

• No disclosures, financial, or otherwise to declare
CARDIOPULMONARY BYPASS

1. Oxygen-poor blood leaves the heart to enter the heart-lung machine.
2. Heart-lung machine pumps and adds oxygen to the blood before it returns to the body.
3. Oxygen-rich blood returns to the body, skipping the heart and lungs.
CABG

- Internal thoracic artery
- Superior epigastric artery
- Saphenous vein
- Internal mammary artery
- Radial artery bypass
- Saphenous vein bypass
- Sites of blockage
VALVE SURGERY

• Which valve? - Aortic, Mitral, Tricuspid
• Repair vs Replacement
• Replacement – Mechanical vs Bioprosthetic i.e. Tissue valve
POST-OP RECOVERY

• CVICU: 1-2 days
  • Monitor for bleeding
  • Wean ventilation\extubate
  • Wean vasopressors, inotropes

• 3W: 4-5 days
  • BP control
  • HR control, monitor/treat arrhythmias
  • Renal function
  • Pacing wire removal
  • CT removal
  • Mobilization
  • Anticoagulation
FIRST POST-OP VISIT TO GP

- What surgery did they have?
- Were there any in-hospital complications?
- Vitals including rhythm
- Volume status – hyper vs hypovolemic
- Wounds

- Review discharge medications:
  - New meds - duration
  - Discontinued old meds
  - Meds to be titrated
  - Anticoagulation? Target INR?
  - Blood work
POST-OP MEDS

• ASA
• Beta-blocker
• ACE-i/ARB
• Statin
• Calcium channel blocker

• Nitro patch
• Coumadin
• Diuretic
• Pantoloc .....
WHY ARE THERE SO MANY MEDICATIONS???
CABG: SECONDARY PREVENTION

2015 Updated AHA Guidelines

“At risk for subsequent ischemic events as a result of native CAD progression, vein graft atherosclerosis”
ANTIPLATELET RECOMMENDATIONS

1. ASA should be administered pre-operatively and within 6 hours after CABG in doses of 81-325mg daily. Should then be continued indefinitely to reduce graft occlusion and adverse cardiac events (IA)

2. After OPCAB, dual antiplatelet for 1 year with ASA (81-162mg od) and clopidogrel 75mg od to reduce graft occlusion (IA)

3. Clopidogrel 75mg od reasonable alternative after CABG for patients who are intolerant of/allergic to ASA. Reasonable to continue indefinitely. (IIa, C)

4. In patients who present with ACS, reasonable to administer ASA and prasugrel or ticagrelor (preferred over clopidogrel) (IIa, B) – SMGH 1 year
ANTIPLATELET RECOMMENDATIONS

5. As sole antiplatelet after CABG, reasonable to consider higher dose ASA (325mg od) rather than 81mg to prevent ASA resistance, but benefits not well established (IIa, A)

6. ASA + clopidogrel for 1 year after CABG may be considered in patients without ACS, but benefits not well established (IIb, A)
ANTITHROMBOTIC RECOMMENDATIONS

1. Warfarin should NOT be *routinely* prescribed after CABG for graft patency unless other indications (AF, venous thromboembolism, mechanical valve) (III,A)

2. Warfarin alternatives (dabigatran, apixaban, rivaroxaban) should NOT be routinely administered early after CABG until additional safety data (III,C)
LIPID RECOMMENDATIONS

1. Unless contraindicated, all CABG patients should receive statin, starting pre-op and restarting after surgery (I, A)

2. High-intensity statin (atorvastatin 40-80mg, rosuvastatin 20-40mg) should be administered after CABG to all patients <75 years of age (I, A)

3. Moderate-intensity statin should be administered after CABG for those who are intolerant of high-intensity statin therapy or at greater risk for drug-drug interactions (I,A)

4. Discontinuation of statin therapy NOT recommended before or after CABG unless adverse reactions (III,B)
**β-BLOCKER RECOMMENDATIONS**

