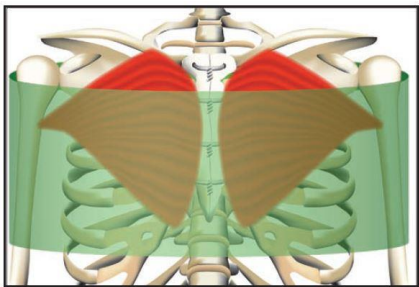


Get SMART for Heart & Keep Your Move in the Tube: Evidence-Based Practice



Imagine. Discover. Grow.



ACADEMY OF ACUTE CARE
PHYSICAL THERAPY



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Disclosure



- No relevant financial relationships exist for any of today's speakers

Session Learning Objectives

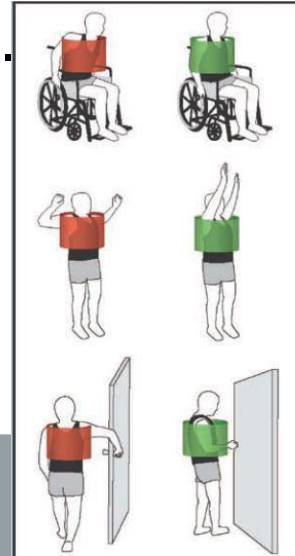
- Explain the physiological, mechanical, cognitive, & functional effects of cardiac surgery procedures.
- Discuss the evidence-based role of the PT in the pre- & post-operative management of the cardiac surgery patient.
- Select and administer reliable & valid assessment and outcome measurement tools pertaining to sternal instability, physical function, frailty, and ex. prescription

Session Learning Objectives

“Keep Your Move in the Tube”

- Apply evidence-based practice to the management of selected clinical cases from the “bedside to the gym”
 - Discuss how to implement such evidence-based practice in the hospital and clinical settings.

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The Human Movement System: Our Professional Identity

Shirley A. Sahrman

DOI: 10.2522/ptj.20130319 Published July 2014

Article

Figures & Data

Info & Metrics

eLetters

PDF

This article has a correction. Please see:

- Sahrman SA. The human movement system: our professional identity. Phys Ther. 2014;94:1034–1042. - December 2014

Abstract

The 2013 House of Delegates of the American Physical Therapy Association adopted a vision statement that addresses the role of physical therapy in transforming society through optimizing movement. The accompanying guidelines address the movement system as key to achieving this vision. The profession has incorporated movement in position statements and documents since the early 1980s, but movement as a physiological system has not been

Vol 94 Issue 7 Table of



Rationale for Defining the Movement System as a Physiological System

Is the Concept of a Movement System Consistent With the Definition of a System?

Yes!

According to the *American Heritage Dictionary*, a *system* is defined as: “1) A group of interacting, interrelated, or interdependent elements forming a complex whole; 2) A functionally related group of elements, especially: a. The human body regarded as a functional physiological unit, b. An organism as a whole, especially with regard to its vital processes or functions, c. A group of physiologically or anatomically complementary organs or parts: the nervous system; the skeletal system.”¹⁸ Using these criteria for a system, the movement system concept meets the requirements because it is a group of functionally related interacting, interrelated, and interdependent elements forming a complex whole, which produces the function known as movement.

Can the Movement System Be Considered a Physiological System?

Yes!

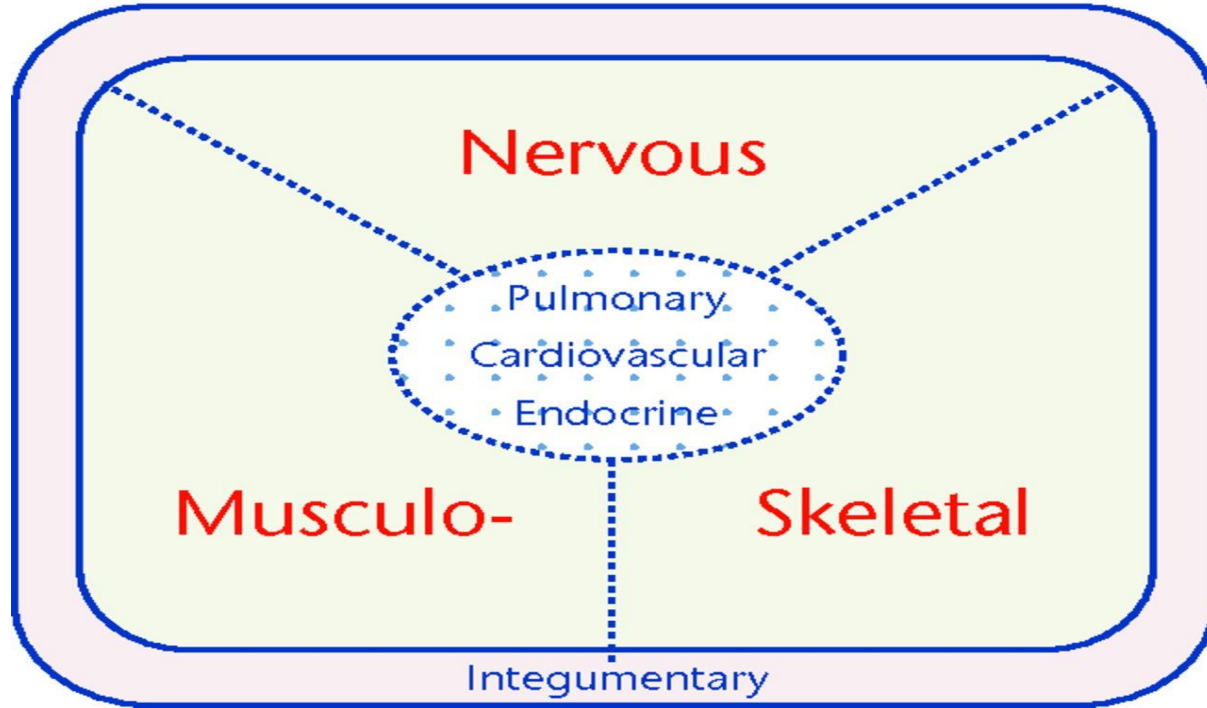
According to the *Random House Dictionary*,¹⁹ *physiology* is defined as: “1) the branch of biology dealing with the functions and activities of living organisms and their parts, including all physical and chemical processes; 2) the organic

Proposed Model of the Human Movement System

One possible form of illustrating the components of the human movement system is shown in the **Figure**. The muscular, nervous, and skeletal systems are the main effectors of movement and thus play a key role. The interaction of the structures and functions of the musculoskeletal and nervous systems produces the visible components of the movement system from static postures through performance of purposeful activity at the level of the person. The endocrine, cardiovascular, and pulmonary systems are the fundamental systems responsible for uptake and delivery of oxygen and metabolically active substances required for generating and maintaining movement and, therefore, are necessary for the sustenance and maintenance of movement. Additionally, all these systems are affected by movement because without adequate movement, they deteriorate.

The human movement system: a system comprising movement-related physiological organ systems.

Human Movement System



Shirley A. Sahrmann PHYS THER 2014;94:1034-1042

Sternal Precautions: Is It Time for Change?

Precautions versus Restrictions – A Review of Literature and Recommendations for Revision

Lawrence P. Cahalin, PT, PhD, CCS, FAACVPR;¹ Tanya Kinney LaPier, PT, PhD, CCS;²
Donald K. Shaw, PT, PhD, D.Min., FAACVPR³

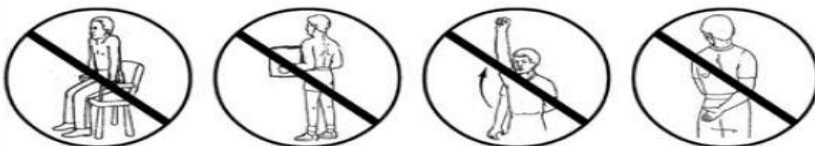
STERNAL PRECAUTIONS AFTER CARDIAC SURGERY

Introduction

An important part of your recovery from cardiac surgery is learning how to move safely and how to gradually return to your daily activities. A therapist will meet with you and your caregiver to help you learn how to safely proceed in various aspects of your recovery.

Basic Principles

1. **Follow your sternal precautions at all times (8-10 weeks).** Your surgeon will let you know when these precautions can be stopped.
 - NO pushing or pulling (e.g., no pushing up from a chair or opening a heavy door).
 - NO lifting more than 5 pounds (the weight of a half gallon of milk).
 - NO lifting one arm above your head (you can lift both hands above your head at the same time).
 - NO reaching behind your back (e.g., no tucking in your shirt, putting your wallet in your back pocket, pulling your trousers up from behind or reaching behind for toilet hygiene).



2. Pace yourself. Plan your day to include activity and rest.
3. Rest one hour after meals before doing exercise and strenuous activities. This allows time for proper digestion and decreased workload on the heart.
4. Avoid excessive heat or cold.

Table 2. The Top 5 Sternal Precautions Reported by Cardiothoracic Surgeons, Physical Therapists, and Those Observed by Physical Therapists in the Facilities Where They Work

Top 5 sternal precautions prescribed by cardiothoracic surgeons:

- (1) Lifting no more than 10 pounds of weight bilaterally
- (2) Lifting no more than 10 pounds of weight unilaterally
- (3) Bilateral sports restrictions
- (4) No driving
- (5) Unilateral sports restrictions

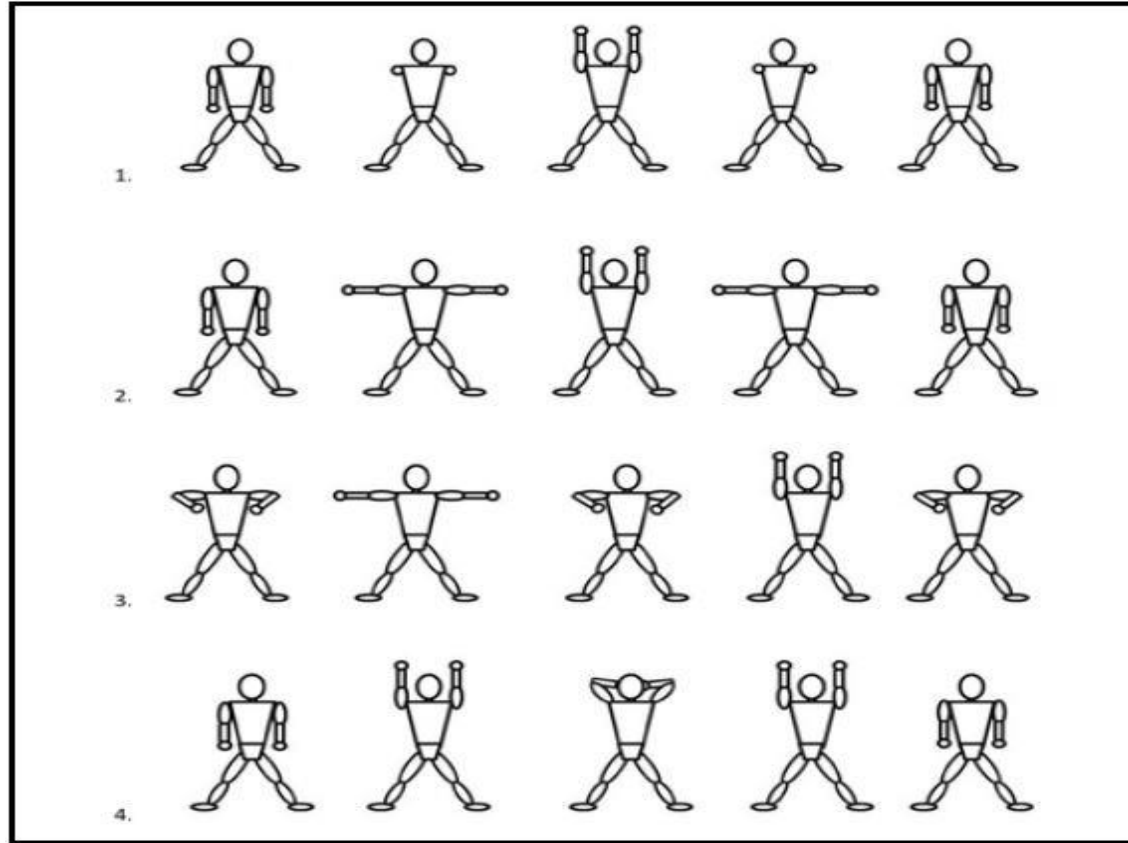
Top 5 sternal precautions reported by physical therapists in order of importance:

