Keep Your Move in the Tube™

Breaking Down the Restricted Walls of Movement

Presented by:

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Disclosures

None
Discuss the median sternotomy approach used in open heart surgery and the history behind sternal precautions

Discuss the current sternal precautions, the challenges and the evidence

Introduce and understand a new approach to movement post-sternotomy - "Keep your Move in the Tube"

Our journey for change!
Median Sternotomy

Cardiac surgery via median sternotomy is pervasive

Sternal precautions

Intended to help protect patients from wound complications
- Incidence between 1-8%
Median Sternotomy and Physiotherapy

Role of Physiotherapy

- pulmonary and physical rehabilitation following sternal precautions to enable safe discharge from hospital

Goal

- return to baseline function
- return to daily activities
Sternal Precautions – A Historical Perspective

1964
CABG introduced as adjunct treatment to medical treatment of coronary artery disease

Unique group of patients in cardiac rehab
Patients now candidates for more aggressive rehab given newly improved coronary blood flow

Surgical site infection
Mortality by 14-50% when infected
What are Sternal Precautions?

Guidelines implemented following procedures involving median sternotomy

Focus on restricting loads for varying time periods

ARTICLES

Physical Therapy Management for Adult Patients Undergoing Cardiac Surgery: A Canadian Practice Survey

Tom J. Overend, Cathy M. Anderson, Jennifer Jackson, S. Deborah Lucy, Monique Prendergast, Susanne Sinclair
Goal of Sternal Precautions?

PREVENT wound complications which result in:

- Instability
- Non-union
- Infection

- Morbidity/mortality, healthcare costs
- Quality of life
- Prolonged or repeated hospitalization
Wound Complications

Table 4. Risk Factors Associated with Sternal Wound Complications

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

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

Dehiscence

Do you see MOBILITY?

Sternal Wound Vac Dressing
No direct evidence linking activity level or arm movement to increased risk of sternal complications

Cahalin et al. (2011)
Sternal Precautions Practiced at Foothills Medical Center in Calgary

Don’t lift, push, or pull more than 5 lbs for 6-8 weeks after surgery

Don’t do anything that could strain the sternum

With surgeon approval, resume usual activities after 3 months
Protective? Or RESTRICTIVE?

May **impede** recovery

Hinders optimal sternal healing due to insufficient stress on the chest wall

Leads to substantial muscle atrophy that occurs with disuse

Impaired pulmonary/chest wall function
What Else Is Wrong With These Sternal Precautions?

- Reinforces patient’s fear of activity and injury
- Decreases quality of life
- Can delay/prevent return to work
- May be unable to return home

- Delaying discharge
- Increasing burden on secondary facilities
- $$$
Precautions after hip replacement can cause:
- Loss of conditioning and joint ROM
- Delay return to normal activity
- Fall risk
- Nursing care difficulty

Although theoretically sound, there is limited evidence to support this practice.

Rate of dislocation after anterolateral THA is low and **NOT** improved by hip precautions.
Is There Evidence for Sternal Precautions?
Where Did a Weight Restriction of 5 lbs Come From??

What is the weight of a single arm?

What about a cough?

What about a sneeze?
The Impact of Coughing on the Sternum

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

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Comparison of forces exerted on a median sternotomy during a cough and 5 weighted activities

Measured internal pressure, internal force on sternotomy and total force on sternotomy
<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cough</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measured internal pressure (cmH$_2$O)</td>
<td>61.0 – 97.3</td>
<td>74.8</td>
<td>12.1</td>
</tr>
<tr>
<td>Internal calculated force on sternotomy (kg-mass)</td>
<td>22.4 – 35.8</td>
<td>27.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Total force on sternotomy (kg-mass)</td>
<td><strong>22.4 – 35.8</strong></td>
<td>27.5</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>5-lb weight</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measured internal pressure (cmH$_2$O)</td>
<td>2.3 – 20.7</td>
<td>7.4</td>
<td>5.8</td>
</tr>
<tr>
<td>Internal calculated force on sternotomy (kg-mass)</td>
<td>0.9 – 7.6</td>
<td>2.7</td>
<td>2.1</td>
</tr>
<tr>
<td>External force on sternotomy (kg-mass)</td>
<td>2.3 – 2.3</td>
<td>2.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Total force on sternotomy (kg-mass)</td>
<td><strong>3.2 – 9.9</strong></td>
<td>5.0</td>
<td>2.1</td>
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<tr>
<td><strong>30-lb suitcase</strong></td>
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<tr>
<td>Measured internal pressure (cmH$_2$O)</td>
<td>10.3 – 27.3</td>
<td>17.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Internal calculated force on sternotomy (kg-mass)</td>
<td>3.8 – 10.0</td>
<td>6.3</td>
<td>2.5</td>
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<tr>
<td>External force on sternotomy (kg-mass)</td>
<td>13.6 – 13.6</td>
<td>13.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Total force on sternotomy (kg-mass)</td>
<td><strong>17.4 – 23.6</strong></td>
<td>19.9</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>2 × 20-lb weights</strong></td>
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<tr>
<td>Measured internal pressure (cmH$_2$O)</td>
<td>8.0 – 28.3</td>
<td>13.8</td>
<td>6.3</td>
</tr>
<tr>
<td>Internal calculated force on sternotomy (kg-mass)</td>
<td>2.9 – 10.4</td>
<td>5.1</td>
<td>2.3</td>
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<tr>
<td>External force on sternotomy (kg-mass)</td>
<td>18.2 – 18.2</td>
<td>18.2</td>
<td>0.0</td>
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<tr>
<td>Total force on sternotomy (kg-mass)</td>
<td><strong>21.1 – 28.6</strong></td>
<td>23.3</td>
<td>2.3</td>
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<tr>
<td><strong>25-lb grandchild</strong></td>
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<tr>
<td>Measured internal pressure (cmH$_2$O)</td>
<td>8.7 – 24.7</td>
<td>16.1</td>
<td>5.9</td>
</tr>
<tr>
<td>Internal calculated force on sternotomy (kg-mass)</td>
<td>3.2 – 9.1</td>
<td>5.9</td>
<td>2.2</td>
</tr>
<tr>
<td>External force on sternotomy (kg-mass)</td>
<td>11.6 – 11.6</td>
<td>11.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Total force on sternotomy (kg-mass)</td>
<td><strong>14.8 – 20.7</strong></td>
<td>17.5</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Milk to counter</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Measured internal pressure (cmH$_2$O)</td>
<td>7.0 – 34.3</td>
<td>16.4</td>
<td>8.9</td>
</tr>
<tr>
<td>Internal calculated force on sternotomy (kg-mass)</td>
<td>2.6 – 12.6</td>
<td>6.0</td>
<td>3.3</td>
</tr>
<tr>
<td>External force on sternotomy (kg-mass)</td>
<td>4.1 – 4.1</td>
<td>4.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Total force on sternotomy (kg-mass)</td>
<td><strong>6.7 – 16.7</strong></td>
<td>10.1</td>
<td>3.2</td>
</tr>
</tbody>
</table>