1. All CABG patients → peri-op β-blocker to prevent post-op AF, ideally before surgery (I,A)
2. CABG patients with history of MI → β-blocker unless contraindicated (I,A)
3. CABG patients with LV dysfunction → β-blocker unless contraindicated (I,B)
4. Chronic β-blocker (in absence of prior MI or LV dysfunction) may be considered, but other antihypertensives may be more effective and more easily tolerated (IIb, B)
1. **β-blockers** ASAP after CABG, in absence of contraindications, to reduce risk of post-op AF and to facilitate BP control early after surgery (I,A)

2. **ACE-i** for CABG patients with recent MI, LV dysfunction, DM, chronic kidney disease, with careful consideration of renal function in determining timing of initiation and dose selection (I, B)

3. Target **BP <140/85 mmHg** after CABG; however ideal BP target not formally evaluated in CABG patient (IIa, B)

4. Reasonable to add CCB or diuretic agent as an additional therapeutic choice if BP goal not achieved after CABG despite β-blocker /ACE-i (IIa, B)
HYPERTENSION RECOMMENDATIONS

5. In absence of prior MI or LV dysfunction, anti-hypertensives other than β-blockers should be considered for chronic HTN management long-term after CABG (IIb, B)

6. Routine ACE-i NOT recommended early after CABG among patients who do not have a history of recent MI, LV dysfunction, DM, CKD because it may lead to more harm than benefit and an unpredictable BP response (III,B)
1. In absence of contraindications, β-blockers (bisoprolol, carvedilol, SR metoprolol) recommended after CABG in all patients with EF<40%, especially among patients with heart failure or prior MI (I,A)

2. In absence of contraindications, ACE-i/ARB recommended after CABG in all patients with EF<40% or previous MI (I,B)

3. In absence of contraindications, reasonable to add aldosterone antagonist after CABG for patients with EF<35% who have NYHA II-III (IIa, B)

4. Among patients with EF<35%, ICD therapy NOT recommended for prevention of sudden cardiac death after CABG until 3 months of post-op GDMT and persistent LV dysfunction confirmed (III,A)
DIABETES RECOMMENDATIONS

• Target HbA1c of 7% reasonable after CABG to reduce microvascular diabetic complications and macrovascular cardiovascular disease (IIa, B)

• Poor glucose control also increases risk of peri-op infection
SMOKING CESSATION

1. Smoking cessation critical, and counseling should be offered to all patients who smoke, during and after hospitalization for CABG, to help improve both short- and long-term clinical outcomes after surgery (I, A)

2. Reasonable to offer NRT, bupropion, varenicline as adjuncts to counseling for stable CABG patients after hospital discharge (IIa, B)

3. NRT, bupropion, varenicline may be considered as adjuncts to counseling during CABG hospitalization but their use should be carefully considered on an individualized basis (IIb, B)
CARDIAC REHABILITATION

• Recommended for ALL patients after CABG, with referral ideally performed early post-operatively during surgical hospital stay (I, A)

• Important to encourage *ongoing* physical activity & cardiac diet
Why do they need a nitro-patch?

• Is he still having angina?
• Did they forget to discontinue it?
• What do surgeons know about medications???
RADIAL ARTERY SPASM

• Radial artery - structurally & functionally different from IMA
  • More muscular, more susceptible to vasospasm → pharmacologic prophylaxis
  • CCB +/- nitrates most commonly used in OR

• SMGH practice
  • Nitro patch 0.4 mg/hr OR
  • Amlodipine
  • Continue for 6 months post-op
CASE 1

- 65 yo male, 1 week after CABGx5 with LIMA, RA, SVG.
- Feels dizzy whenever he stands up quickly.
- BP 80/50; HR 55 regular
- Exam:
  - Wounds healing well, no infection
  - No pedal edema
  - Lungs clear
- Hgb 95, Creatinine 105
- Meds: ASA, Metoprolol, Perindopril, Nitro patch 0.4mg/h, Lasix 40 BID, atorvastatin
What should you do?