- (1) Lifting no more than 10 pounds of weight bilaterally
- (2) No hand over head activities bilaterally
- (3) Bilateral sports restrictions
- (4) No driving
- (5) Active bilateral shoulder flexion no greater than 90°

Top 5 sternal precautions observed in the physical therapists' institution:

- (1) Lifting no more than 10 pounds of weight bilaterally
- (2) Active bilateral shoulder flexion no greater than 90°
- (3) No driving
- (4) Active bilateral shoulder abduction not > 90°
- (5) No hand over head activities bilaterally

Inpatient CABG Surgery Exercises



Differences in Sternal Precautions in the Same State

Table 1. Comparison of Select Sternal Precautions by Health Care Providers

Activity	OhioHealth ¹	The Ohio State Medical Center ²	Cleveland Clinic ³
Shoulder Movement	Do not raise your elbows higher than your shoulders	You may move your arms within a pain free range	It is okay to perform activities above shoulder level
Lifting	Do not lift greater than 5 to 10 pounds with your affected arm (for 4 weeks)	Do not lift more than 10 pounds for the 6 weeks after your surgery	Do not lift objects greater than 20 pounds for first 6-8 weeks following surgery
Reaching	Do not reach behind you when dressing your upper body	Avoid reaching backwards	Not mentioned

¹<http://www.ohiohealth.com/documents/orb/Sternal%20precautions.pdf>

²<http://medicalcenter.osu.edu/PatientEd/Materials/PDFDocs/surgery/activity-after-chest-surgery.pdf>


³http://my.clevelandclinic.org/heart/disorders/recovery_ohs.aspx

Table 3. Complications Associated with Cardiac Surgery via Median Sternotomy

- Myocardial injury
- Blood loss
- Atrial fibrillation
- Pneumonia
- Memory/cognitive impairment
- Subxiphoid incisional hernias
- Brachial plexus injury
- Superficial incisional infections
- Sternal instability/mediastinitis

Risk Factors Associated with Sternal Wound Complications

Table 4. Risk Factors Associated with Sternal Wound Complications

Primary Risk Factors		Secondary Risk Factors
<u>Obesity/high body mass index</u> Chronic obstructive pulmonary disease <u>Internal mammary artery grafting (bilateral)</u> <u>Diabetes mellitus</u> <u>Rethoracotomy</u> <u>Increased blood loss/number of transfused units</u> Higher disability classification (CCS or NYHA) Smoking Prolonged cardiopulmonary bypass/surgical/time Prolonged mechanical ventilation Peripheral vascular disease <u>Female gender with large breast size</u>	 <p>Balachandran S et al. <i>Ann Thorac Surg</i> 2016;102:2109-17.</p>	Osteoporosis/decreased sternal thickness Longer intensive care unit length of stay Time of surgery Antibiotic administration > 2 hours presurgery Staple use for skin closure Impaired renal function Immunocompromised status Closure by noncardiovascular surgeon Cardiac reinfarction Inadvertent paramedian sternotomy Emergency surgery ACE inhibitor use Use and duration of temporary pacing wires Septic shock Depressed left ventricular function

CCS = Canadian Cardiovascular Society Anginal Classification; NYHA = New York Heart Association Heart Failure Classification

Sternal Precautions Algorithm

Risk of Sternal Complications
Number of Primary & Secondary Risk Factors
Sternal Instability Scale Score²⁵
Patient Characteristics / Clinical Profile

High Risk

Moderate Risk

Low Risk

2-4 weeks

2 weeks

2 weeks

Conservative Activity Guidelines

- No lifting, pushing, or pulling > 10 lbs
- No shoulder abd. or flex > 90° when UE weighted
- Shoulder AROM in pain-free range
- No scapular retraction past neutral
- Avoid active trunk flex. & rot. with supine ↔ sit
- No UE use with sit ↔ stand
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- No driving

Moderate Activity Guidelines

- No lifting, pushing, or pulling > 10 lbs
- No unilateral shoulder abd. or flex > 90° when UE weighted > 5 lbs
- Shoulder & scapular AROM in pain-free range
- Avoid active trunk flex. & rot. with supine ↔ sit
- UE use with sit ↔ stand keeping shoulders in neutral position
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- No driving if lost 2 weeks

Progressive Activity Guidelines

- No lifting, pushing, or pulling > 10-20 lbs
- No unilateral shoulder abd. or flex > 90° when UE weighted > 10 lbs each
- Full shoulder & scapular ROM
- Avoid trunk flex. & not resistance exercise
- UE use with sit ↔ stand as needed
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- Resume driving

2 weeks

No

Normal healing

Yes

2 weeks

No

Normal healing

No

Normal healing

2 weeks

No

Normal healing

Yes

Normal Healing

- Improvement in sternal pain
- No reported clicking/popping of sternum
- No crepitus on palpation
- Complete cutaneous healing
- No signs or symptoms of local or systemic infection

Progression of Activity Resumption

- ↑ Lifting, pushing, & pulling by 10-20 lbs every 1-2 weeks
- Reintroduce ADLs, IADLs, occupational, & recreational tasks

Sternal Precautions Algorithm

Risk of Sternal Complications
Number of Primary & Secondary Risk Factors
Sternal Instability Scale Score²⁵
Patient Characteristics / Clinical Profile

High Risk

Moderate Risk

Low Risk

2-4 weeks

2 weeks

2 weeks

Conservative Activity Guidelines

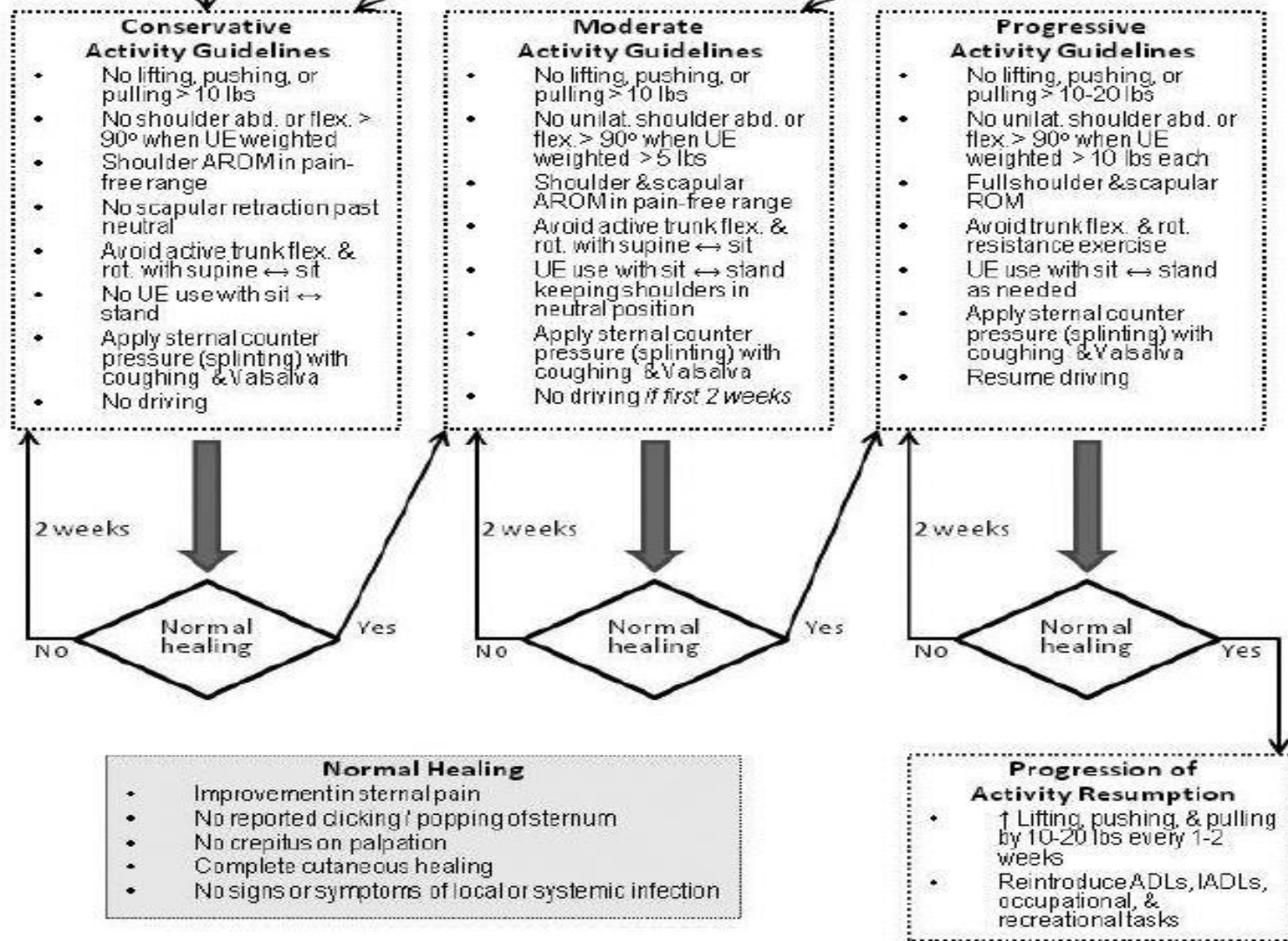
- No lifting, pushing, or pulling > 10 lbs
- No shoulder abd. or flex. > 90° when UE weighted
- Shoulder AROM in pain-free range
- No scapular retraction past neutral
- Avoid active trunk flex. & rot. with supine ↔ sit
- No UE use with sit ↔ stand
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- No driving

Moderate Activity Guidelines

- No lifting, pushing, or pulling > 10 lbs
- No unilat. shoulder abd. or flex. > 90° when UE weighted > 5 lbs
- Shoulder & scapular AROM in pain-free range
- Avoid active trunk flex. & rot. with supine ↔ sit
- UE use with sit ↔ stand keeping shoulders in neutral position
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- No driving if first 2 weeks

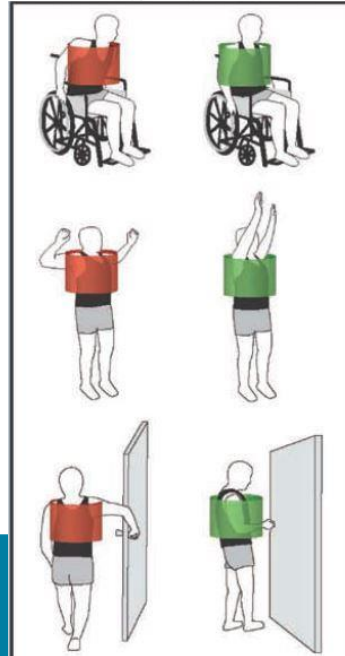
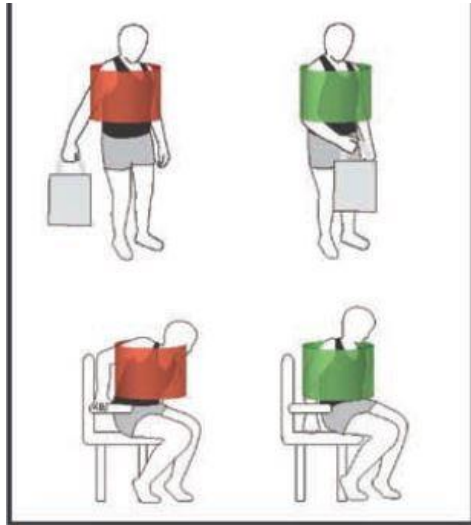
Progressive Activity Guidelines

- No lifting, pushing, or pulling > 10-20 lbs
- No unilat. shoulder abd. or flex. > 90° when UE weighted > 10 lbs each
- Full shoulder & scapular ROM
- Avoid trunk flex. & rot. resistance exercise
- UE use with sit ↔ stand as needed
- Apply sternal counter pressure (splinting) with coughing & Valsalva
- Resume driving



An alternative approach to prescribing sternal precautions after median sternotomy, “Keep Your Move in the Tube”

Jenny Adams, PhD, Ana Lotshaw, PT, PhD, CCS, Emelia Exum, PT, DPT, Mark Campbell, BSc, MSc, Cathy B. Spranger, DrPH, Jim Beveridge, RN, PCCN, Shawn Baker, PT, DPT, MS, Stephanie McCray, RN, Tim Bilbrey, MBA, Tiffany Shock, BS, Anne Lawrence, RN, Baron L. Hamman, MD, and Jeffrey M. Schussler, MD





Evidence for Intervention

Dr Doa El-Ansary



"The handle on your recliner does not count as an exercise machine."



