ACPRC (UK) Meeting 9th June 2021

Sternal Precautions and Physical Activity After Cardiac Surgery: What is the Evidence

A/P Doa El-Ansary

Director of Physiotherapy, Swinburne University of Technology, Melbourne

Senior Research Fellow, University of Melbourne, Melbourne

Senior Research Fellow, Clinical Research Institute, Westmead Private Hospital, Sydney

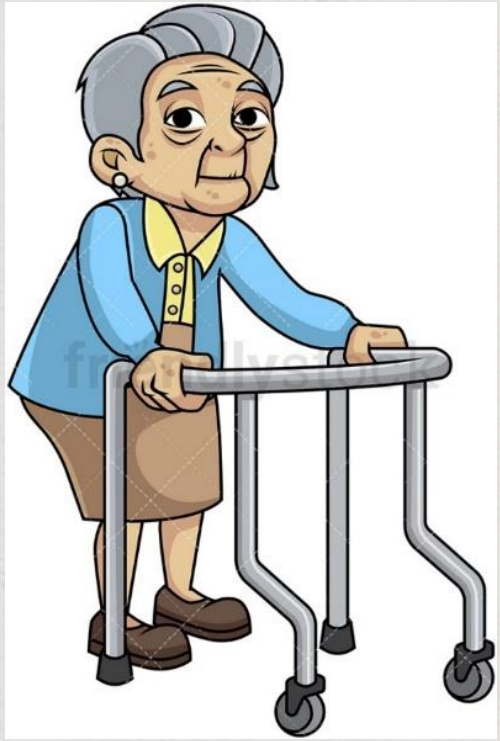
AUSTRALIA

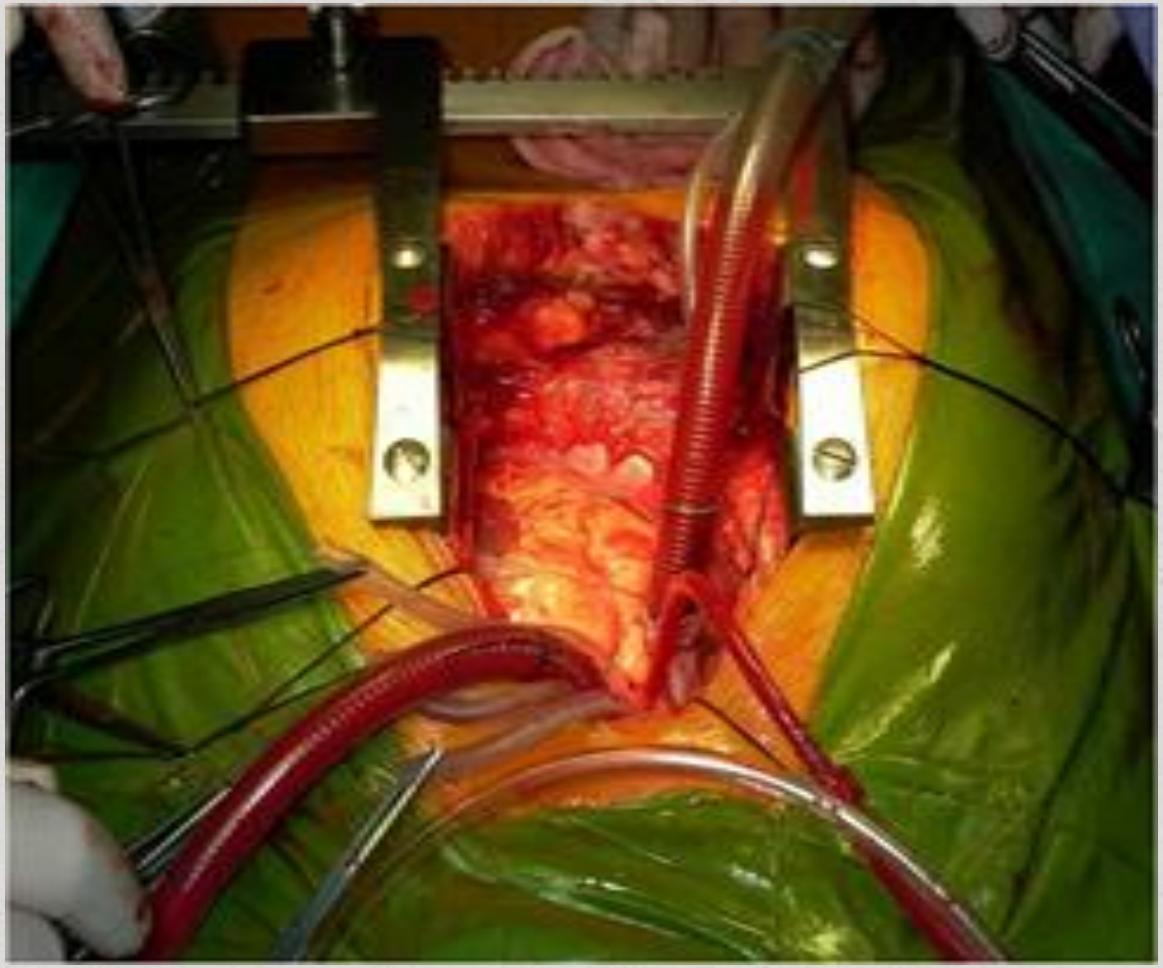
delansary@swin.edu.au

The new millennium…our Cardiac Surgery Population

- Median sternotomy- 2 million worldwide
- Sternal precautions are prescribed ROUTINELY with NO consistency
- Mean age 70 + comorbidities; 15% are Frail