A. Nothing. Tell the patient to wait until they see the surgeon at 4-6 weeks.

B. Discontinue nitro patch since he is no longer having angina after his surgery.

C. Discontinue ACE-I, beta-blocker, diuretic, and nitro patch. Arrange follow-up in 3 months.

D. Decrease/discontinue ACE-I and Lasix and arrange follow-up in 1 week. Encourage PO intake.
What should you do?

A. Nothing. Tell the patient to wait until they see the surgeon at 4-6 weeks.

B. Discontinue nitro patch since he is no longer having angina after his surgery.

C. Discontinue ACE-I, beta-blocker, diuretic, and nitro patch. Arrange follow-up in 3 months.

D. **Decrease/discontinue ACE-I and Lasix and arrange follow-up in 1 week. Encourage PO intake.**
CASE 2

• 45 yo male, 1 week after CABGx4 with LIMA, RA, SVG.
• ++ sternal pain, otherwise no complaints.
• BP 175/90; 75 sinus rhythm

Exam:
• Wounds healing well, no infection
• No pedal edema
• Lungs clear

Hgb 115, Creatinine 85

Meds: ASA, nitro patch, metoprolol 50mg BID, atorvastatin
What should you do?

A. Nothing. Discharge medications should only be adjusted by the surgical team.

B. Discontinue nitro patch since he is no longer having angina after his surgery. Start ACE-i.

C. Nothing. Improved heart function must be causing increased BP. See him again in 6 months.

D. Add ACE-I and see patient again in 1 week to reassess BP.
What should you do?

A. Nothing. Discharge medications should only be adjusted by the surgical team.

B. Discontinue nitro patch since he is no longer having angina after his surgery.

C. Nothing. Improved heart function must be causing increased BP. See him again in 6 months.

D. Add ACE-I and see patient again in 1 week to reassess BP.
CASE 3

• 60 yo male, 5 weeks after CABGx3 with LIMA, RA. Post-op Afib
• Feels easily fatigued, no energy
• BP 110/55; HR 40, regular
• Exam:
  • Wounds healing well, no infection
  • No pedal edema
  • Lungs clear
• Hgb 100, Creatinine 90
• Meds: ASA, nitro patch, metoprolol 75mg BID, Amiodarone 150mg BID, warfarin, atorvastatin
CASE 3
What should you do?

A. Discontinue nitro patch since he is no longer having angina after his surgery.
B. Stop warfarin since he is in sinus rhythm.
C. Stop amiodarone.
D. Decrease metoprolol.
E. See patient in follow-up in 1 week.
What should you do?

A. Discontinue nitro patch since he is no longer having angina after his surgery.
B. Stop warfarin since he is in sinus rhythm.
C. Stop amiodarone.
D. Decrease metoprolol.
E. See patient in follow-up in 1 week.
POST-OP ATRIAL FIBRILLATION

• 15-40% after CABG
• 37-50% after valve surgery
• Up to 60% percent after CABG + valve
• **Risk factors**: Increasing age, previous history of AF, mitral valvular disease, increased left atrial size or cardiomegaly, previous cardiac surgery, COPD, obesity, severe RCA disease, etc, etc, etc....
• ↑risk of peri-op stroke (?), length of hospital stay, long-term mortality
• **Treatment**: Rate/rhythm control – β-blocker, amiodarone, digoxin
AFIB & ANTICOAGULATION

• Anticoagulation if multiple episodes or prolonged episode >24 hours
• Warfarin (INR 2.0-3.0) – if no other indication for higher INR
• How long to anticoagulate?
  • Majority of patients in sinus by 4 weeks
  • Continue anticoagulation for 4 weeks – 3 months
  • SMGH – Holter monitor at 3 months; if sinus rhythm → stop warfarin
  • If remains in AF (persistent or paroxysmal) or other indications → continue long-term anticoagulation
  • Switch to NOAC at 3 months???
CASE 4

• 65 yo male. 2 weeks post- “valve” surgery.
• No complaints.
• Exam:
  • 120/70. HR 70 regular.
  • Lungs clear. No pedal edema.
  • Incisions healing well.
• Meds: ASA, metoprolol, warfarin.
• Discharge summary – “GP to titrate warfarin to maintain therapeutic INR”
What is his target INR?
How often should I check INR?
# Anticoagulation After Valve Surgery

