

# PHYSICAL THERAPY MANAGEMENT OF PATIENTS S/P CABG: ACUTE CARE TO HOME

Jackie Mulgrew PT, DPT, CCS

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## BIBLIOGRAPHY

- 25+ years of acute care experience
- Board certified in cardiovascular & pulmonary physical therapy
- Clinician at MGH
- Clinical Informaticist
- Author

### Clinical Interests:-

- Exercise physiology, heart failure and mechanical circulatory support



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## OBJECTIVES

- Describe the clinical decision making involved in the physical therapy examination
- Understand the most common impairments seen in this patient population
- Understand the current evidence supporting sternal and thoracotomy precautions



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## OBJECTIVES CONT'D

- Create evidence-based exercise prescriptions for patients s/p CABG
- Recognize indications for terminating exercise
- Recognize sternum instability



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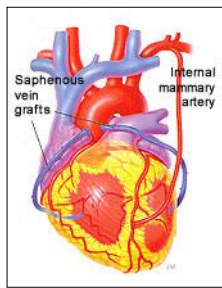
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## CORONARY ARTERY BYPASS GRAFT



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## CORONARY ARTERY DISEASE

- 610,000 people die of heart disease every year in the United States
- Risk factors:
  - Diabetes, obesity, poor diet, inactivity, excessive alcohol use, hypertension
- ~500,000 CABGs are performed each year in the United States



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## CONSULTING PHYSICAL THERAPY

- For the ½ million patients s/p cabg, these patients routinely are mobilized post-operatively
- In some hospitals its standard protocol that physical therapy is consulted on all patients s/p cabg
- In some hospitals physical therapy is consulted depending on impairments or functional limitations
- The day of consult by physical therapy also varies; some patients are automatically seen on POD#1 and others are seen closer to discharge
- The national average LOS s/p cabg is 10.1 (2001-2010)



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## TYPES OF APPROACHES

- Sternotomy vs Thoracotomy
- Off Pump or On Pump
  - <https://www.youtube.com/watch?v=WX04rLHSTP4>



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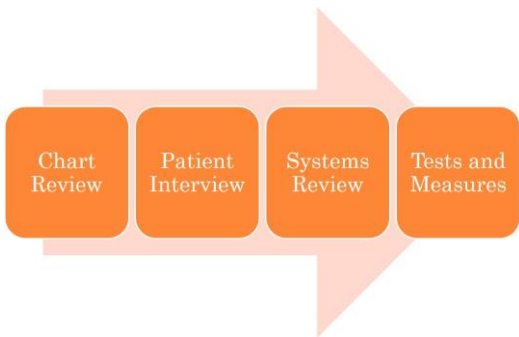
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## PHYSICAL THERAPIST EXAMINATION



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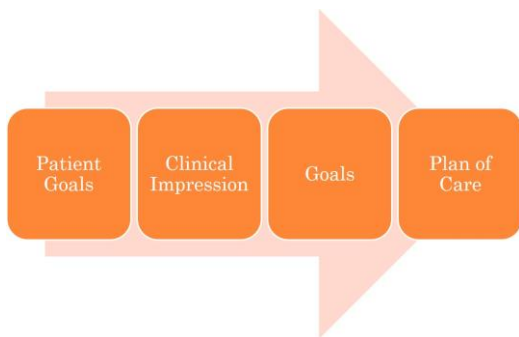
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## PHYSICAL THERAPIST EXAMINATION



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### HISTORY:

#### PATIENTS WITH CARDIAC DISEASE

- History of Present Illness
  - Reason for admission (Elective vs emergent)
  - Pre-op work up:
    - Exercise test
    - Cardiac Catheterization
    - Cardiac Ultrasound
  - Hospital course (s/p CABG x ?), dates of cardiac insults (MI), procedures (stents), rhythm issues, angina pattern, current management of problems
- PMH
  - Previous cardiac events, interventions, arrhythmias, comorbidities



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**HISTORY:  
PATIENTS WITH CARDIAC DISEASE**

- Social History
  - Support system
  - Living environment
  - Functional status PTA
  - Occupational profile
  - Hobbies
  - Exercise history
  - Patient's goal



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**HISTORY:  
PATIENTS WITH CARDIAC DISEASE**