(ANZCTS, 2020)

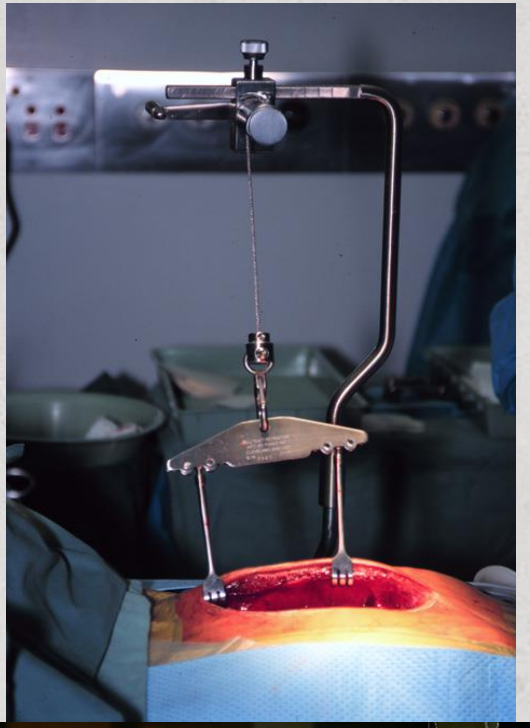


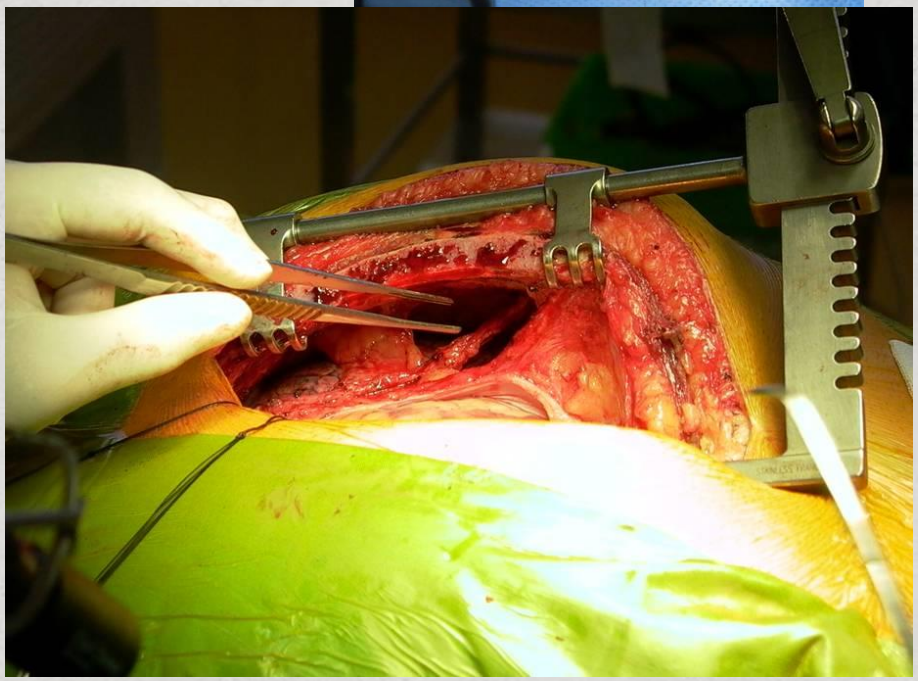



Hisense
Hisense
KIA
KIA

Musculoskeletal Complications of Cardiac Surgery

- Roy et al (1988)- 38% IMAG, 17% SVG
- Selvaratnam et al (1994) – unilateral shoulder and upper limb pain
- *Stiller et al (1997)- 30% of shoulder and back problems at 3/12*
- *association between IMA harvest and musculoskeletal complaints* ***(El-Ansary et al, 2000)***
- *IMA harvest - anterior chest wall complications in 38.5%* ***(El-Ansary et al, 2000)***
- Functional impairments 6-12 months post-operatively Post-sternotomy pain: 40% at 3 months (severe) (La Pier et al, 2008)