Australia: land of danger

Bellagio Due

Two-Seater Sofa,
Onur Çobanlı, 2010

**Australia's biggest killer in 2015:
more than 8000 deaths from obesity
related illness**

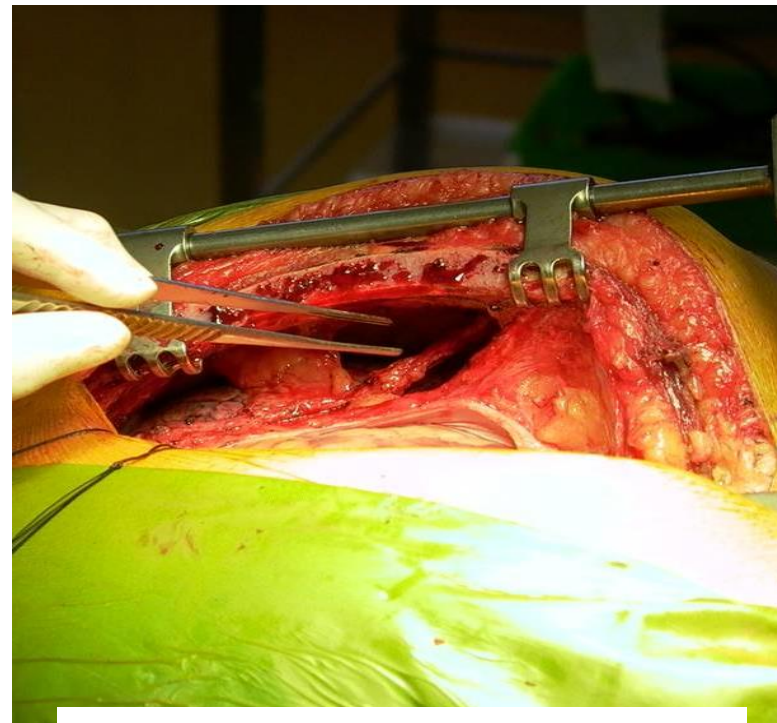
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X: 2050 mm
Y: 890 mm
Z: 1050 mm

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Clinical Outcomes

- **Postoperative Pulmonary complications:**
7% (Stiller et al, 1997)
- **Post-sternotomy pain (mod to severe):**
40.1% at 3/12 ; 9.5% at 24/12 months
(Choiniere et al, 2014; IASP, 2012)
- **Musculoskeletal problems 30%** (El-Ansary et al, 2000; Stllier et al, 1999)
- **Sternal complications:** 1% to 8%
 - 66% are identified post 6/52
(Robicsek, 2000; Bitkover et al, 1998;
El-Ansary et al, 2009)



Sternotomy: IMA Harvest, The Alfred Hospital, Australia

Musculoskeletal Complications

- 38% IMAG, 17% SVG Roy et al 1988
- Unilateral shoulder and upper limb pain Selvaratnam et al 1994
- 30% of shoulder and back problems at 3/12 Stiller et al 1997
- An association between IMA harvest and musculoskeletal complaints Roy et al, 1998, El-Ansary et al 2000
- IMA harvest - anterior chest wall pain (38.5%) El-Ansary et al 2000

Musculoskeletal Complications

- Brachial plexus injuries
- Sternal instability
- Drain site adhesions
- C/S and T/S dysfunction
- SC and MS subluxation
- Rib fractures
- Phrenic nerve palsy
- Scar thickening (keloid)
- Anterior/AL chest wall hypersensitivity
- Deep chest wall pain
- Left parasternal /AL paraesthesia

**Keloid
Scar**



Possible Reasons for MS complications

- **Sternal retraction-** type and placement
- **Dissection of the IMA**
- **Devascularisation of the sternum**

***IMA harvest- chest wall retracted and everted 30-40 degrees (non-physiological position for thoracic cage)*

(El-Ansary et al, 2000)



Sternal Instability

Separation of the sternum at the midline
due to bony fracture or disruption of the
wires

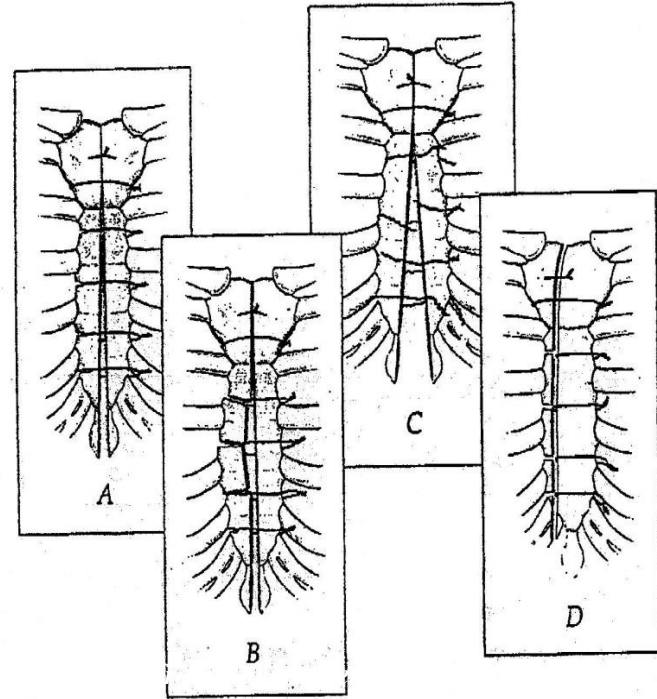
(Robicsek, 2000)

Separation may be total or partial
(usually the lower third of the sternum)

(Robicsek et al, 2000; El-Ansary et al, 2000, 2007, 2008)

4 year survival rate - 65% versus 89%
controls

(Baskett et al, 1999; Losanoff et al, 2002 Zetani et al, 2006;
Howlader et al, 2009; Mekontso et al, 2010)



Clinical Features of Sternal Instability

broken/loose wires and/or infection



friction, pain/discomfort



excessive motion and clicking of sternal segments



wire/bone fracture; non-union

+/- skin breakdown and infection

pain and muscle guarding, disruption of ADL



Increase in morbidity and mortality



Increase in length and treble cost of care

(Baskett et al, 1999; Losanoff et al, 2002; Mekontso et al, 2010; Oakley et al, 1996; Zeitani et al, 2006)



Sternal infection



Early diagnosis of SI provides an enhanced recovery strategy

Study: The Effects of Upper Limb and Trunk Tasks



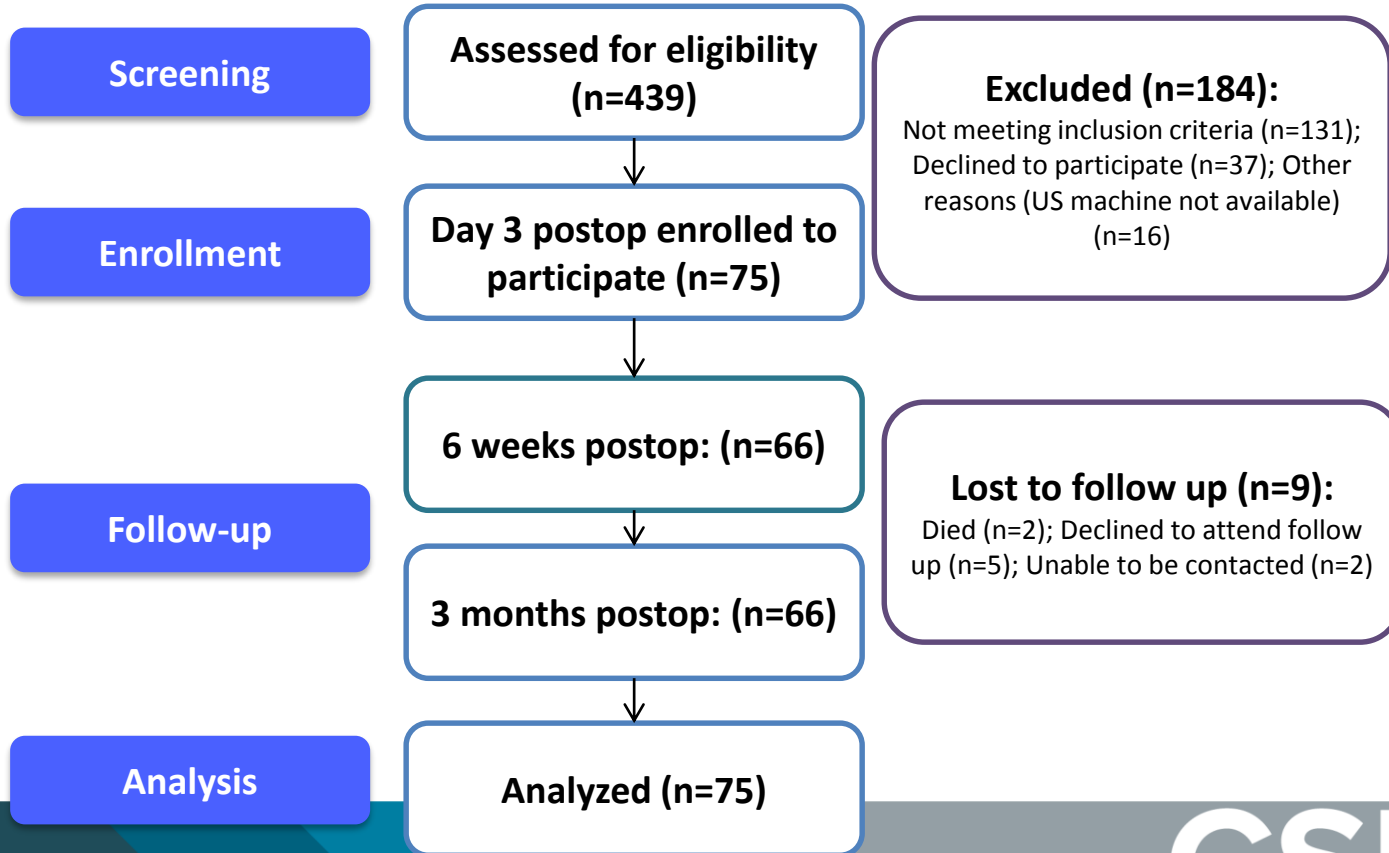
Primary aim:

Quantify sternal micromotion during upper limb and functional tasks (first 3 post-op months)

Secondary aims:

- (1) sternal pain during functional tasks and
- (2) post-operative function, over the first 3 post-op months

Consort Flowchart



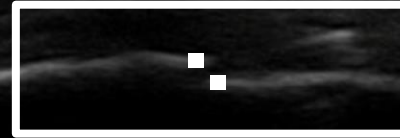
Method: Sternal Micromotion



Skin

Fascia

Sternum



Horizontal = 0.010 cm
Vertical = 0.020 cm

Intra-rater reliability
ICC (3,1)

0.990 to 0.997

Inter-rater reliability
ICC (2,1)

0.994 to 0.998

Results: Sternal Micromotion

- **Time:**
 - Significant decrease in sternal separation and pain over time
- **Task:**
 - Significant increase in sternal separation during cough (compared to other tasks): 0.14-0.16mm mean increase
 - Cough produced significant pain
 - Bilateral arm better tolerated than unilateral arm movements
- **Sternal Healing:**
 - 5 out of 75 patients had bony union on US at 3 months
 - Clinical union verses radiological consolidation

Real-Time US:

demonstrates that *bilateral upper limb elevation* results in minimal motion < 2mm

Conventional Wired Sternotomy



(Unilateral Upper Limb Elevation)