- Family History
  - Who and what
- Cardiac Risk Factors
  - Genetics, age, sex, race
  - HTN, obesity, diet/cholesterol, inactivity, smoking, diabetes, stress, alcohol
- Medications
- Labs
- Relevant Tests
- Precautions



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**DW: HISTORY OF PRESENT  
ILLNESS**

- DW is a 66 year old male
- 2 weeks prior to surgery, c/o chest pain when climbing a ladder
- Diagnosis: NSTEMI, EF 55%
- Cardiac catheterization next day
- Now s/p CABG x3 (elective)



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## ANGINA PATTERN

- Location
- Onset
- Pattern
  - For men and women, the most common heart attack symptom is chest pain or discomfort. But women are somewhat more likely than men to experience some of the other common symptoms, particularly shortness of breath, nausea/vomiting, and back or jaw pain, c/o fatigue the week leading up to the MI.
- DW: Angina Pattern
  - L pectoral and substernal pressure



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## DW: PMH AND SOCIAL HISTORY

- PMH: CAD, HTN, hyperlipidemia, smoker
- SH:
  - retired fireman
  - lives with his wife in a 2 story home
  - bedroom and bathroom on second floor with a walk in shower
  - drives
  - volunteers for the local fire station teaching kids about fire prevention
  - independent PTA



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## FAMILY HISTORY

- Mother alive at age 89
- Father died age 73 from heart disease



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## DW: CARDIAC RISK FACTORS

- HTN
- Hypercholesterolemia
- Lack of regular exercise
- Obesity – BMI 30.2
- Smoker



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## MEDICATIONS – POST OP

- Lipitor
- Lisinopril
- Toprol
- ASA
- Oxycodone
- Tylenol
- Albuterol
- Nitroglycerin – prn



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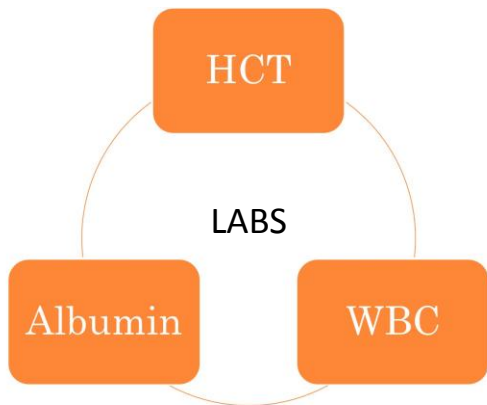
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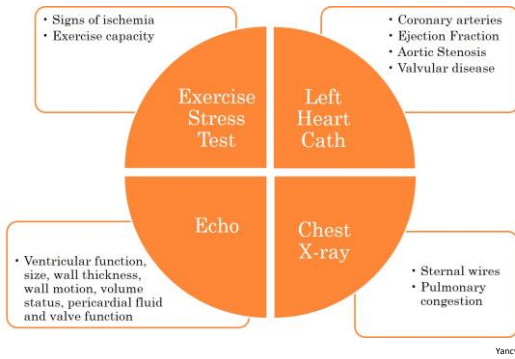
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## TESTS/PROCEDURES



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## RELEVANT PRECAUTIONS

- Chest Tubes
- Pacemaker
- Sternal
- Thoracotomy
- s/p stent
- s/p MI

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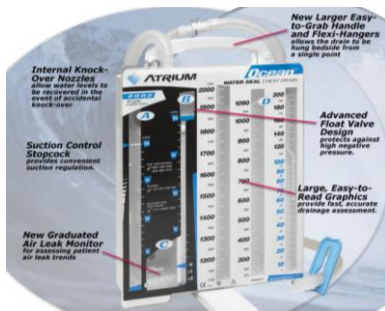
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## CHEST TUBES – UNDERWATER SEAL DRAIN



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## CHEST TUBES: IMPLICATIONS FOR THERAPY

- Keep the tubing below the level of the chest to ensure drainage of fluid
- Bubbling in the water seal chamber indicates the presence of air
- Ask the MD if the patient can be disconnected from suction to walk
- Use portable suction if needed
- Do not clamp the tube to ambulate patients



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## CHEST TUBES: IMPLICATIONS FOR THERAPY

- If the drainage unit falls over:
  - Stand it upright and notify the RN
  - Concern that water seal may have broken and air leaked into chest
- If the tube disconnects:
  - Clamp it to avoid air entering chest
  - Notify RN immediately
- If the chest tube falls out:
  - Cover the insertion site immediately
  - Apply an air occlusive dressing
  - Notify RN and MD immediately