Sternal Instability

1- 8% worldwide

broken/loose wires

⇓

friction, pain/discomfort

⇓

abnormal motion and clicking

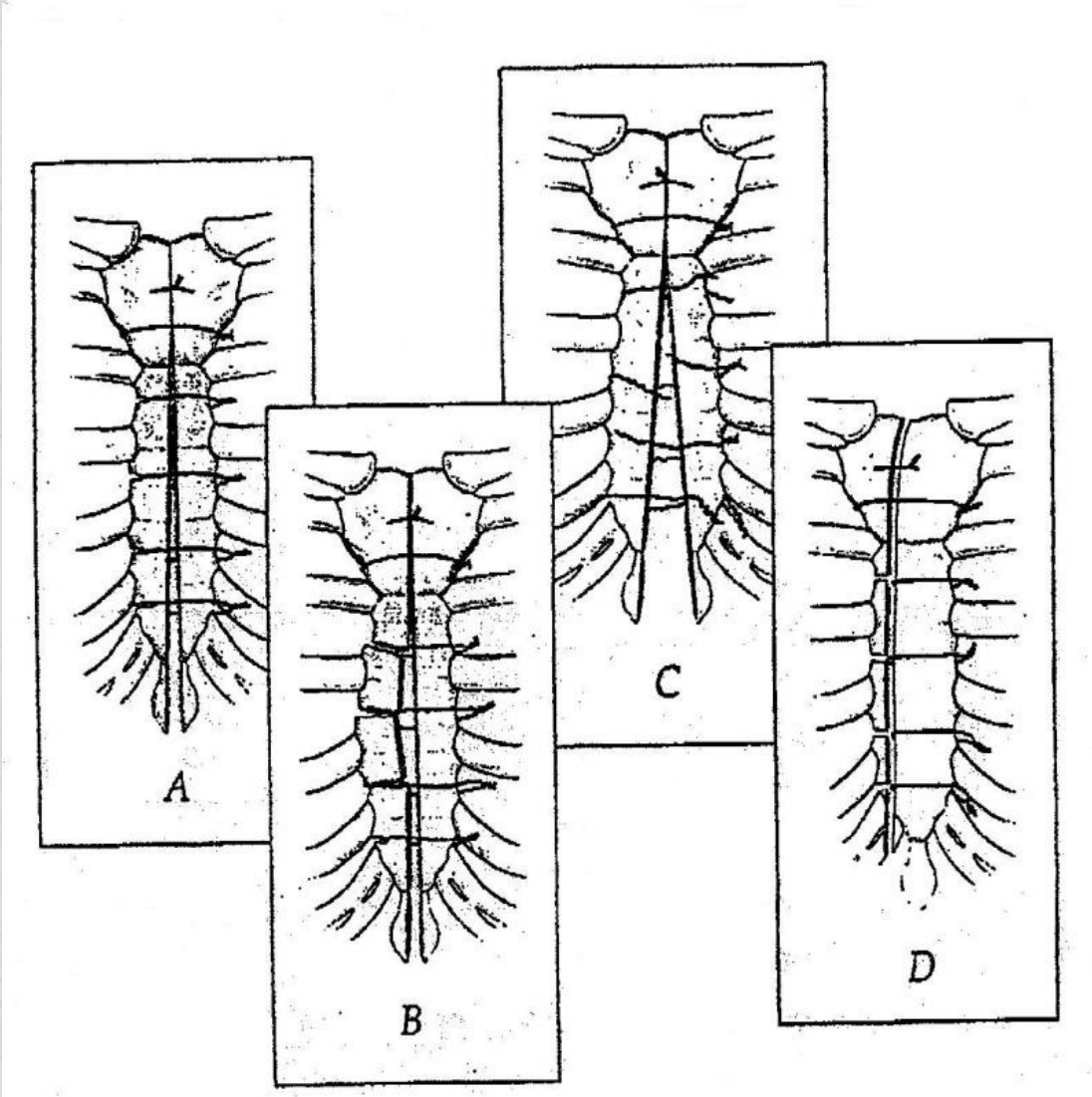
⇓

wire fracture

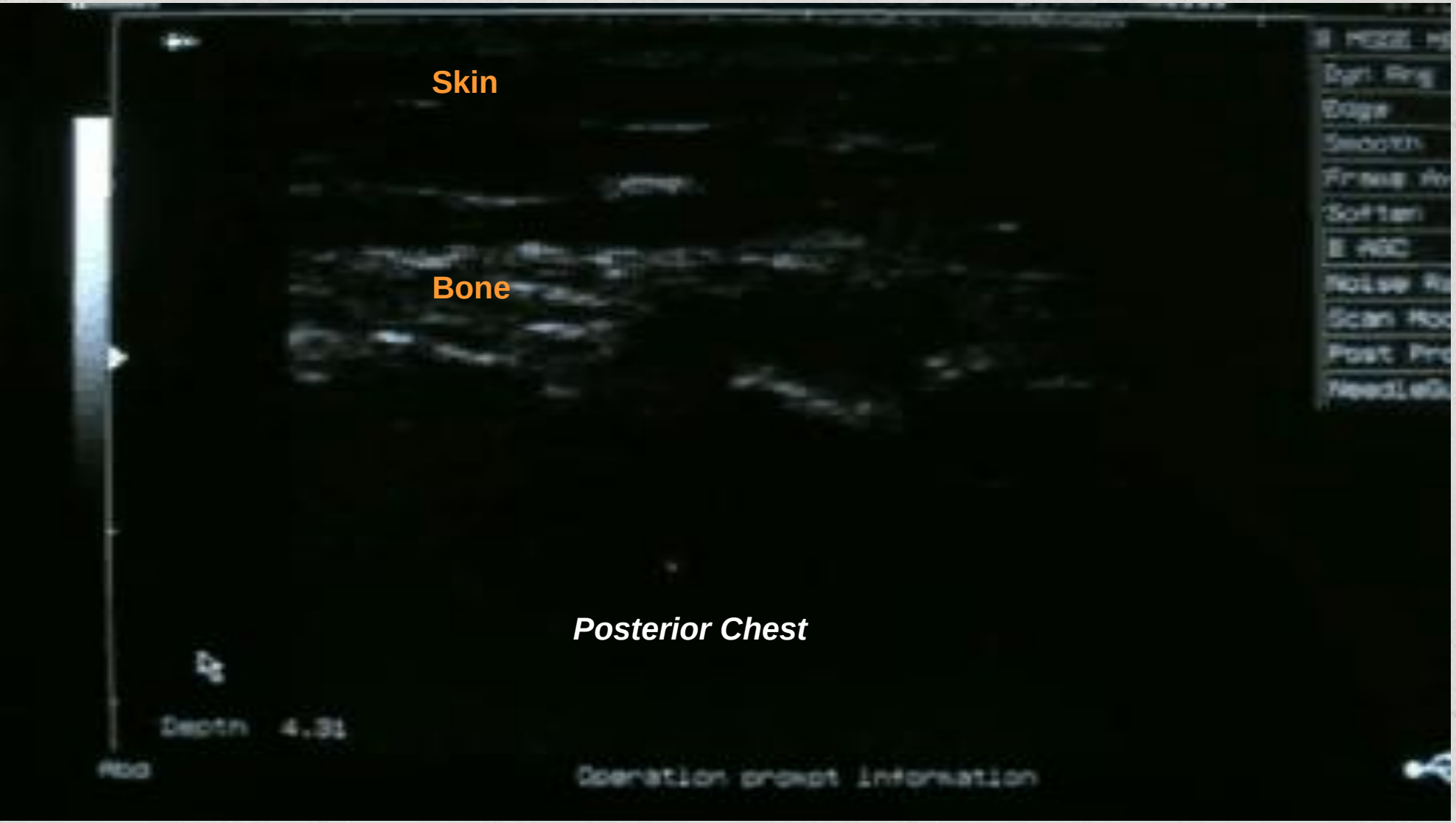
+/- skin breakdown and infection

⇓

Functional impairment, infection



Assessment and Diagnosis: Ultrasound



Ultrasound: **valid and reliable**

Sternal instability is 'dynamic'

El-Ansary et al, 2007; El-Ansary et al (2009)

Risk factors for Sternal Complications

Table 4. Risk Factors Associated with Sternal Wound Complications