X = sternal edge

Real-Time US: demonstrates that *sit to stand* results in minimal motion < 2mm

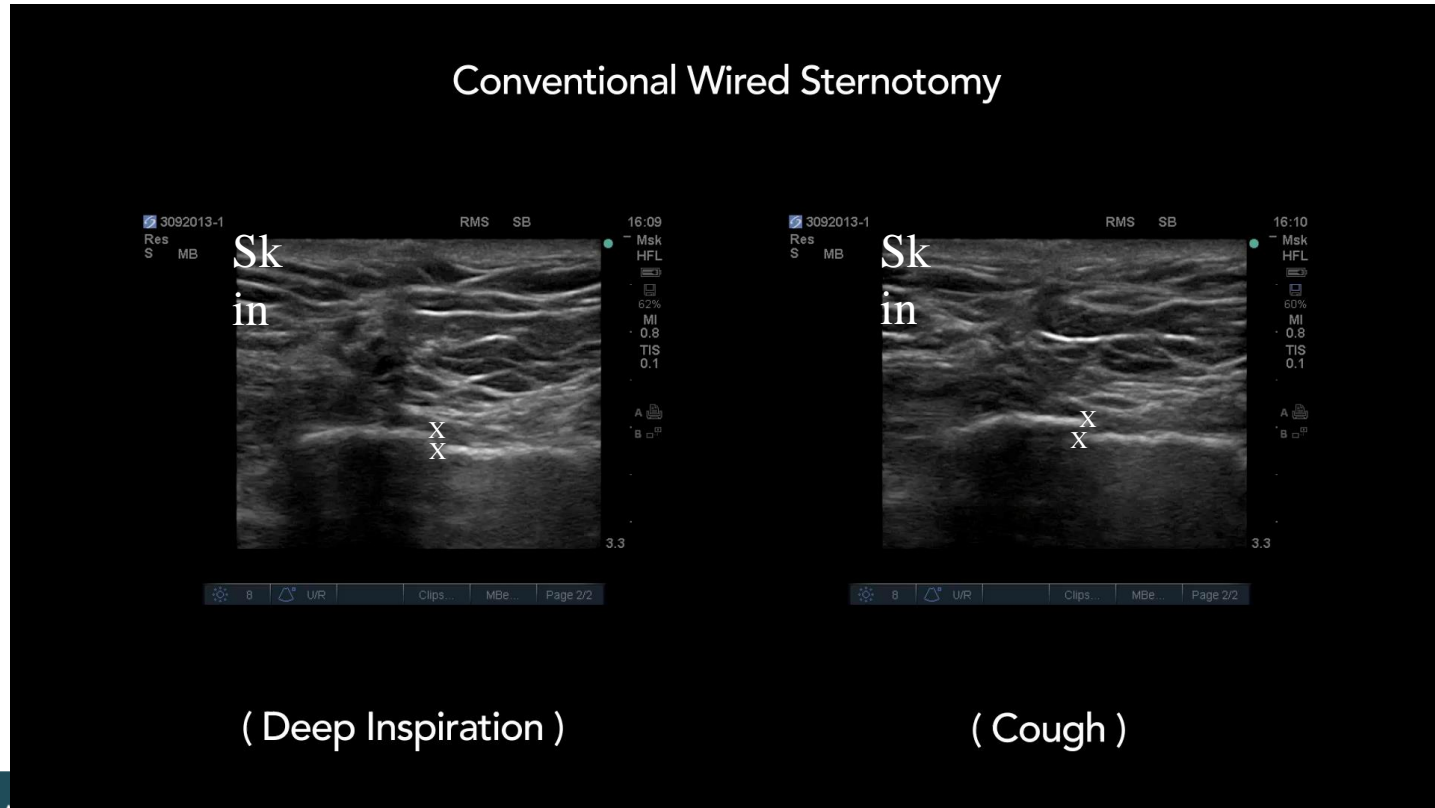
Conventional Wired Sternotomy



(Sit to Stand)

X = sternal edge

Real-Time US: deep inspiration (L) and coughing (R) – *most motion*



Conclusions: Clinical Relevance

- Sternal precautions maybe overly restrictive and delay recovery
- Bilateral UL exercises and activities are safe (e.g. walking frame)
- Cough should be limited and not used prophylactically (e.g. active cycle of breathing and huffing more effective)
- Findings are comparable with Dr Jenny Adams research re-forces in coughing

→ **ENCOURAGE** early mobilisation
→ **FOLLOW-UP** patients with irritable/constant cough



Motor vehicle driving after cardiac surgery via a median sternotomy: mechanical and neurocognitive considerations

El-Ansary D, Jackson M, Howard M, Royse C, Royse A, Heiberg J, Bryant A, and Denehy L

Aims

1. To evaluate the effects of a median sternotomy on driving performance

Hypothesis: *driving should recover to pre-surgery levels at 6 weeks*

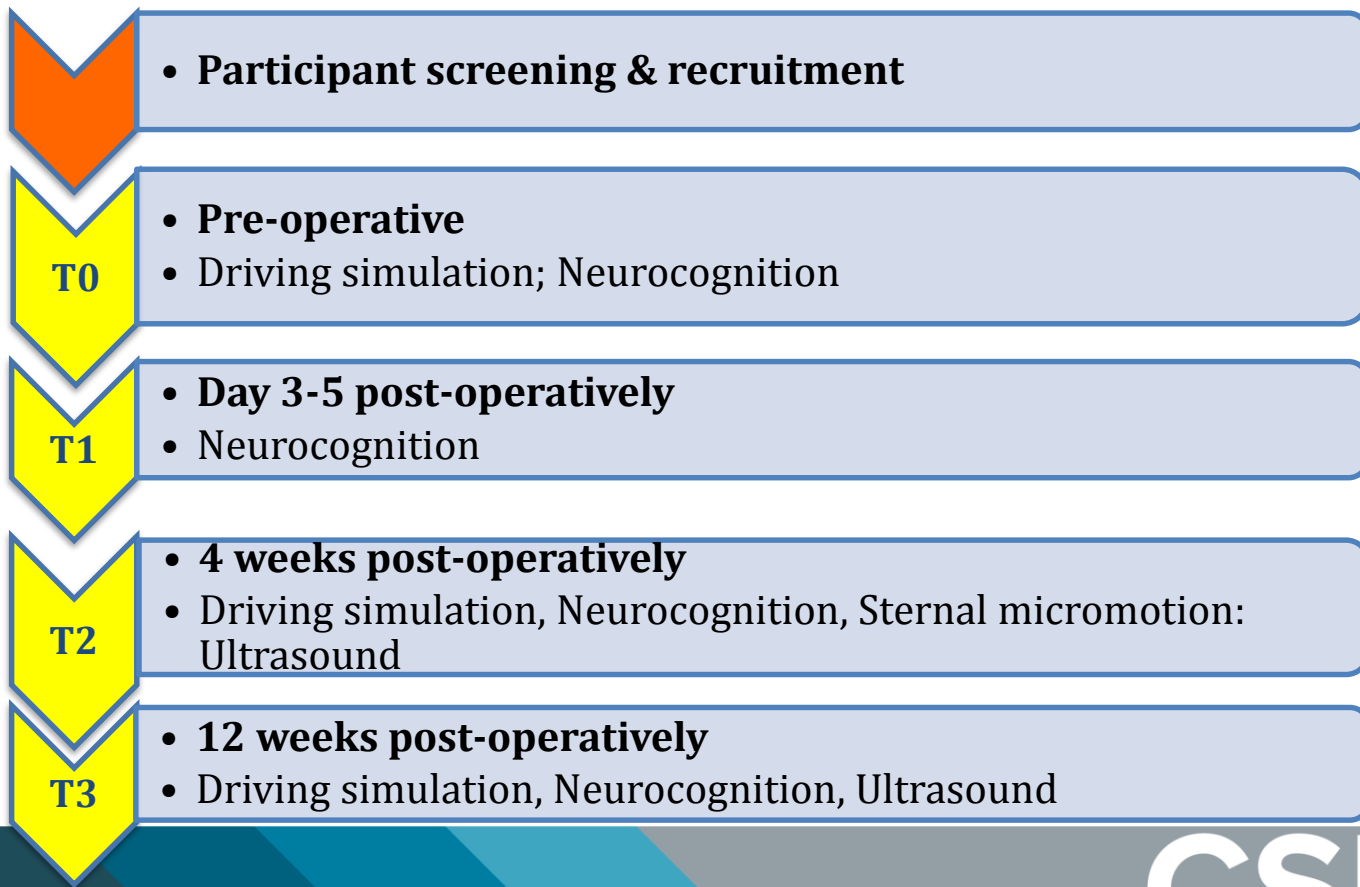
2. To measure sternal micromotion during simulated driving tasks using ultrasound

Hypothesis: *driving will not impact on sternal micromotion*

Method: Design

- Prospective observational pilot study
- **Sample Size:**
27 participants
- **Inclusion criteria:**
 - Elective cardiac surgery patients
 - Adult drivers with a current driving license
 - Living within a 50 km radius from Melbourne to reduce the burden of follow-up

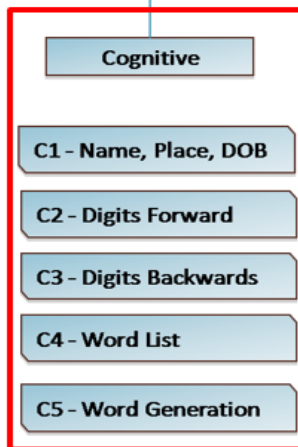
Method



Method: Neurocognitive Measures

PostopQRS:

- multiple domain
- validated (phone and paper) in cardiac surgery (Royse et al, 2012)



DSST:

- assesses visuo-motor coordination
- validated neurocognitive measure = driving performance (Szlyk et al, 2002)

Name: _____
Date: _____

Digit	1	2	3	4	5	6	7	8	9	Score
Symbol	—	⊥	□	L	⊐	○	△	×	=	

Samples

2	1	3	7	2	4	8	2	1	3	2	1	4	2	3	5	2	3	1	4	5	6	3	1	4
⊥	—	□	△	⊥	L	×																		
1	5	4	2	7	6	3	5	7	2	8	5	4	6	3	7	2	8	1	9	5	8	4	7	3
6	2	5	1	9	2	8	3	7	4	6	5	9	4	8	3	7	2	6	1	5	4	6	3	7
9	2	8	1	7	9	4	6	8	5	9	7	1	8	5	2	9	4	8	6	3	7	9	8	6

Figure 13.1 The Digit Symbol Substitution Test (DSST). The athlete completes as many boxes as possible in 90 seconds

Primary Outcome: Driving Performance



Method: US of sternal micromotion of driving tasks- driving; placing seat belt on and reverse parking

Wired Conventional Sternotomy



(REST)

Results

Table 1: Demographic Information

N	27
Age, Yrs Mean (SD)	60.2 (16.5)
Gender: Male/Female	22/5
Education, Yrs Mean (SD)	12.5 (3.8)
BMI, Mean (SD)	29 (5)
Past Medical History (%)	
Diabetes	18.5%
Hypertension	37%
COPD	3.7%
Operation n (%)	
CABG	17 (63%)
AVR	4 (15%)
MVR	3 (11%)
CABG and Valve surgery	1 (4%)
CABG and ASD	1 (4%)
Operation Time (minutes), Mean (SD)	263 (69.7)
Bypass Time (minutes), Mean (SD)	111 (35.5)
Cross-clamp Time (minutes), Mean (SD)	85 (29.2)
Mechanical Ventilation Time (hours), Mean, (SD)	15 (11.2)

Results : Sternal Micromotion (US)

- Decreased significantly ($p < 0.05$)

4 weeks (diff from rest)

- horizontal = 0.4mm (0.1)
- mean vertical = 0.2 mm (0.1)

12 weeks

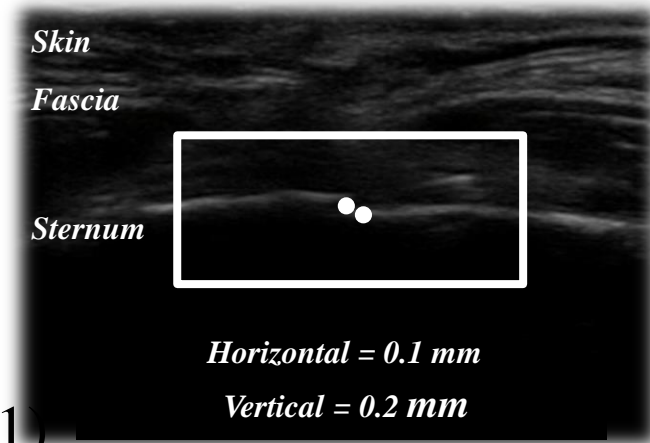
- mean horizontal = 0.2mm (0.1)
- mean vertical = 0.1mm (0.1)