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## TEMPORARY PACEMAKERS

- **Access:**
  - Epicardial
    - via wires placed during cardiac surgery
- **Mobility**
  - No limitations to mobility provided the wires are secured, and the pacer is triggering the heart appropriately
  - Patient on bedrest x 1 hour after the wires are pulled to decrease risk of cardiac tamponade



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## STERNAL PRECAUTIONS - LITERATURE

- No literature to support or refute restrictions in ROM assessment of the UE
  - unilateral UE ROM is preferred over bilateral to reduce sternal skin stresses
  - recommend avoiding aggressive stretching
- Most surgeons do not want patients lifting more than 10 lbs for 6-8 weeks
  - Load is related to size and lever arm
  - No heavy pushing or pulling
  - Symmetrical push up from chair is preferred over unilateral to reduce sternal bone stresses
  - Consider weight restrictions with functional movements



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## STERNAL PRECAUTIONS – “THE MYTHS”

- No pushing up with arms from sit to stand
- No washing your own hair
- Only performing pain-free bilateral arm movements
- No sleeping on your side
- No pushing self in a wheelchair



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## STERNAL PRECAUTIONS MYTHS – IMPEDING RECOVERY

- Inconsistent message from providers
- Reinforce fear of activity
- Muscle atrophy
- Delay or prevent return to work



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## RISK OF STERNAL INSTABILITY - FACTS

- Smokers
  - Diabetes
  - Obesity
  - Macromastia
  - COPD
  - Osteoporosis
  - Prolonged steroid use
  - Chronic/persistent cough
  - Prolonged cardiopulmonary bypass time
  - Prolonged mechanical ventilation > 24 hours
  - Bilateral internal mammary artery harvesting
- Sternal infections
    - 50-80% of sternal infections are discovered after discharge
    - Infection rates are <1%
    - Mortality 15-40% in serious cases
  - Sternal Dehiscence
    - Occurs in ~ 0.2 – 5% of patients
    - Is the separation of the bony sternum



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## WAYS TO DECREASE POST OP STERNAL INFECTIONS

- Chest support vest/sternal precautions
- Antibiotics
- Maintain serum glucose levels <180 mg/dL
- Achieve hemostasis
- Early extubation
- Early removal of urinary catheters
- Early removal of central venous catheters



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## STERNAL FORCES – WHAT DO WE KNOW?

- Power of a cough/sneeze
- The force across the sternum during a cough or sneeze is  $\geq 60$  lbs and  $\geq 90$  lbs respectively.
- So should patients be allowed to lift 60-90 lbs?
- No, because chronic coughing has been linked to sternal dehiscence, therefore, repetitive lifting could lead to the same outcome
- “Trying to determine a single load restriction appears to be futile”



Adams et al 2016

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# KINESIOLOGY PRINCIPLES

- o “Keep your Move in the Tube”

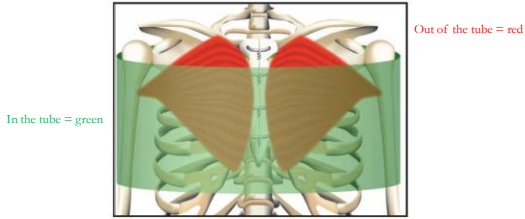


Figure 1. Illustration used to teach patients about their sternotomy, the attachments of the pectoralis major, and the imaginary truncal tube that is the basis of the Keep Your Move in the Tube approach.

Adams et al 2016

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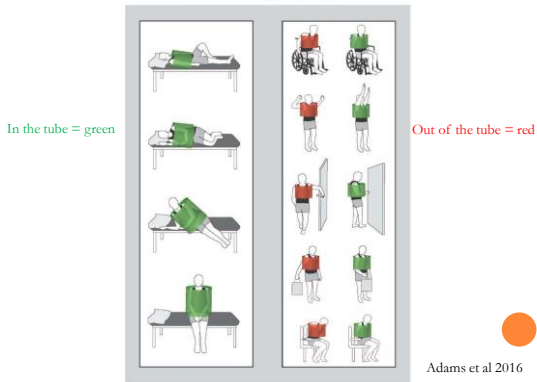
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## Keep Your Move in the Tube™

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Adams et al 2016

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## MAINTAINING STERNAL PRECAUTIONS DURING SUPINE TO STAND TO SUPINE (VIDEO)