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

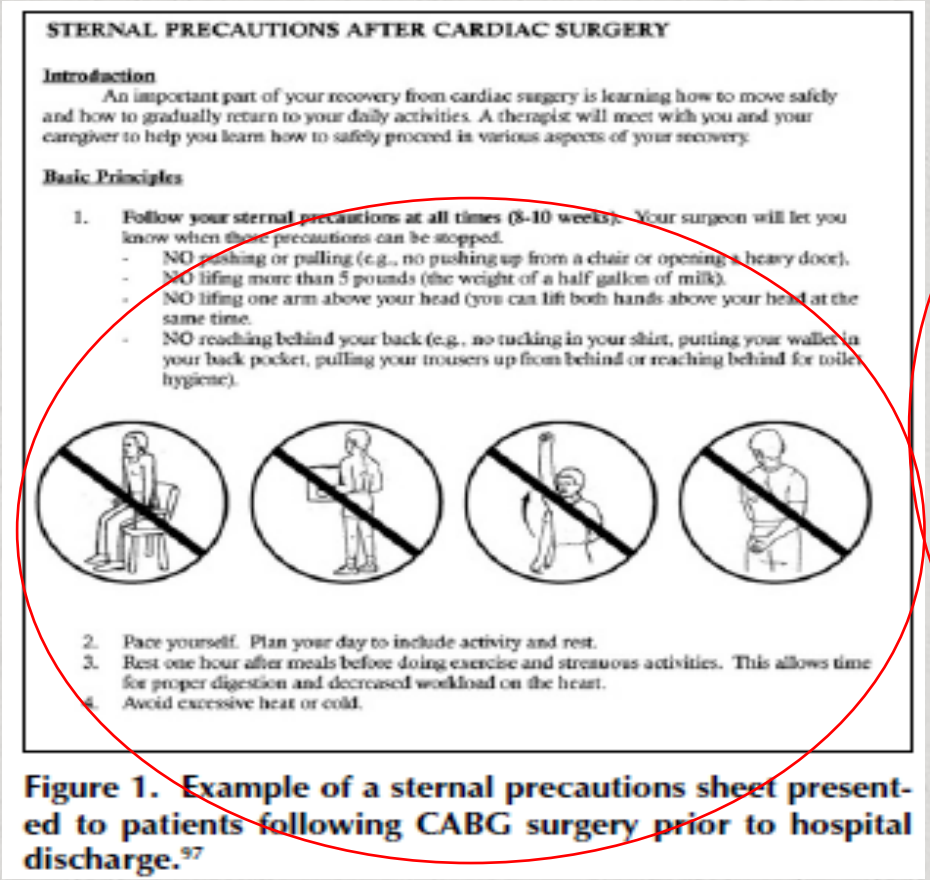
CCS = Canadian Cardiovascular Society Anginal Classification; NYHA = New York Heart Association Heart Failure Classification

Balachandran et al. *Ann Thorac Surg* 2016;102:2109-17.

Cahalin LP et al *Cardiopulm Phys Ther J* 2011;22:5-15

KNOW ING

Clinical Dilemma



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.

Figure 1. Example of a sternal precautions sheet presented to patients following CABG surgery prior to hospital discharge.[97]