<table>
<thead>
<tr>
<th>Type of Valve</th>
<th>Target INR</th>
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<tbody>
<tr>
<td>Mechanical Aortic – no risk factors</td>
<td>2.5 (2.0-3.0) + ASA</td>
</tr>
<tr>
<td>Mechanical Aortic – with risk factors (AF, previous VTE, LV dysfunction, hypercoagulable, ball-cage valve)</td>
<td>3.0 (2.5-3.5) + ASA</td>
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<tr>
<td>Mechanical Mitral</td>
<td>3.0 (2.5-3.5) + ASA</td>
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<tr>
<td>Tissue Mitral</td>
<td>2.5 (2.0-3.0) – 3 months + ASA</td>
</tr>
<tr>
<td>Tissue Aortic</td>
<td>2.5 (2.0-3.0) – first 3 months (IIb, B) + ASA</td>
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ANTICOAGULATION AFTER VALVE SURGERY

• INR check Q 2-3 days until therapeutic on 2 consecutive checks
• Then weekly until therapeutic on 2 consecutive checks
• Then Q 2 weeks until INR therapeutic on 2 consecutive checks
• Then Q 4 weeks – **Probably too infrequent for valve patients!!!**
• Drug interactions, nutrition status, dietary intake, EtOH → check INR more frequently
• Home INR monitor – COMPARE TO LAB!!!
• Systematic process to ensure patients aren’t missed!

CHEST 2012
CASE 5

• 70 year old male
• Mechanical AVR 10 years ago for BAV
• ASA 81mg, warfarin. INR 2.5
• Needs dental extraction
• Should his warfarin be stopped?
• What about endocarditis prophylaxis? I heard the recommendations have changed...
BRIDGING ANTICOAGULATION

1. Continue warfarin with therapeutic INR if *mechanical* valve undergoing minor procedure (dental extraction, cataract removal) where bleeding is easily controlled (I,C) – discuss bleeding risk with dentist, surgeon, etc.

2. TEMPORARY interruption of warfarin, without bridge, recommended for bileaflet mechanical AVR without other risk factors for thrombosis, who are undergoing invasive or surgical procedure (I, C)

3. Bridging with IV heparin or LMWH recommended while INR subtherapeutic pre-operatively in patients undergoing invasive or surgical procedures with (I, C):
   - Mechanical AVR + thromboembolic risk factor
   - Older-generation mechanical AVR
   - Mechanical MVR
ENDOCARDITIS PROPHYLAXIS

1. Reasonable in the following patients at highest risk for adverse outcomes from IE before dental procedures that involve manipulation of gingival tissue, manipulation of the periapical region of teeth, or perforation of oral mucosa (IIa, B):
   • Prosthetic cardiac valves
   • Previous infective endocarditis
   • Cardiac transplant recipients with valve regurgitation due to structurally abnormal valve
   • Congenital heart disease with unrepaired cyanotic CHD, including palliative shunts/conduits; completely repaired CHD with prosthetic material/device, during first 6 months; repaired CHD with residual defects at site or adjacent to site of prosthetic patch/device

2. Prophylaxis NOT recommended for non-dental procedures in absence of active infection (TEE, EGD, colonoscopy, cystoscopy) (III,C)

**THIS IS NOT THE PRACTICE OF MANY CARDIAC SURGEONS & CARDIOLOGISTS**
CASE 6

• 76 year old male for new patient visit
• HTN, dyslipidemia
• Awaiting hip surgery
• Says he is getting older and slowing down; can’t keep up with his grandkids
• Had a “cow valve” put in 8 years ago he thinks...
• Systolic ejection murmur
What should you do?

A. Nothing. Anesthesia will see him at some point before his hip surgery.
B. Nothing. He is 76 – no wonder he can’t keep up with his grandkids.
C. Manage his HTN and dyslipidemia. Arrange follow-up in a year.
D. Order an echocardiogram and discuss endocarditis prophylaxis.
What should you do?