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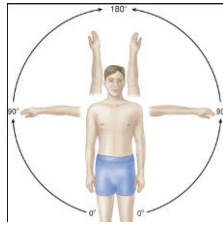
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## THORACOTOMY

- Should there be restrictions on ROM?
  - No, patients are encouraged to move their arms within their pain tolerance



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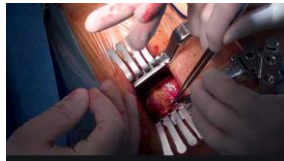
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## THORACOTOMY

- Should PT or OT be consulted for ROM?
  - No, research shows that should ROM is not impaired 30 days post-thoracotomy, therefore, there is no need to be consulted for this initial impairment alone
  - Most patients return to their baseline ROM with 7-14 days post-thoracotomy



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## CATHETERIZATION

- Used to evaluate the status of the coronary arteries
- Access gained via artery or vein in arm or leg
  - Artery vs Vein
    - Artery is for left heart cath
    - Vein is for right heart cath
  - Leg vs Arm



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## EXERCISE LIMITS S/P MI

- Intensity depends on the type of MI
  - STEMI
    - Consider RPE  $\leq 13$  and target HR of  $\leq 70\%$
    - $< 5$  METS
  - NSTEMI
    - Consider RPE  $\leq 16$  and target HR of  $\leq 85\%$

A.C.C. 

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## Determining Maximum Heart Rate

- There are several methods to determine maximum heart rate outside of the gold standard graded exercise test
- All are limited because they are estimations with large standard deviations
- Age predicted estimate:
  - HR max =  $220 - \text{age}$
  - HR max =  $208 - (0.7 \times \text{age})$
  - HR max =  $164 - (0.7 \times \text{age})$  for stable patients on  $\beta$ -blocker



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## Determining Maximum Heart Rate

DW: 66 years old with a NSTEMI

- HR max =  $220 - 66 = 154$  bpm
- HR max =  $208 - (0.7 \times 66) = 162$  bpm
- HR max =  $164 - (0.7 \times 66) = 118$  bpm {on  $\beta$ -blocker}
- 85% HR max is  $162 \times 0.85 = 138$  bpm
- 85% HR max is  $118 \times 0.85 = 100$  bpm {on  $\beta$ -blocker}



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## DW'S GOAL

To get back to his volunteer activities



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## SELECTION OF TESTS AND MEASURES

- Mental Function
- Pain
- Integumentary Integrity
- Circulation
- ROM
- Muscle Performance
- Ventilation
- Gas Exchange
- Aerobic Capacity
- Posture
- Balance
- Gait
- Self Care

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## MENTAL FUNCTION

- With cardiac surgery, patients are at risk for:
  - Microemboli
  - Intra-op or post-op CVA
  - Delirium

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## PAIN

- Sternotomy
- Thoracotomy
- LE from saphenous vein harvest



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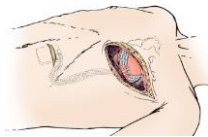
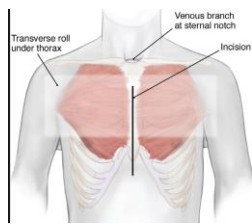
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## INTEGUMENT INTEGRITY

- Sternotomy/Thoracotomy
- LE vein harvest sites



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## CIRCULATION

- Cardioplegia results in cool extremities post-op over the first 1-2 days after surgery
  - Need to monitor for bilateral restoration of temperature
- Patients can be given several liters of fluid during surgery
  - Increased body weight by 5-15 lbs



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## ROM

- Thoracotomy
  - No limitations
  - Within pain tolerance
- Sternotomy
  - No limitations for ROM
  - Avoid over-stretching for 6-8 weeks
  - Unilateral arm movement is preferred over bilateral
  - "Keep your move in the Tube"
- Knee: harvest sites
  - No limitations
  - Within pain tolerance

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## MUSCLE PERFORMANCE

- Limitations due to sternotomy
- Most surgeons do not want patients lifting more than 10 lbs until they are assessed during a post-op visit with the hopes of preventing sternal infection or dehiscence
- Load is related to size and lever arm – consider "Keep your Move in the Tube"
- Once cleared by surgeon, plan appropriate progressive resistance training

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## VENTILATION

- Post op risks of:
  - Atelectasis, pleural effusion
- Need to examine:
  - Breath sounds, Breathing pattern, Cough