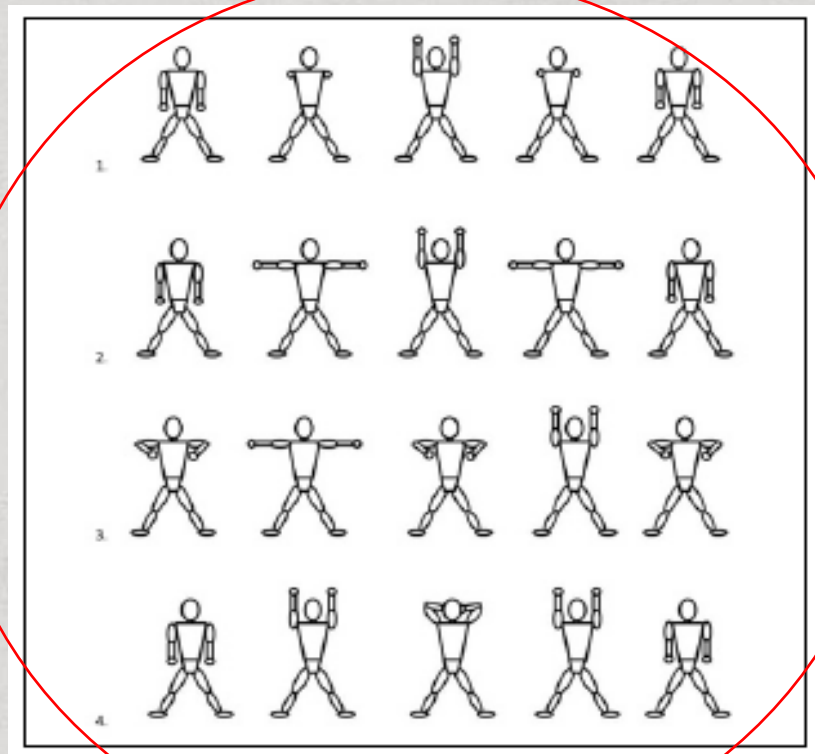


Figure 2. Inpatient CABG exercise regimen showing often contraindicated upper extremity movements. Redrawn from handout obtained from Mary Greeley Medical Center, Ames, Iowa; 2004.[22]

NO CONSISTENCY – definition, duration and type

(Cahalin et al, 2011; Tuyl etal,2012; Balachandran et al, 2014; El-Ansary et al, 2019)

Evidence: Sternal Precautions

- ***Rationale:***
  - minimize forces on sternum
  - Prevent sternal complications
- ***Evidence:***
  - anecdotal and cadaver studies

What do we know?

- Bilateral UL exercise better tolerated
- Force required to complete 32 ADL- majority >10lbs…contrary to restrictions set!
- Coughing is >40lbs of wt. lifting

Adams et al, 2006; El-Ansary et al, 2007a; El-Ansary et al, 2007b; McGregor et al, 1999; Cohen et al, 2002; Parker et al, 2008

How Much Does That Weigh?

Opening car door	5.6 kgs
Lifting a full coffee pot	2.9 kgs
Lifting copy machine lid	2.7 kgs
Lifting a purse	3.4 kgs
Pushing vacuum cleaner	3.4 kgs
Pulling vacuum cleaner	3.8 kgs
Pull open oven door	2.9 kgs
Closing microwave door	2.9 kgs
Cough	**18 kgs**
Opening fridge door	4 kgs

Adams et al, 2006

Sternal micromotion during upper limb tasks: Is it time for a change to sternal precautions following cardiac surgery via a median sternotomy?

Dr Sulakshana Balachandran, Dr Annemarie Lee, Prof Linda Denehy, Prof Alistair Royse. Prof Colin Royse, Dr Doa El-Ansary

- **Primary outcome:** US sternal micromotion during upper limb and functional tasks
- **Secondary aims:**

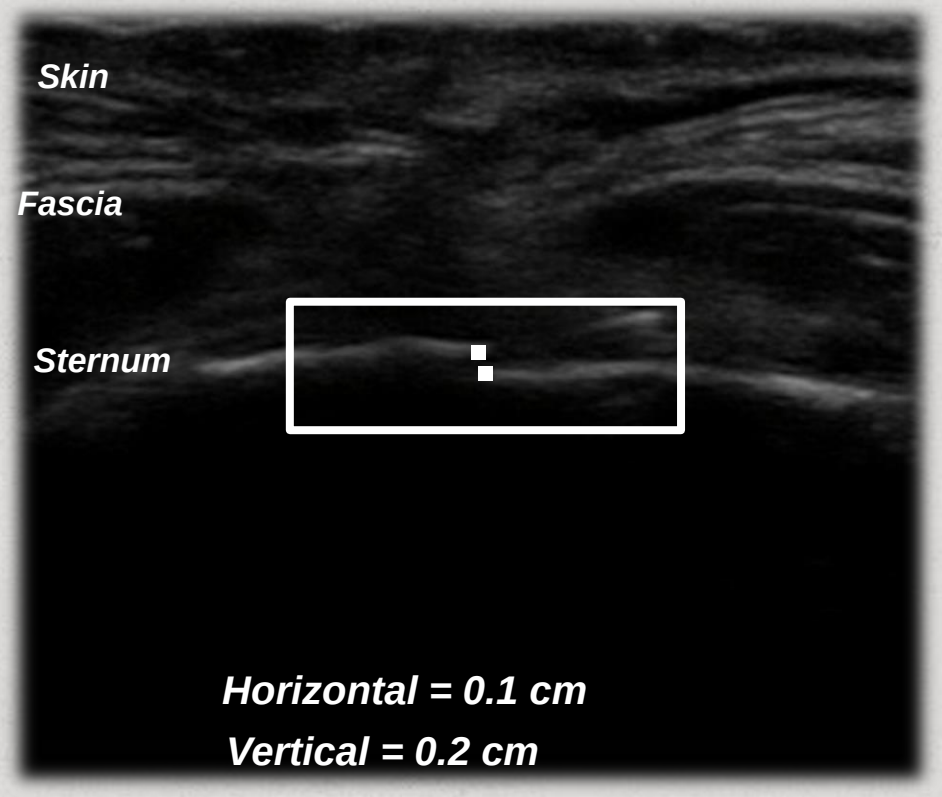
(1) sternal pain during functional tasks and

(2) post-operative function

- n = 75
- **Best research paper, APTA special chapters meeting, San Antonio, 2017**