**Consistent with upper limb exs.*

**Safe for bone healing < 2mm*

- Bone Consolidation

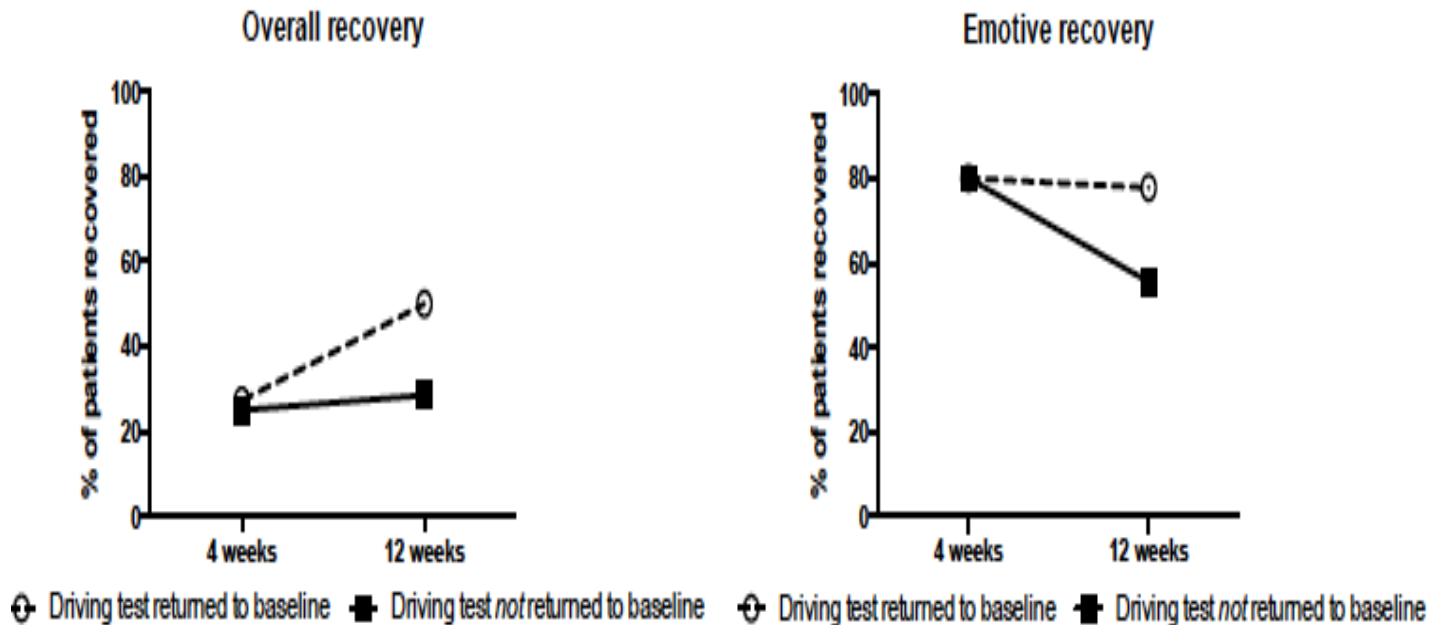
- 15% (n= 4) at 4 weeks
- 55% (n= 15) at 12 weeks



Ultrasound image of a conventional wired sternotomy at 4 weeks

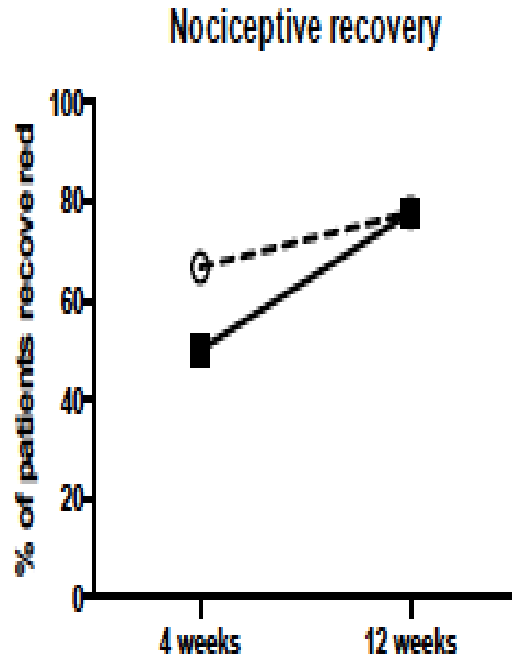


Results: PostopQRS (Recovery)



****30% scored below normative population preoperatively***

Results: PostopQRS



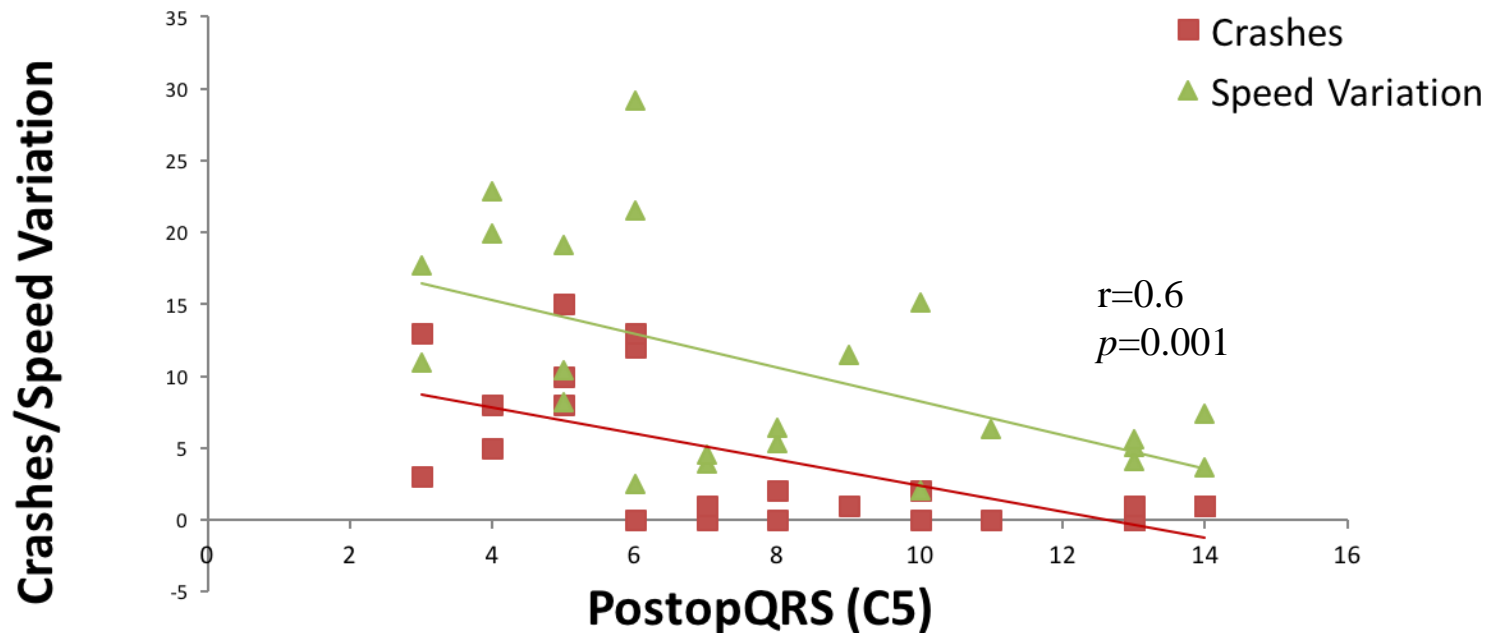
*Both groups: 20% reported persistent pain at 12 weeks

*Consistent with prior research

○ Driving test returned to baseline ■ Driving test not returned to baseline

Results: Neurocognition and Driving (4 weeks)

PostopQRS vs driving variables



DSST vs driving variables



Conclusions

- Sternal micromotion was minimal and within normal limits with consolidation evident in some patients
- **Battery of neurocognitive tests** may be accurate reflection of driving performance (i.e. PostopQRS)
- Overall recovery including neurocognition at baseline may be predictive of driving performance and safety
- **Screening: driving at 4 weeks may be suitable for select patients**
- **A larger study** is needed to investigate:
 - a battery of neurocognitive tests as indicators of driving performance and safety

Evidence: Exercise and Mobilisation

- Benefits of mobilisation on FRC, Oxygen saturation, reducing PaCO₂ and PaO₂ (Systematic review- Neilson et al, 2003)
- Benefits of mobilisation without additional IS or DB exs (Jenkins et al, 1989)
- Bicycle ergometer is as effective as walking during phase 1 rehabilitation (Hischhorn et al, 2010)

Future Directions:

- Can patients exercise better and safer if wearing a supportive brace?
- establish intensity and frequency for safe exercise?
- does greater intensity of mobilisation effect LOS and PPC?



Evidence: trunk exercises

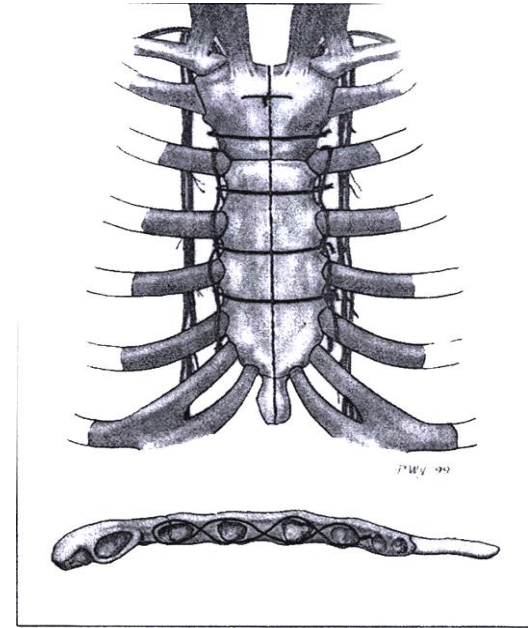
- Routine Active ROM of trunk and UL did not affect incidence of MS up to 10/52 post Sx (Stiller et al, 1997)
- RCT of **progressive Trunk and upper limb exercises** (Hoggins et al, 2014)
 - less sternal pain 4/52 ($p = 0.029$)
 - greater improvements on the global rating of change assessment ($p = 0.04$)



Evidence:

Management of Sternal Instability

- **Surgery:**
 - parasternal weaving (Robiscek)
 - pectoral muscle advancement
- Exercise and activity modification guidelines
- Orthopaedic stabilization devices (brace)
- **Long term studies** - 42% to 45% of patients reported persistent sternal instability (Ringelman et al, 1994; Yuen et al, 1995)
- ***Surgery can only assist some of this group***



Robiscek , 2000

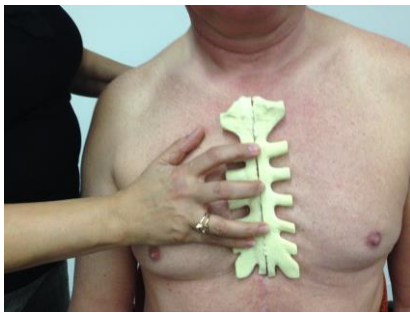
Evidence: Assessment and Diagnosis of SI (Ultrasound)

Anterior Chest



- Ultrasound measures - **valid and reliable** indicator of bony separation (GOLD STANDARD) (El-Ansary et al, 2007)
- Non-physiological motion - transverse and sagittal planes (palpated: longitudinal axis) (El-Ansary et al, 2009)

****sternal instability is seen as ‘dynamic instability’ with upper limb movements**



Evidence: Physical Examination

Sternal Instability Scale (SIS)

- 0 = Clinically stable sternum** (no detectable motion) - normal
- 1 = Minimally separated sternum** (slight increase in motion upon special testing - upper limb, trunk)
- 2 = Partially separated sternum - regional** (moderate increase in movement)
- 3 = Completely separated sternum - entire length** (marked increase in motion)

**EARLY DIAGNOSIS ESSENTIAL TO ENSURE OPTIMAL
MANAGEMENT AND PROGRESSION**

Inter-rater reliability – ICC = 0.98; % exact agreement = 99%
Intra-rater reliability- ICC= 0.92-0.99 (El-Ansary et al, 2007a; 2009)

Evidence: Conservative management of sternal instability

- **SIS- Early assessment and monitoring** (*El-Ansary et al, 2000; 2009*)
- **Unilateral** movements: significantly associated with sternal pain) (*El-Ansary et al, 2007*)
- **Bilateral movements (unloaded and loaded)**: better tolerated (*El-Ansary et al, 2007*)
- **Stabilisation exercises and sternal brace (Qualibreath) splint sternal edges and significantly reduce pain** (*El-Ansary et al, 2008 and 2009*)

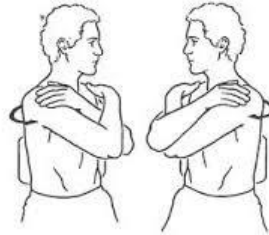
Adjustable fastening brace - “Qualibreath”

Clinical Implications:

DB and Coughing **not warranted**



Trunk and UL exercise : **Yes**



Cycling- safe and effective exercise : **Yes**



Mobilisation: **Yes**



Supportive devices
(Qualibreath) are effective for
patients with or at risk of SI: **Yes**