A. Nothing. Anesthesia will see him at some point before his hip surgery.

B. Nothing. He is 76 – no wonder he can’t keep up with his grandkids.

C. Manage his HTN and dyslipidemia. Arrange follow-up in a year.

D. **Order an echocardiogram and discuss endocarditis prophylaxis.**
ECHO SURVEILLANCE

1. Initial TTE after valve implantation to evaluate valve hemodynamics (I,B) – SMGH done in-hospital prior to discharge

2. Repeat TTE if change in clinical symptoms or signs suggesting valve dysfunction (I,C)

3. Annual TTE reasonable in patients with bioprosthetic valve after first 10 years, even in absence of change in clinical status (IIa, C)
   • Earlier now with early failures
CASE 7

• 75 yo female. 1 week post CABGx5. EF 40%. Post-op Afib.
• Complains of SOB. Can’t walk up a flight of stairs.
• Exam:
  • BP 140/80, HR 80 regular.
  • Obese – pedal edema (?).
  • Poor inspiratory effort – difficult to assess lungs
• Hgb 95, creatinine 110, INR 2.5
Common causes of SOB post-op?

- Pulmonary edema
- Pleural effusion
- Atelectasis
- Pneumothorax
- Pulmonary embolism
How to manage these complications?

- Atelectasis
  - Encourage incentive spirometry, mobilization
  - Ensure adequate pain control
- Pulmonary edema
  - Diuresis
  - Optimize heart failure medications
- Pleural effusion
  - Diuresis
  - Thoracentesis – stop anticoagulation
- Pulmonary embolism
  - CT scan for diagnosis
  - Anticoagulation
- Pneumothorax
  - If small, asymptomatic → manage conservatively, get repeat CXR in 1-2 days.
  - If large, symptomatic → needs CT. Notify surgeon/send to ER.
CASE 8

- 75 yo female. 3 weeks post AVR, MVr, CABGx3. Poorly controlled diabetes. Obese. COPD.
- Hears a “click”. New drainage from sternal incision.
- POD#1 – re-exploration for bleeding.
- CVICU stay 4 days – prolonged inotropes, vasopressors; delirium.
- Post-op hospital stay 14 days.
- Discharged home with 1 week course of Keflex for sternal wound cellulitis.
- O/E: Temp 38.7, HR 80, BP 100-70. Sternum clearly unstable. Erythema entire length of incision, worse at distal aspect. Distal incision open 5cm. Thick, yellowish-white discharge.
What should you do?

A. Reassess the patient in 1 week.
B. Send swab for culture.
C. Broaden antibiotic coverage.
D. Ensure excellent glucose control.
E. Notify the surgeon - urgently.
What should you do?

A. Reassess the patient in 1 week.
B. Send swab for culture.
C. Broaden antibiotic coverage.
D. Ensure excellent glucose control.
E. Notify the surgeon – urgently!
SOFT TISSUE DEHISCENCE

• Separation of superficial tissues (ie, skin, subcutaneous fat, muscle)
• 6-8% of cardiac surgery patients undergoing cardiac surgery
• Sternum stable to palpation
• Sternal wires may be exposed
SOFT TISSUE DEHISCENCE

• Usually treated with conservative management:
  • Antibiotics
  • Wound care/packing/dressing changes
  • VAC

• Occasionally, surgical debridement, closure with retention sutures

• Manage risk factors – sternal precautions, glucose control, bra for women
STERNAL DEHISCENCE

• Separation of edges of sternum
• Can occur in absence of soft tissue dehiscence - wire fracture, loosening or “pulling through” the sternal edge
• Complain of painful chest motion and "clicking"
• Diagnosis made on physical examination
• Increased risk of ventricular rupture due to sharp wires or bone fragments rubbing against the heart
• CT scan if diagnosis uncertain
• Sternal debridement ± rewire ± VAC
DEEP STERNAL WOUND INFECTION