Balachandran S; Lee AM; Denehy L; Royse A; Royse C and **El-Ansary D** (2019): Motion at the sternal edges during upper limb and trunk tasks in-vivo as measured by real-time ultrasound following cardiac surgery: A three-month prospective, observational study *Heart, Lung and Circulation*, Vol. 28, no. 8 (Aug 2019), pp. 1283-1291. https://doi.org/10.1016/j.hlc.2018.05.195

Sternal Assessment: Ultrasound



SEM= 0.05cm
MCID= 0.14cm

Intra-rater reliability ICC (3,1)	Inter-rater reliability ICC (2,1)
0.990 to 0.997	0.994 to 0.998

International Journal of Therapy and Rehabilitation 2017; 24(2): 62-70

KNOW ING

Ultrasound: demonstrates that *bilateral upper limb elevation motion < 2mm*

Conventional Wired Sternotomy

(Bilateral Upper Limb Elevation)

Ultrasound: deep inspiration (L) and coughing (R) *most motion*

Conventional Wired Sternotomy

(Deep Inspiration)

(Cough)

Evidence: Trunk and Upper Limb Exercise

- UL elevation, sit to stand:
  no increase in pain and
  sternal micromotion <2mm
  (Balachandran et al, 2018)

- Cough: high velocity shear
  (Balachandran et al, 2018)

- Trunk and UL ex. less sternal pain 4/52
  (Hoggins et al, 2014)

Katijjahbe et al, 2018

Journal of Physiotherapy 64 (2018) 97–106

Journal of PHYSIOTHERAPY

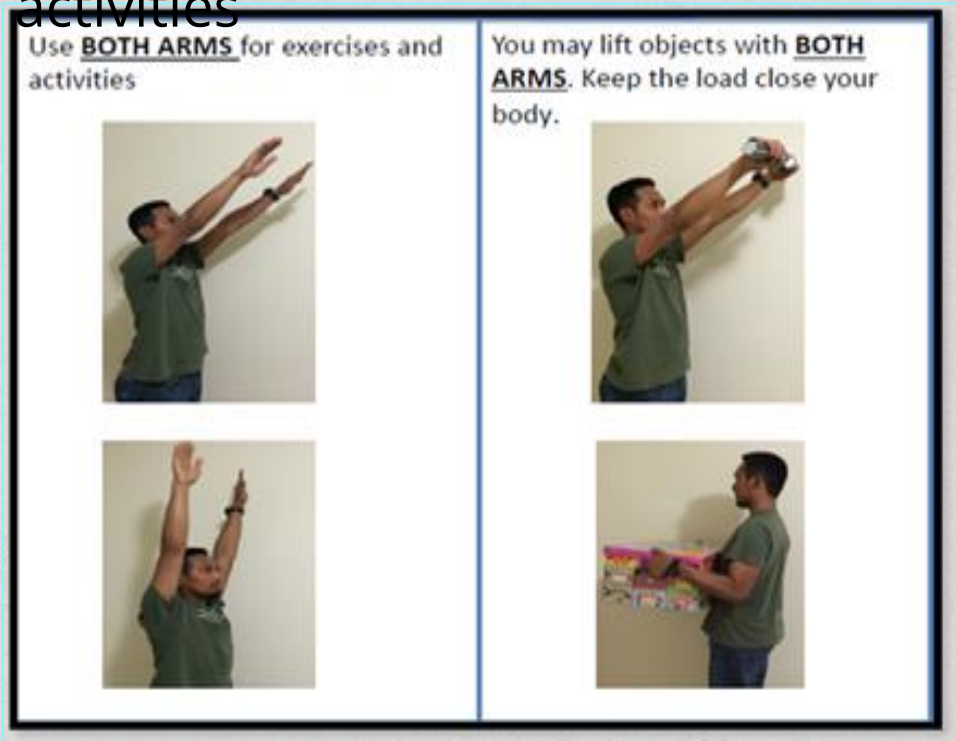
journal homepage: www.elsevier.com/locate/jphys

Research

Standard restrictive sternal precautions and modified sternal precautions had similar effects in people after cardiac surgery via median sternotomy ('SMART' Trial): a randomised trial

Standard care: restricted use of the UL for all daily activities

Intervention: bilateral use of UL with pain and discomfort as a guide for safety for all daily activities



Sternal Assessment: Sternal Instability Scale (SIS)

0 = Clinically stable sternum (no detectable motion) - normal

1 = Minimally separated sternum (slight increase in motion)

2 = Partially separated sternum - regional
(moderate increase in movement)