**Yes! Keep
your move
in the TUBE**

Gait aid : **Yes if needed**



Good-bye Sternal Precautions: *You won't be missed*



Jenny Adams, PhD

Research Associate

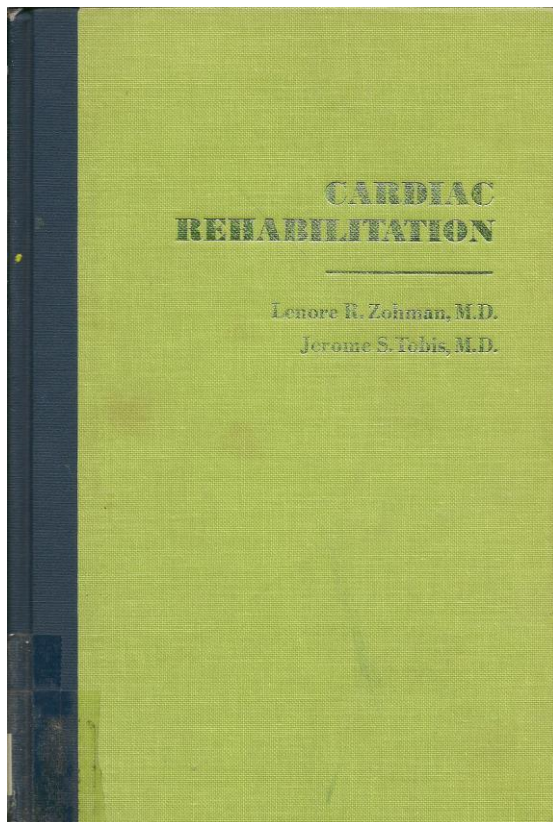
Baylor Hamilton Heart and Vascular Hospital, Dallas, Texas







1970



Foreword

Within the past ten years, there has been a remarkable change in the management of the cardiac patient, particularly the postcoronary patient. Most physicians practicing today were indoctrinated with the belief that the cardiac patient could best protect his longevity by reducing his physical activity and living a restricted life that never taxed his physical capacity. Dr. Lenore Zohman and Dr. Jerome Tobis have been among the clinicians who question the validity of this concept, and they have carried out clinical investigations aimed at determining if such restrictions are necessary or, indeed, even desirable. This monograph, *Cardiac Rehabilitation*, brings together the evidence now available on this question and, in particular, provides clinicians with reasonable guidelines applicable to the practical management of the cardiac patient.

Throughout the volume, Drs. Zohman and Tobis place emphasis on techniques that permit practical evaluation of the functional capacity of the cardiac patient for the activities of daily living. Their work in the Montefiore Hospital program has been directed toward restoring the cardiac patient to as full functional capacity as possible. Fully recognizing that final answers on the value of exercise programs in changing the morbidity and subsequent mortality of the cardiac patient are not yet available, they detail the evaluation and exercise-prescription procedures that have evolved from their own experience. By making their expe-

xi

1982

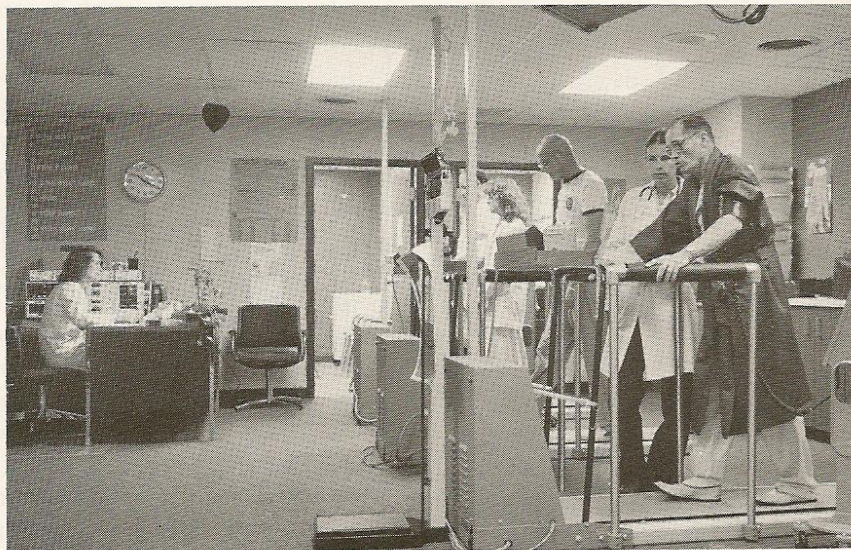


Figure 8-3. Inpatient Exercise Center.⁵⁵ Cardiac rehabilitation nurse station with four-channel ECG monitor at left with inpatient education classroom entrance in center background. Physical therapist is supervising patient during treadmill walking (right foot). (Courtesy of the Cardiac Rehabilitation Program, Mount Sinai Medical Center, Milwaukee, WI.)

1ST WEEK

Teach patient to relax; may feed self; may use bedside commode with assistance.

Physical therapy. Commence supervised exercises; include diaphragmatic breathing exercises. Make sure patient does not hold his breath or strain while doing exercises.

1st day. Flex and extend toes—relax.

Dorsiflex and plantar flex ankle—relax.

Make fist—open—relax.

Repeat above exercises 5 times.

2nd and 3rd days. Increase above exercises to 10 times b.i.d.

Add isometric contractions of quadriceps group.

Flex and extend elbows.

Actively place hands behind head once b.i.d.

Repeat above exercises 5 times b.i.d.

4th and 5th days. Add to above exercises. Flex knees to 90° angle by sliding foot on bed.

Repeat 10 times b.i.d.

6th and 7th days. Same exercises.

3RD WEEK

May shave and wash at bedside.

1st and 2nd days.

Occupational therapy. Continue as outlined in Appendix A.

Physical therapy. Above exercises 10 times b.i.d.

Start *progressive sitting* as follows:

Assist to arm chair and bed first two days. Instruct in proper sitting posture. *Caution:* Do not allow patient to use 'over-stuffed' or sofa spring seat chair. Also instruct in proper transfer technique.

Progressive sitting. 30 min t.i.d. for 3 days. 60 min t.i.d. for 3 days. 90 min t.i.d. for 6 days. Thereafter may sit *ad lib.*

3rd day. As above, with the addition of active movements of the shoulders, hips and knees in a sitting position.

4th and 5th days. As above.

6th day. Complete sitting 60 min t.i.d. Exercises as before.

7th day. Start 6 days of sitting 90 min t.i.d.

5TH WEEK

1st and 2nd days.

Manual arts therapy. Wheelchair (see Appendix B).

Occupational therapy. May go to clinic in wheelchair. Modify program for evening and week-end activities.

Physical therapy. Exercises as before—continue in clinic (wheelchair).

Permit to walk by bed 5 min t.i.d.

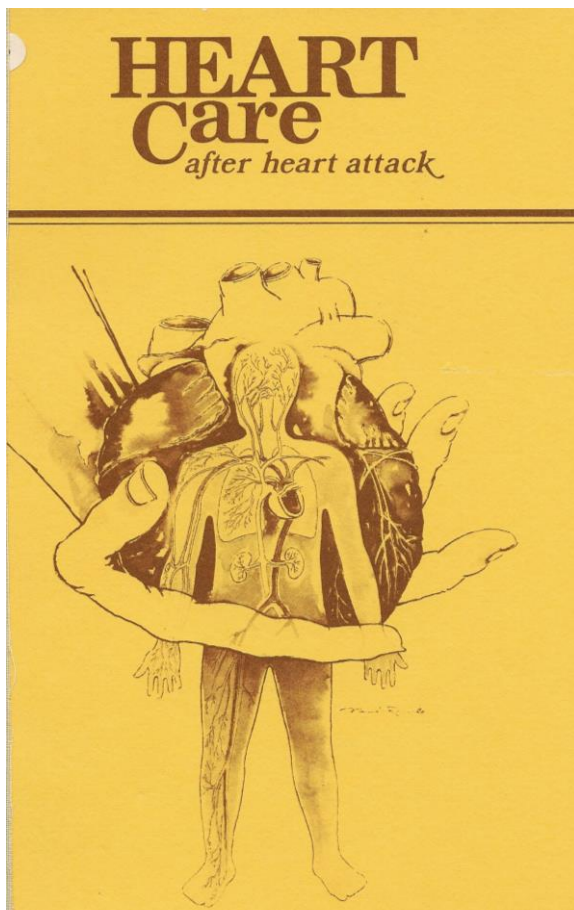
3rd day. May have bathroom privileges (BRP) for toilet. Up *ad lib.* in cubicle or room.

4th day. May have BRP for washing, shaving and toilet. Same exercises.

5th day. May have BRP for washing, shaving, toilet and shower.

6th and 7th days. Same as before.

1984



RECOVERY AT HOME

Activities of Daily Living

Lifting and Other Arm Work

Avoid lifting or carrying more than 10 pounds for the first six to eight weeks after your heart attack. During this healing time, do low-level, rhythmic activities that do not hinder breathing.

Stairs

You may climb stairs at home as part of your activities of daily living. Take your time and *rest if you become short of breath*. While there are no rules as to the number of trips up and down stairs per day, use good judgment and listen to your body.

Chores

During the first six weeks at home, light household activities are encouraged if you feel up to them. These tasks may include light gardening or carpentry, and light household chores such as setting the table, dusting, meal preparation, broom sweeping indoors, washing clothes with an automatic washer and dryer, and washing dishes. Pace yourself, and don't try to do everything right away. Harder activities, like vacuuming, raking, and lifting over ten pounds, should be avoided during the healing period.

Visiting

During the first two weeks at home, limit visits according to how you feel. Fifteen-minute visits may be long for some, while others may tolerate much longer periods without fatigue. Remember to pace yourself, and increase visiting times gradually. Never hesitate to excuse yourself and retire early.

Example Guidelines From Dallas Physicians

DO NOT

- lift more than 5 pounds for 6 weeks
- lift anything for one month
- lift more than 2 pounds
- lift or push anything
- lift more than a gallon of milk for 4 weeks
- lift anything heavier than a Dallas phone book
- do anything but light cleaning for 7 weeks
- pull anything for 8 weeks
- reach high or low
- do too much

A New Paradigm for Post-Cardiac Event Resistance Exercise Guidelines

Jenny Adams, PhD^{a,*}, Matthew J. Cline, MS^b, Matt Hubbard, MS^a,
Tiffany McCullough, BS^a, and Julie Hartman, MS^a



**Open Cardiac Rehab
door** →→→→→



= 15.5 lb.

Challenging Traditional Activity Limits After Coronary Artery Bypass Graft Surgery

A SIMULATED LAWN-MOWING ACTIVITY

Jenny Adams, PhD, Gwen Pullum, LVN, Pamala Stafford, RN, BS, Nava Hanners, RN, Julie Hartman, MS, Danielle Strauss, BS, BSN, Matt Hubbard, MS, Anne Lawrence, RN, Valerie Anderson, RN, and Tiffany McCullough, BS



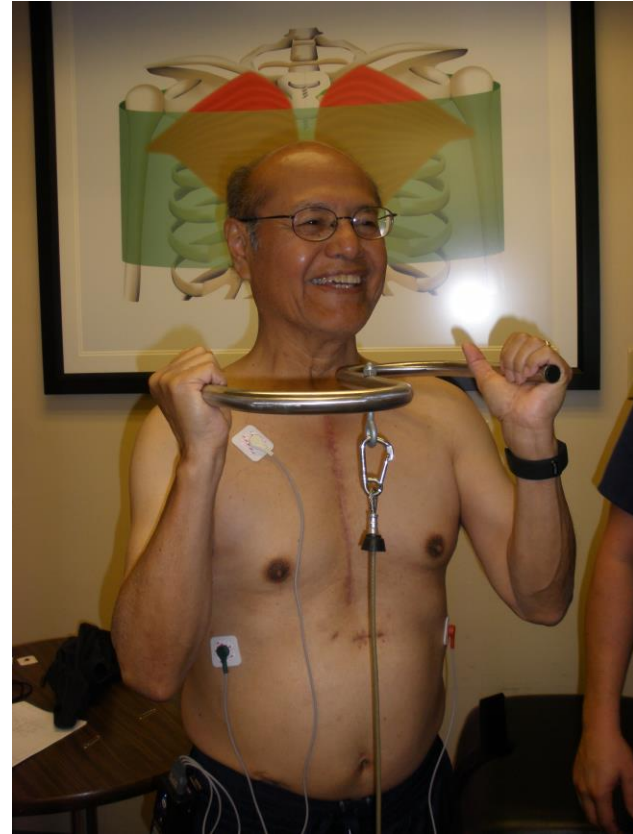
Current Activity Guidelines for CABG Patients are too Restrictive: Comparison of the Forces Exerted on the Median Sternotomy during a Cough vs. Lifting Activities Combined with Valsalva Maneuver