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## GAS EXCHANGE

- Fluid resuscitation can cause pulmonary edema or pleural effusion
- Need to assess oxygen saturation

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## AEROBIC CAPACITY

- Assess for orthostasis
- Patients usually can tolerate more activity now that they have better blood flow to their heart
- Follow target HR guidelines keeping within s/p MI guidelines
- If no MI, patients can exercise up to 85% of their HR max

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## DW: AEROBIC CAPACITY RESULTS

Activity	HR	BP	RR	RPE
sit	76	110/60	14	7
Stand 1'	88	*90/50		8
Stand 2'	84	98/54		7
Stand 3' pre	84	98/52	14	7
Amb 2' peak	102	114/56	24	12
Stand 2' post	90	96/54	18	8

85% HR max is 128 (100 on  $\beta$ -blocker)

\*Dizzy when stood up, resolved with in 40 secs, ambulation 125ft in 1 min limited by fatigue and discomfort (2.1 METS)

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## POSTURE

- Can be affected by:
  - Fluid gains
  - Pain from sternotomy/thoracotomy



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## BALANCE/GAIT

- Fluid shifts
- LE vein harvesting
  
- Patients usually require an assistive device the first few days depending on their baseline mobility



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## SELF CARE AND DOMESTIC LIFE

- In relation to:
  - ROM restrictions
    - Sternotomy vs thoracotomy
    - Avoiding overstretching at end ROM .e.g. toileting
    - “Keep your Move in the Tube”
  - Energy conservation
    - Pacing guidelines



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## STROKE RISK

- Throughout your exam, watch for signs of stroke
- Risk of stroke after CABG can be up to 5.2% depending on the study design, patient risk profile, operating techniques and the length of the study follow up.



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## DETERMINING PROGNOSIS TO RETURN TO HIS GOALS

- Readiness to learn
- Bone healing time of the sternum
- Soft tissue healing of sternotomy/thoracotomy
- Improved coronary blood flow so activity tolerance should improve
- Social support
- Prior level of function
- Patterns of behavior
- Comorbidities including previous MI
- Severity of MI
- Habits and coping styles



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## DW: CLINICAL IMPRESSION

66 y.o. male s/p NSTEMI 2 weeks ago, and now POD #3 s/p CABG. He presents with an exaggerated blood pressure response to low level activity secondary to deconditioning and discomfort. He also presented with orthostatic hypotension during the exam. Prior to admission he was independent but he has known HTN and does not perform regular exercise. These latter two factors, along with sternal discomfort, reflect his hypertensive blood pressure response, in the presence of a preserved EF.



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## CLINICAL IMPRESSION

It is anticipated that he will be safe to discharge to home with the company of his wife and appropriate pacing guidelines to help him return to his instrumental activities of daily living while following sternal precautions. Before discharge he needs to be assessed on stairs. Once home, and cleared by his surgeon, he would benefit from a comprehensive cardiac rehab program to address his cardiac risk factors that he has not controlled and to provide guidance on returning to activities with increased workload such as climbing ladders. Anticipate he will be able to return to his volunteer work in 8-12 weeks.



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## FACTORS TO CONSIDER

- Outpatient cardiac rehab after CABG improves patient's exercise capacity by 35% and reduces body fat by 6%
- Men more likely to be referred to cardiac rehab than women
- Men more likely to attend cardiac rehab than women



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## FACTORS TO CONSIDER

- Comprehensive outpatient cardiac rehab after hospitalization for a MI reduces mortality
- Exercise only intervention also has reduced mortality
- Only 16% of patients with MI are referred to cardiac rehab on discharge from hospital
- 26% of patients with MI attend cardiac rehab
- Physician referral was the most powerful predictor of patient attendance at cardiac rehab



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## FACTORS TO CONSIDER

- Reasons why patients do not attend cardiac rehab:
  - Lack of insurance coverage
  - Lack of social support
  - Gender-specific attitudes
  - Poor motivation
  - Logistical constraints
  - Women and older adults are referred less frequently

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## IDEAS TO IMPROVE CARDIAC REHAB REFERRAL

- | <u>Uptake</u>                      | <u>Adherence</u>     |
|------------------------------------|----------------------|
| ○ F/u phone calls                  | ○ Contracts          |
| ○ Buddy program                    | ○ Spouse involvement |
| ○ Improve coordination of referral | ○ Written feedback   |
| ○ Motivational letters             |                      |
| ○ Electronic pathways              |                      |