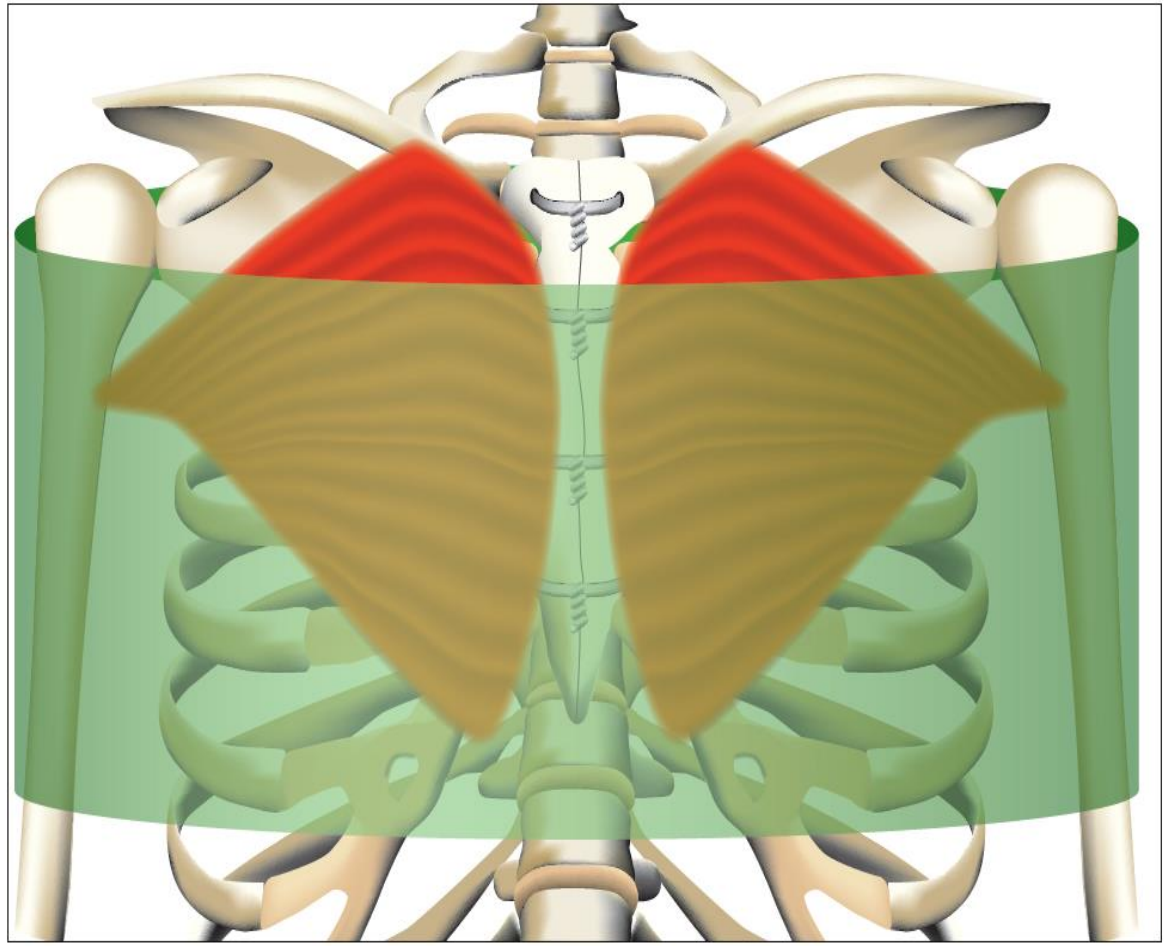
3 = Completely separated sternum - entire length
(marked increase in motion)

Inter-rater reliability – ICC = 0.98; % exact agreement = 99%
Intra-rater reliability- ICC= 0.92-0.99

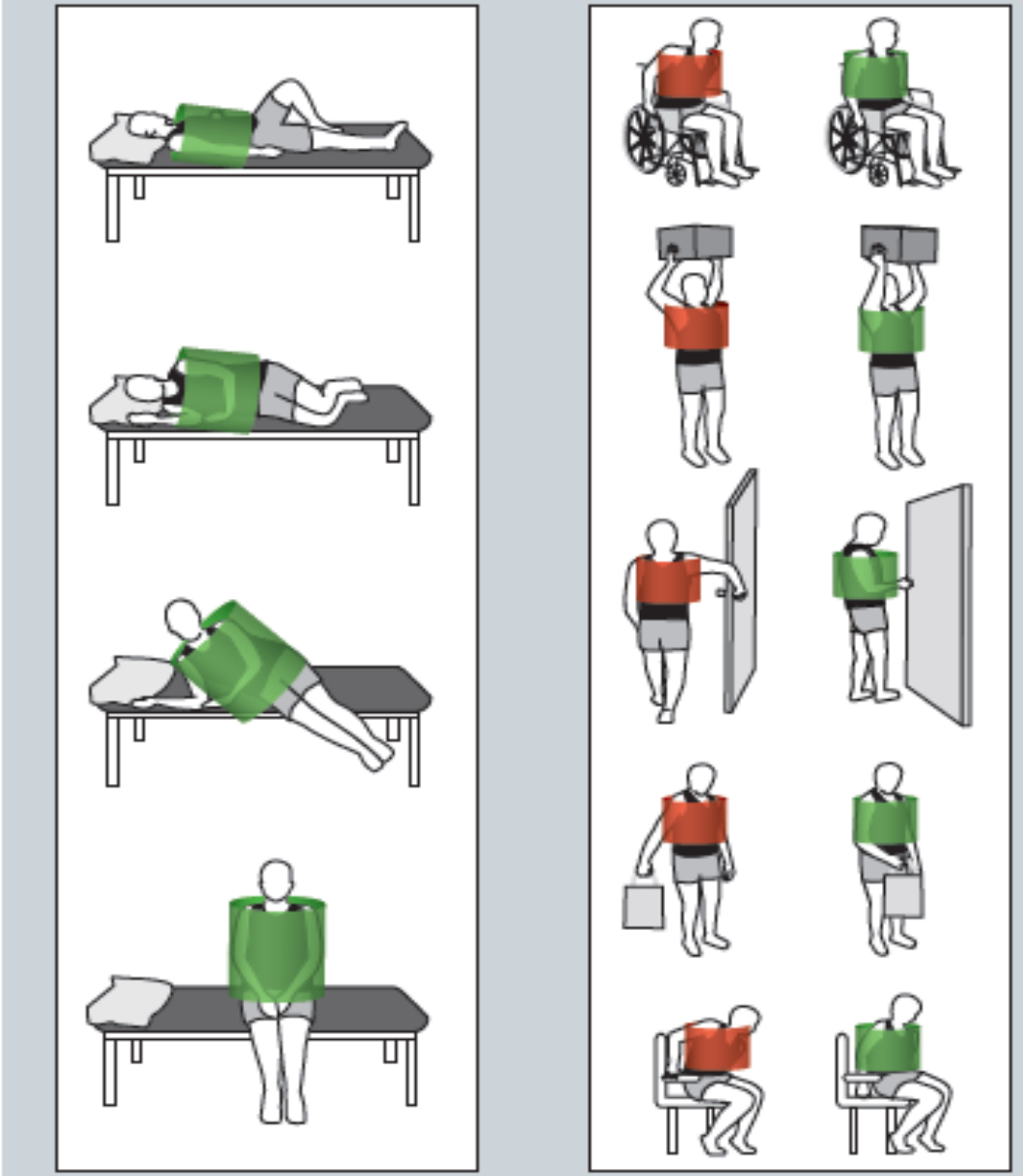
(El-Ansary et al, 2007a; 2009; El-Ansary et al, IntJThR 2018)