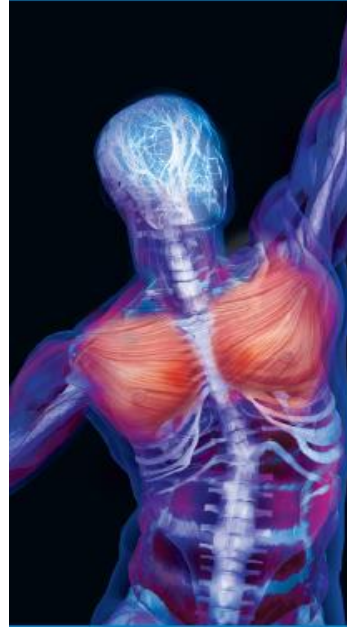
Comparison of Force Exerted on the Sternum During a Sneeze Versus During Low-, Moderate-, and High-Intensity Bench Press Resistance Exercise With and Without the Valsalva Maneuver in Healthy Volunteers

Jenny Adams, PhD^{a,*}, Jack Schmid, BSc^a, Robert D. Parker, PhD^a, J. Richard Coast, PhD^b, Dunlei Cheng, PhD^c, Aaron D. Killian, PharmD^d, Stephanie McCray, RN^a, Danielle Strauss, MSN, RN^a, Sandra McLeroy DeJong, BSN, RN^c, and Rafic Barbarie, MD^f





ACTIVE LIVING FOLLOWING STERNOTOMY™



HANDOUT

Provide Stage the Gauge™ and
Keep Your Move in the Tube™

EMPOWER

Promote safe activity

ANATOMY

Show model of thorax

DEMONSTRATE

Perform safe motions

STERNUM

Explain sternotomy

UNDERSTAND

Use teach-back method

PARTICIPATE

Enroll in Cardiac Rehabilitation

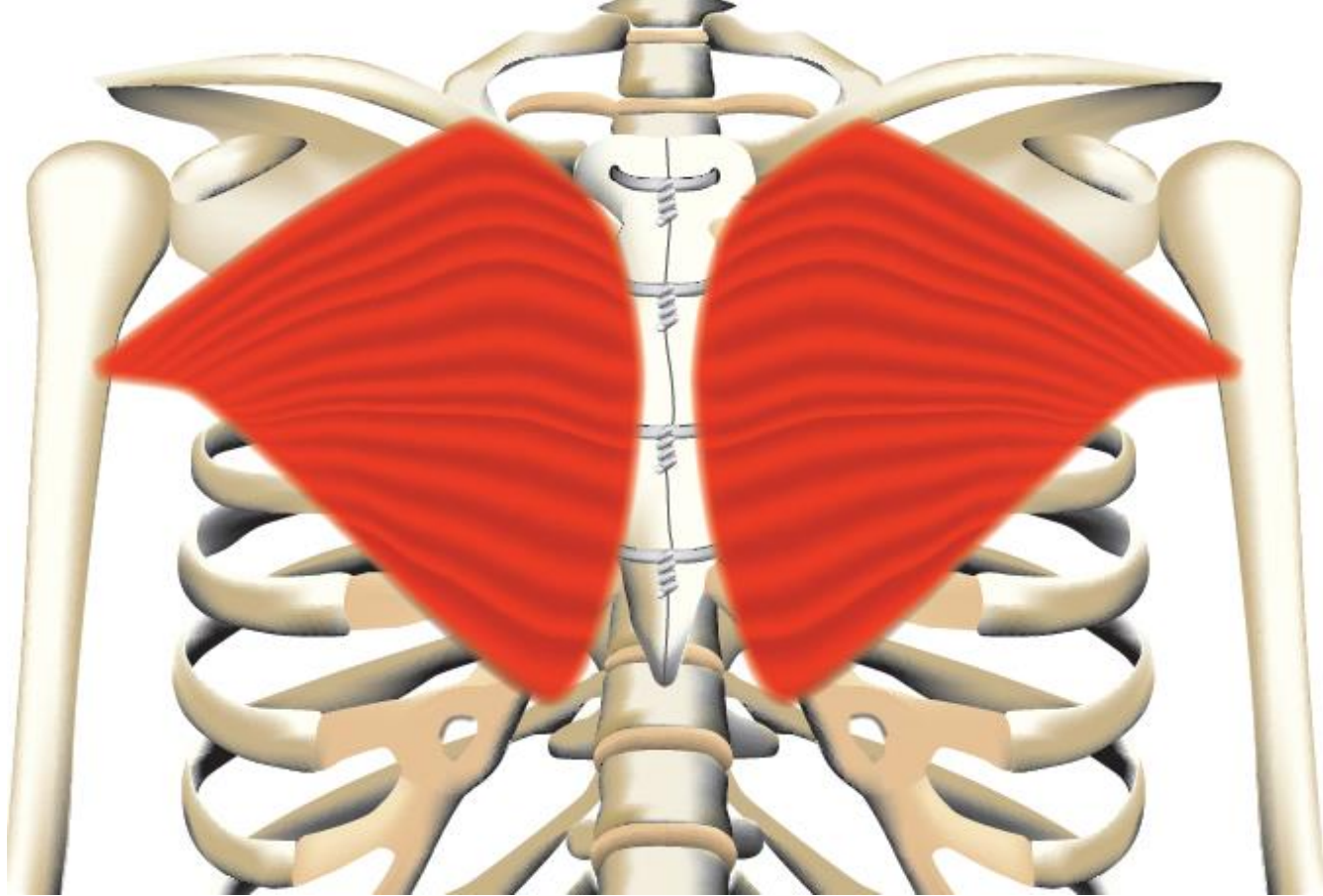


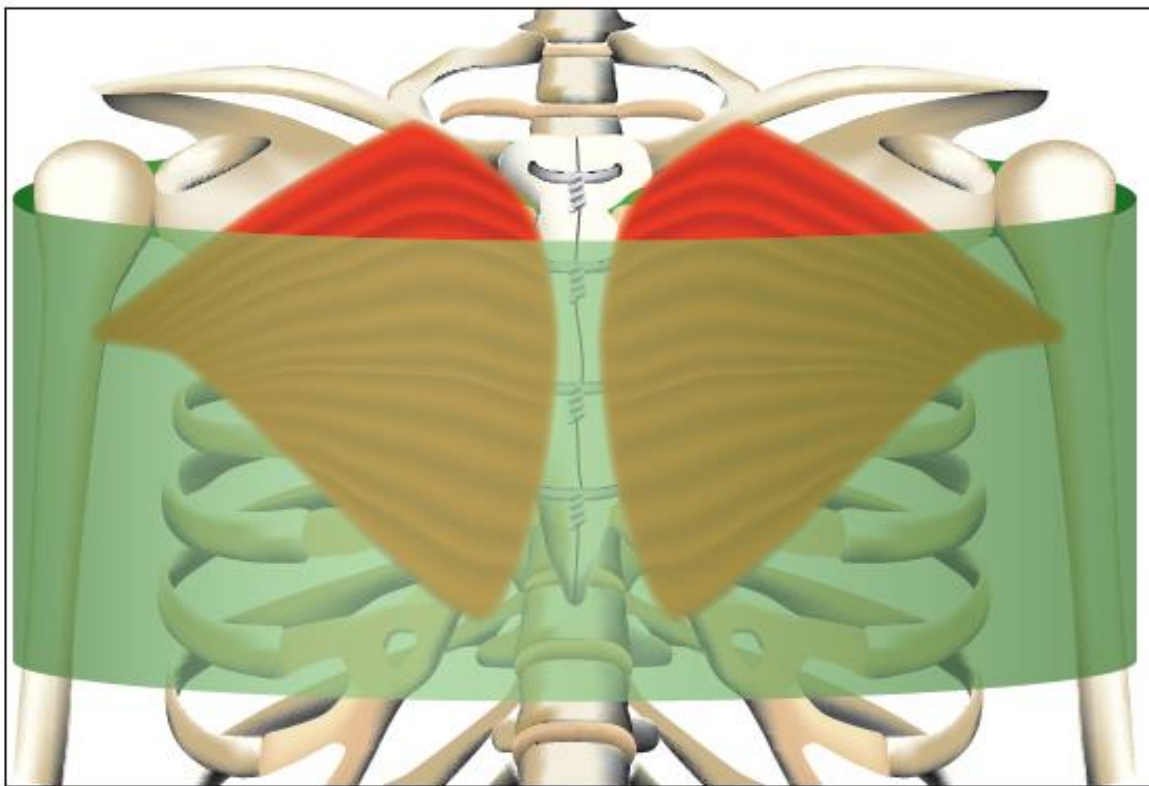
Heart and Vascular Services
at Dallas

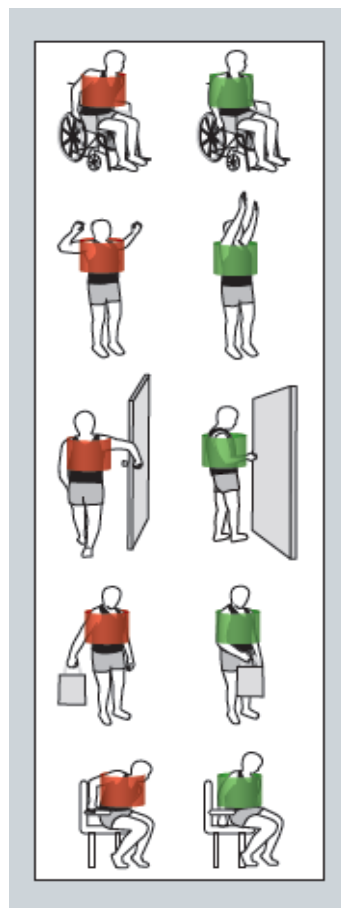
Baylor University Medical Center at Dallas
Baylor Jack and Jane Hamilton Heart and Vascular Hospital
Joint ownership with physicians

Education about the potential danger of shoulder joint
abduction, extension and flexion

Physicians are members of the medical staff at one of Baylor Health Care System's subsidiary, community or affiliated medical centers and are neither employees nor agents of Baylor University Medical Center at Dallas, Baylor Jack and Jane Hamilton Heart and Vascular Hospital or Baylor Health Care System. ©2014 Baylor Health Care System. BHTV15126-2013, MED 13108, 4/14, MTF-008







Case Studies

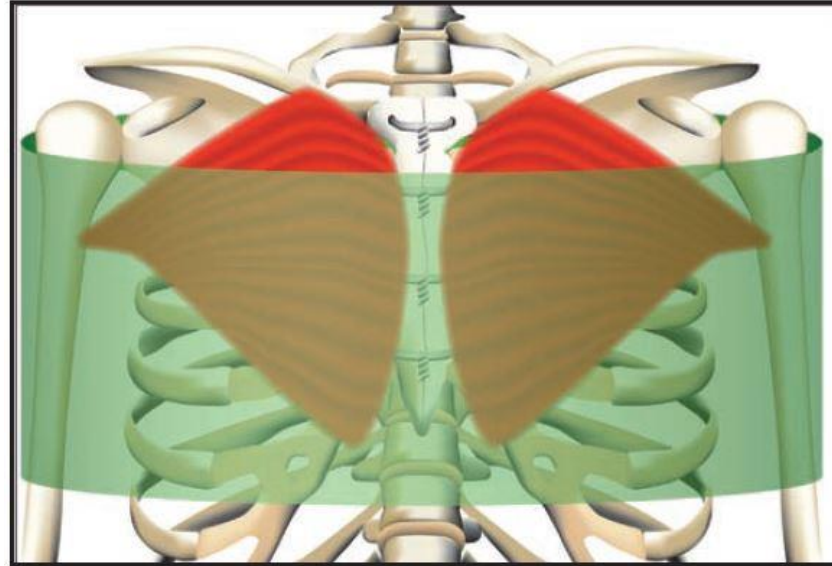
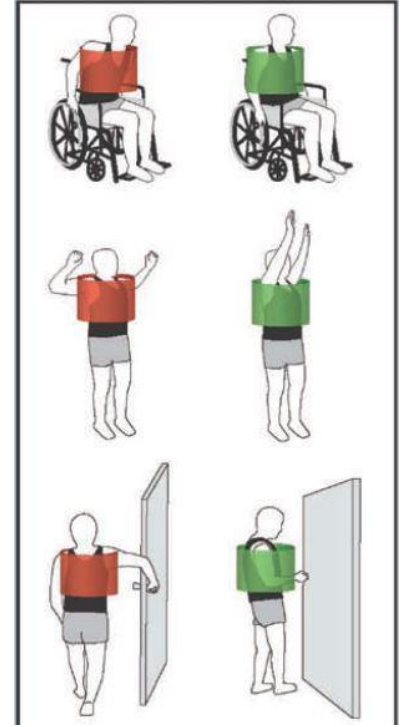
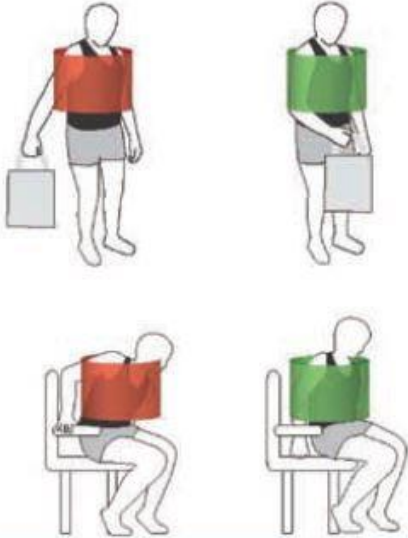


Figure 1. Illustration used to teach patients about their sternotomy, the attachments of the pectoralis major, and the imaginary truncal tube that is the basis of the *Keep Your Move in the Tube* approach.