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## PRIORITIES OF TREATMENT WHILE IN THE HOSPITAL

- Patient education
  - Breathing exercises
  - Sternal precautions
  - Cardiac risk factor reduction
  - Lifestyle modification/activity adaptation
  - Referral to outpatient cardiac rehab
- Exercise prescription
  - Determining activity tolerance to ↑ workload
  - Instruction on aerobic capacity training
  - Use RPE or steady state heart rate as guide
    - Focus on intensity and not duration

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## DW: AEROBIC CAPACITY RESULTS

Activity	HR	BP	RR	RPE
sit	76	114/60	14	7
Stand 1'	78	112/60		8
Amb 3.5' peak	90	130/64	24	11
Stand 2' post	78	116/58	16	8

85% HR max is 128 (100 on  $\beta$ -blocker)  
ambulation 505ft in 3.5 mins limited by fatigue (2.5 METS)

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## EXERCISE PRESCRIPTION

- Frequency: daily
- Intensity: RPE 11
- Time: build up to 30 mins each day
- Type: walking
  
- Refer to outpatient cardiac rehab

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## PRIORITIES OF TREATMENT WHILE IN THE HOSPITAL

- Ventilation/gas exchange
  - Frequent short walks; monitor DOE; monitor and titration of any oxygen; deep breathing exercises; supportive cough
- Safety
  - Progress from rolling walker to no assistive device on level and on stairs
  - Progress from basic to advanced ADLs/IADLs while maintaining sternal precautions

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## RECOGNIZING SIGNS OF PATIENT INSTABILITY

- What might go wrong in this type of pt?
  - AF
  - Heart blocks
  - Angina
  - Cardiac tamponade after wires pulled
  - Abnormal response to increased workload
  - Orthostatic hypotension
  - Stroke

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## HOW TO MANAGE PATIENT INSTABILITY

- Arrhythmia – AF, heart block, bradycardia
  - Stop activity
  - Get pt back to bed
  - Monitor HR and BP
  - For AF, MD needs to get rate back under control before you can continue
  - For heart blocks/bradycardia, may need a temporary pacemaker

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## HOW TO MANAGE SUDDEN ONSET OF INSTABILITY

- Angina
  - Stop the activity
  - Sit the patient down
  - Monitor angina pattern, intensity
  - Call for assistance
  - RN or patient will issue nitroglycerin
  - Monitor HR, rhythm and BP
- Cardiac tamponade after temporary wires pulled
  - Pt should be on bedrest for ~ 1hr
  - Be aware of when the wires are removed

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## HOW TO MANAGE SUDDEN ONSET OF INSTABILITY

- Abnormal response to increased workload
  - Sudden or unexpected increase or decrease in HR and BP beyond expected norms
  - Stop the activity; have the patient sit, monitor the HP and BP; report abnormal findings to the team
  - Find an intensity that works for your patient
- Orthostatic hypotension
  - Due to fluid loss, fluid imbalance
  - LE ex; breathing ex; LE compression, sitting schedule
- Stroke
  - Report findings immediately



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## HOW TO RECOGNIZE STERNAL INSTABILITY

- Sternal instability is the unwanted movement of the 2 halves of the sternum after healing should have occurred; typically by 4 weeks post-op
- How to recognize it:
  - Pain
  - Feeling of instability
    - Pt may say, "feels like my chest is going to fall open"
  - Sounds
    - Clicking or clunking sounds
  - State of the wound/scar
    - Redness, discharge



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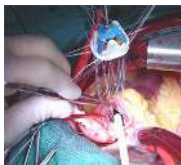
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## VALVE REPLACEMENT

What's different?



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## VALVE REPLACEMENT: WHAT'S DIFFERENT?

- If patient receives mechanical valve, patient must be on lifetime anticoagulation
  - Need to assess patient's risk to fall
- If patient receives biological valve, patient is usually on 3 months of anticoagulation
- Since March 2006, patients with valve replacements can attend outpatient cardiac rehab
- No veins need to be harvested

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## YOU DID IT!!!



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## QUESTIONS?



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## HOW TO REACH ME

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You can reach Jackie at  
[jmulgrew@partners.org](mailto:jmulgrew@partners.org)

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# THANK YOU!



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