KNOW ING

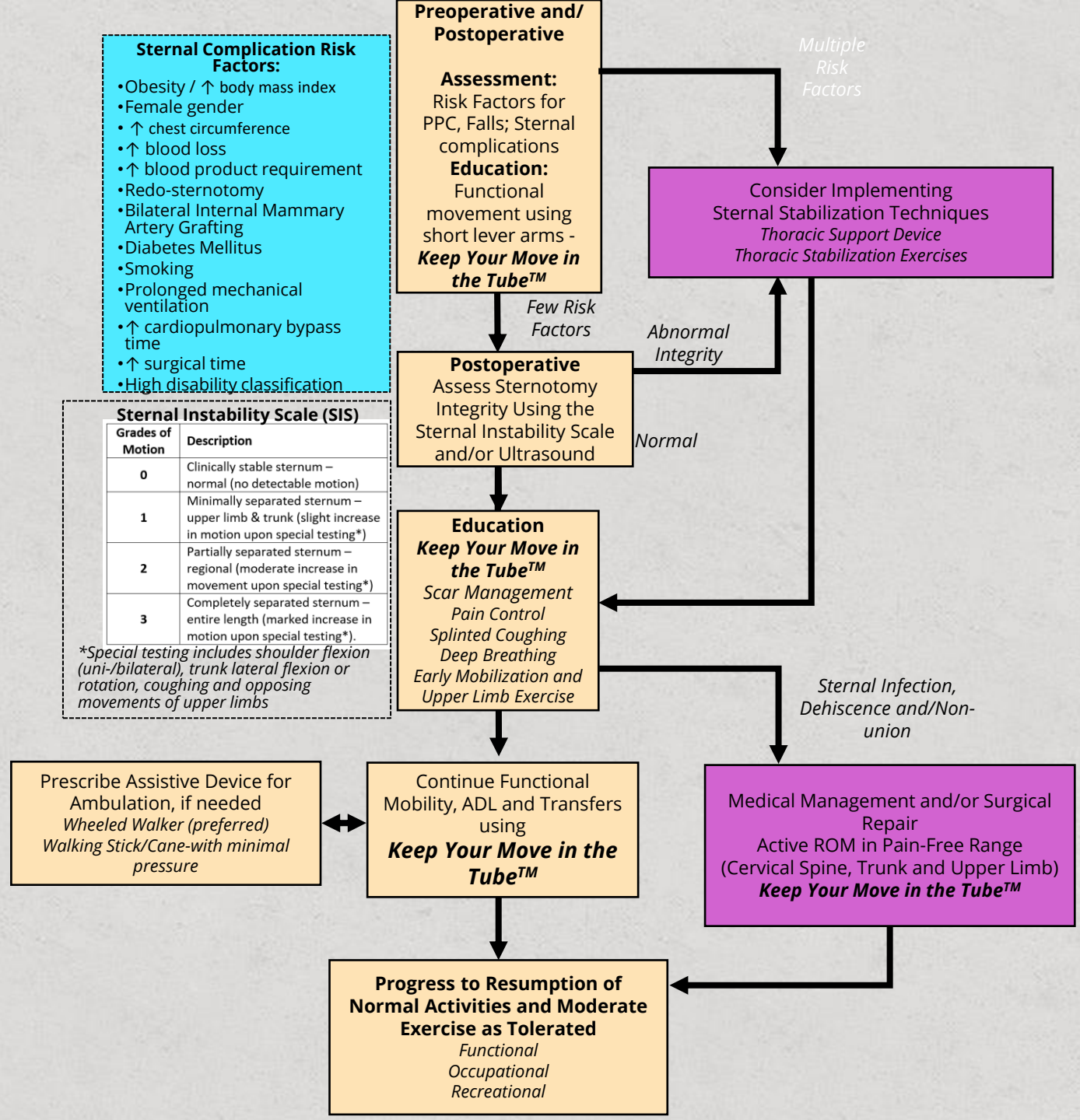
A new **Paradigm** to promote active participation in physical activity and exercise



Keep Your Move in the Tube®



Summary



El-Ansary et al, 2019
Physical Therapy

NEW COURSE FOR NURSES AND PHYSIOTHERAPISTS

Lung and Sternal Ultrasound Course

Innovative and introductory course for nurses and physiotherapists to learn how to perform bedside lung and sternal ultrasound in clinical practice

How to apply

go.unimelb.edu.au/bx4r

mobile-learning@unimelb.edu.au

delansary@swin.edu.au