Building a bridge between Cardiac Rehab and Inpatient Services



Dallas Zoo

Ana Lotshaw, PT, PhD, CCS

Advanced Clinical Specialist

Baylor Institute for Rehabilitation, Baylor Scott and White- Baylor University Medical Center, Dallas, Texas

Bringing an idea to practice

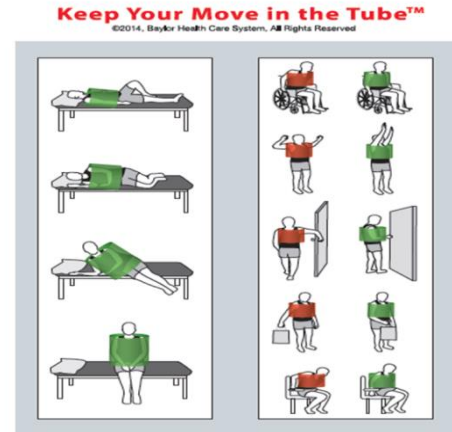
Adding more tools to the toolbox

Patient assessment

Standardized
assessments

DC planning

Patient education



Expanding Move in Tube

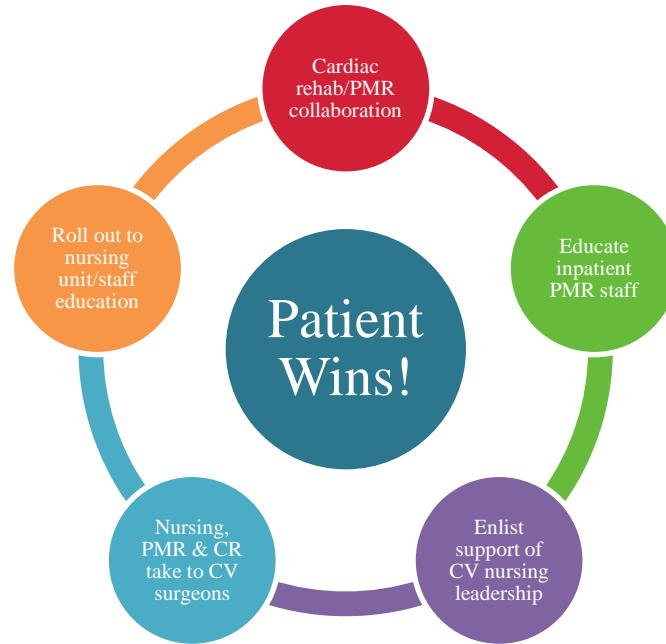
- Adding the acute PT perspective
- Current education limits mobility
- Current education causing increase in health-care resources
- Expand original MinT to include basic bed mobility

Find your champions

- How do things happen in your facility?
- What is your sphere of influence and who can help you?
- Make a plan!



How me made it work!



Patient education

- Message must start in the ICU
- Importance of the patient getting the same message throughout continuum of care ICU-acute care-inpatient rehab



Our job is never done...

- Challenges
 - Sustainability
 - Hardwiring the information
 - Staff changes in all areas
(Nursing, Physicians, Rehab)
Continuing Education
 - Outcomes



How to measure success...

- Remember that power analysis thing....

MinT just one aspect of care affecting outcome and discharge disposition

- What we do know
 - No report of sternal dehiscence due to movement since start of “Move in the Tube” Sept 2014-Nov 2016

Measuring Success

Usage of inpatient rehab and LTAC

- Approx. 80% sternotomies (over 1200pts) go home (>1000pts) since starting “Move in the Tube”
- No change in usage of post acute resources in 20 months before or after starting “Move in the tube”

Mobility training with MinT gives the patient the best opportunity to reach highest level of mobility and return to prior level of function without additional healthcare resources

Home and abroad

- Began in large facility
- Information passed on by PMR system wide council to take back to system facilities.
- Jenny- takes staff education on the road to help with implementation-
- Baylor Scott and White and beyond.....

Implementation of Keep Your Move in the Tube: *Lessons Learned*



Rick Gach PT, DPT, CMPT, KTCC, CEAS
Physical Therapist
Memorial Regional Hospital, Hollywood, Florida

Steps on the Path to Change

- Dr. Rick Gach PT, DPT, CMPT, KTCC, CEAS
- January 2015 I Started in the Cardiac Unit
- Orthopedic to Cardiac Transition
- February 2015 CPR Event
- August 2016 Chest Tube Policy Created

Evolution not a Revolution

- August 2015 Cahalin (2011) Article Found
- September 2015 Cough Abstract Found
- The 11 PM Call that Changed Everything
- January 2016 Trip to Baylor
- March 2016 Tube was Implemented

Roll-Out at Memorial Regional

- My Director and Her Boss
- Meetings with Surgeons (Adult/Peds)
- In-Service to Rehab and Nursing Dept (comps)
- Revised Patient Education Booklets
- Posted Signage
- Created a Video (Annual Comps/Training)

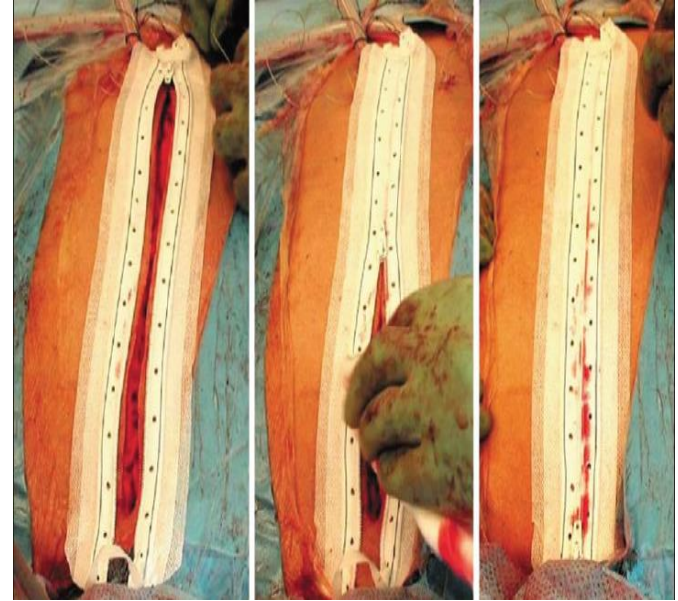
Story Time...

I will discuss various conversations
and interactions that I had with
different team members

My thoughts/fears the 1st time I used the tube



Can you close my patient's chest for me?



Why did you give our info to the janitor?



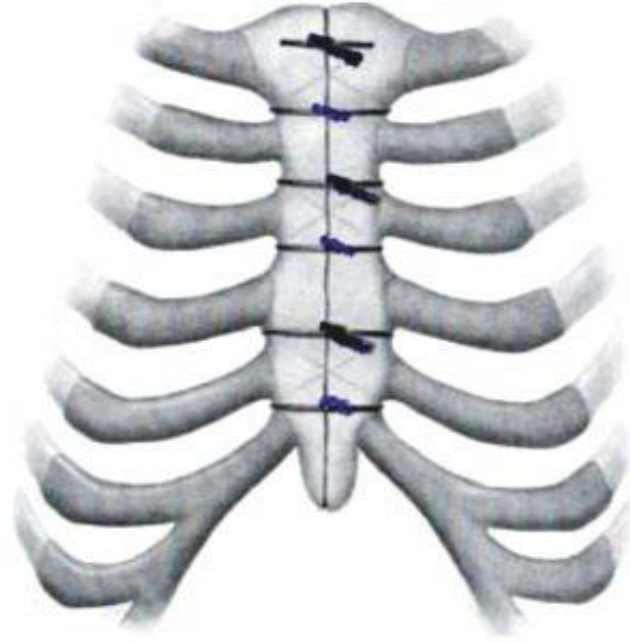
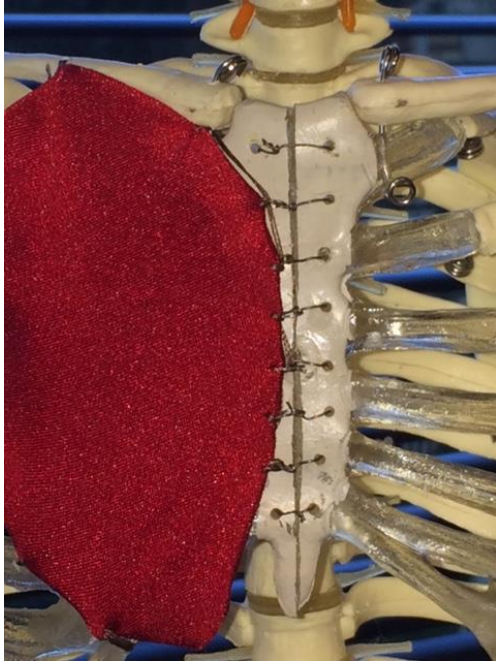
RNs push-back with mobility (med stable?)



Brittle chest and Dr conversation (new/old/new)



My CPR story $10 \text{ mins} \times 100 = 1,000$ compressions



We Went From This...To This



“God is in the Details”

- Tremendous Positive Change in Function
- Patient Satisfaction
- March 2016 - October 2016 ~ 300 Patients
- Working on Data for D/C Dispo

Inspiration

- The same boiling water that softens the potato hardens the egg. It's about what you're made of, not the circumstances. ~Unknown
- What if I fall? Oh, but my darling, what if you fly? ~Unknown

Be The One...



Panel Discussion & Quiz

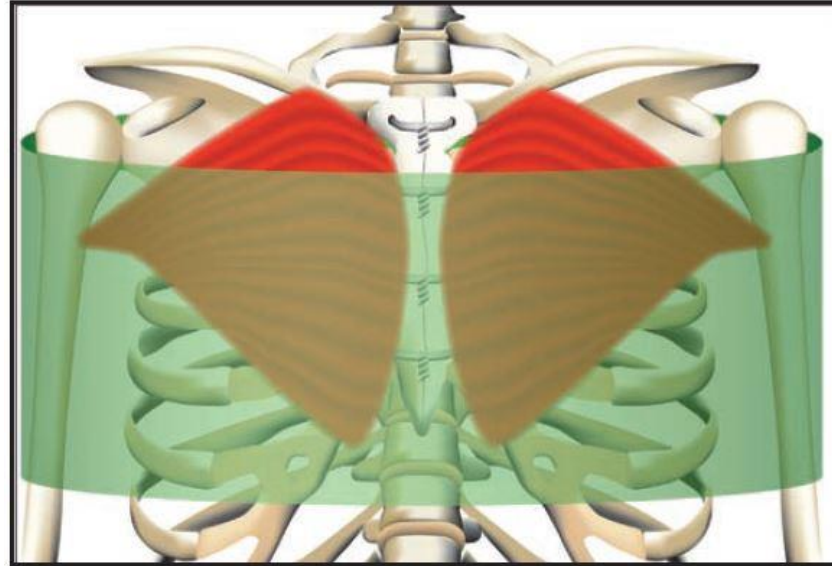


Figure 1. Illustration used to teach patients about their sternotomy, the attachments of the pectoralis major, and the imaginary truncal tube that is the basis of the *Keep Your Move in the Tube* approach.