• AKA mediastinitis
• Can result from overlying soft tissue dehiscence, or due to intraoperative contamination of deeper tissues
• Typically presents with fever and systemic symptoms within several weeks of surgery ± local symptoms/signs of superficial soft tissue dehiscence, sternal dehiscence, or wound infection
• Urgent surgical consult
• Sternal debridement ± rewire ± VAC ± tissue/muscle flaps
CASE 9

- 80 yo male. Vasculopathy. Diabetic. 1 week post-CABGx5.
- Worried about his SVG incision – increased drainage.
- BP 110/60, HR 90. Afebrile.
- Bilateral pedal edema.
- Decreased A/E to lung bases. Few crackles.
- Sternal and radial incisions healing well.
LEG WOUND COMPLICATIONS

• 1-18% of patients with SVG harvesting
• Most are minor complications; do NOT require surgical intervention
  • Dermatitis, cellulitis, greater saphenous neuropathy, chronic nonhealing ulcers, and lymphocele
  • Antibiotics – NOT ALWAYS NECESSARY
• Wound care/dressing changes
• DIURESIS if pedal edema
• Major complications requiring surgery are RARE
  • Wound debridement, skin grafting, vascular procedure, amputation, or fasciotomy
CASE 10

• 55 yo female. 1 week post mitral valve repair. Pre-existing renal dysfunction, Creatinine 130 pre-op.

• Only complaint is sternal pain.

• On discharge, creatinine 140 → today creatinine 190

• O/E: 100/55, HR 80 regular. Mild edema. Lungs clear. Sternal wound healing well.

• Meds: ASA, warfarin, metoprolol 50mg BID, perindopril 8mg OD, Lasix 80mg BID, Tramadol, Tylenol
What should you do?

A. Increase Lasix – she still has some pedal edema.
B. Add Ibuprofen to help with pain control.
C. Repeat blood work in 3 months. Creatinine is always elevated after cardiac surgery.
D. Hold perindopril. Monitor blood pressure. Add CCB for HTN if necessary.
E. Hold Lasix and monitor volume status.
F. Repeat blood work in a few days.
What should you do?

A. Increase Lasix – she still has some pedal edema.
B. Add Ibuprofen to help with pain control.
C. Repeat blood work in 3 months. Creatinine is always elevated after cardiac surgery.
D. **Hold perindopril. Monitor blood pressure. Add CCB for HTN if necessary.**
E. **Hold Lasix and monitor volume status.**
F. **Repeat blood work in a few days.**
SUMMARY

• CABG
  • Secondary prevention guidelines
  • Radial artery – nitro patch x 6 months
  • Afib – Holter at 3 months +/- discontinue warfarin

• Valves
  • Guidelines for anticoagulation
  • Endocarditis prophylaxis
  • Echo surveillance

• DON’T BE AFRAID TO PHONE THE SURGEON IF UNSURE HOW TO MANAGE A COMPLICATION!!!
REFERENCES

PRACTICE GUIDELINE

2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease

A Report of
Task Force
Developed in
Association With
American Society of
Society of Cardiology

AHA Scientific Statement

Secondary Prevention After Coronary Artery Bypass Graft Surgery

A Scientific Statement From the American Heart Association

Alexander Kulik, MD, MPH, FAHA, Chair; Marc Ruel, MD, MPH, FAHA, Co-Chair; Hani Jneid, MD, FAHA; T. Bruce Ferguson, MD, FAHA; Loren F. Hiratzka, MD, FAHA; John S. Ikonomidis, MD, PhD, FAHA; Francisco Lopez-Jimenez, MD, MSc, FAHA; Sheila M. McNallan, MPH; Mahesh Patel, MD; Véronique L. Roger, MD, MPH, FAHA; Frank W. Sellke, MD, FAHA; Domenic A. Sica, MD, FAHA; Lani Zimmerman, PhD, RN; On behalf of the American Heart Association Council on Cardiovascular Surgery and Anesthesia;
THANK YOU

“OK, the old one’s in my right hand, the donor’s in my left. Right?”