1 kg-mass = 9.8 N; 1 cmH$_2$O = 9.8 × 10$^{-2}$ kPa. * Each of the 9 study subjects performed each activity 3 times. The internal pressure measurements were taken with an Ashcroft Inc. expiratory pressure gauge (model N10-120CMW). SD = standard deviation.
Coughing exerted the largest mean total force on the sternotomy at 60lbs.

The Impact of a Sneeze on the Sternum

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

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Evaluated the forces exerted on the sternum during bench press resistance exercise and sneezing
The Impact of a Sneeze on the Sternum

No statistically significant difference between the mean force from a sneeze and the mean total force exerted during moderate intensity bench press exercise.

Both equate to 90 lbs force on the sternum.

So it’s ok to lift 60-90 lbs?
So Why Are We Still doing This???

A CASE FOR CHANGE!

Sternal precautions are intended to protect the patient but may in fact be impeding patient recovery

No evidence for load and time based movement restrictions

Is there a better way of moving post-sternotomy?
Our Journey At FMC

20 bed unit
9 cardiac surgeons
6-8 cases /day
10+ years traditional sternal precautions
Summer 2017 – something better?

• Patients with increased co-morbidities
• High patient volume without good flow through system
**Sternal Precautions Algorithm**

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

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**High Risk**
- 2-4 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. & rol. with supine → sit
  - No UE use with sit → stand
  - Apply sternal counter pressure (splinting) with coughing & Valsalva
  - No driving

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**Moderate Risk**
- 2 weeks
- Conservative 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. & rol. with supine → sit
  - UE use with sit → stand keeping shoulders in neutral position
  - Apply sternal counter pressure (splinting) with coughing & Valsalva
  - No driving in first 2 weeks

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**Low Risk**
- 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 trunkflex. & rol. resistance exercise
  - UE use with sit → stand as needed
  - Apply sternal counter pressure (splinting) with coughing & Valsalva
  - Resume driving

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**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

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**Progression of Activity Resumption**
- Lift, pushing, & pulling by 10-20 lbs every 1-2 weeks
- Reinroduce ADLs, IADLs, occupational, & recreational tasks
Introducing…

Keep Your Move in The Tube™
Introducing…

Keep Your Move in The Tube™

First described in Jan 2016 from Baylor Health in Texas

• Implemented in 4 centers including Memorial Healthcare System (Hollywood, Florida)
Keep your Move in the Tube™

Shift in thinking from load and time restrictions to standard kinesiology principles

Focuses on lever arm reduction enabling patients to perform previously contraindicated movements
As long as patients stay “in the tube”, they can resume normal load-bearing activities at their own pace.
How Long Do Patients Stay In The Tube?

- No specific time requirement
- Pain is their guide
- Other factors play a role
  - Motivation
  - Pre-op mobility
  - Cultural influences
So what are the *Anticipated Benefits*?

**Increased**
- Quality of life
- Independence
- Mobility

**Decreased**
- Time to cardiac rehab
- Time to return to work
- Depression
- Pain
- $$$
What Do We Know about it’s Implementation So Far?

Fully implemented at Baylor & Memorial Hospitals, US:

• 3000 patients over 2 year period that have gone through both inpatient care and cardiac rehab
• Described drastic improvements in discharge home, functional status and cost savings

9 other facilities in US, 1 in Malaysia and 2 in New Zealand are currently considering adopting
2 centre, RCT

72 adults who underwent cardiac surgery via median sternotomy

Control group: received usual restrictive precautions

Experimental group: received advice to use pain and discomfort as safe limits for upper limb use
Outcome measures

- **Primary outcome**: physical function via Short Physical Performance Battery

- **Secondary outcomes**: upper limb function, pain kinesophobia and health-related Q of L
This trial highlighted that modifying sternal precautions did not cause any harm or adverse events.

Katijjahbe et al (2018)
Our Journey at FMC Continued…

- First contact
- Permission
- Getting Section Chief on board
- Invitation
- Educational sessions
- Coming up with roll out plan…now a study!
In Summary…

Median sternotomy is a universally accepted surgical approach in cardiac surgery.

Sternal precautions to prevent wound complication

- imposed on patients without a foundation in science, anecdotal evidence only

Restrictive more than protective

Shift in thinking from time and load based precautions

Keep your Move in the Tube – pain is your guide!

Stay tuned for study results at FMC
References

• Images sourced from www.googleimages.com
Questions?