

PT Cardiopulmonary Educators

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Cardiopulmonary Interventions

By

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Objectives

- Discuss variety of interventions for patients with cardiopulmonary issues
- Discuss indications and contraindications to interventions
- Discuss the evidence behind the interventions
- Apply interventions to cases

Cardiopulmonary Interventions in the “Acutely ILL Patient

Pulmonary Problem List

- Decreased oxygenation
- Decreased ventilation
- Decreased airway clearance
- Increased amount of secretions
- Increased retention of secretions
- Poor mobility

Pulmonary Problem List

- Decreased thoracic mobility
- Decreased lateral costal expansion
- Decreased diaphragmatic excursion
- Decreased diaphragmatic mobility
- Increased risk for pulmonary dysfunction
- Infection/inflammation

Cardiopulmonary Interventions

- Interventions for decreased oxygenation;
goal to improve oxygenation
 - O₂
 - Positioning
 - Breathing exercises
 - Mobilization of secretions



Interventions



FiO2 achieved with O2 devices

Device	Flow rate	FiO2
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Nasal cannula

1 L/min	24%
2 L/min	28%
3 L/min	32%
4 L/min	36%
5 L/min	40%
6 L/min	44%



FiO2 achieved with O2 devices

Device	Flow rate	FiO2
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Simple mask

5-6 L/min	35%
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6-7 L/min	45%
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7-10 L/min	55%
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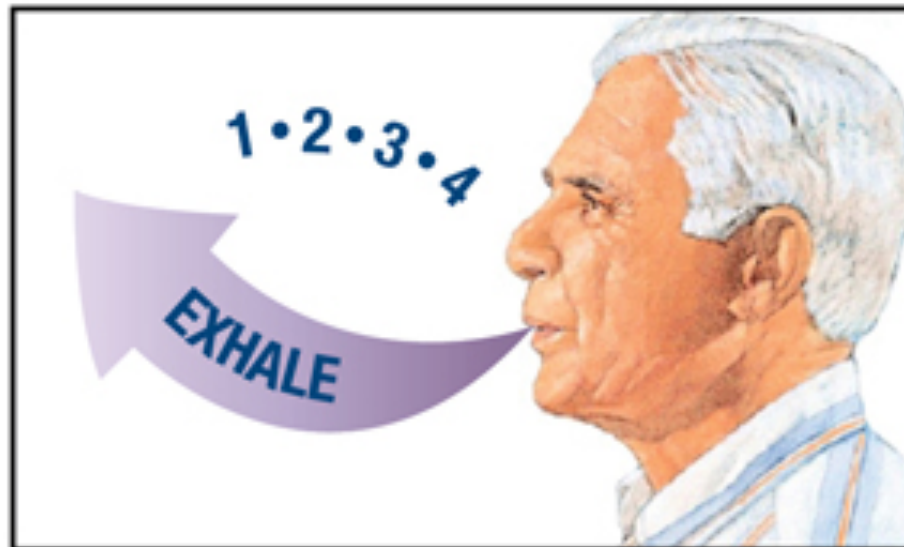
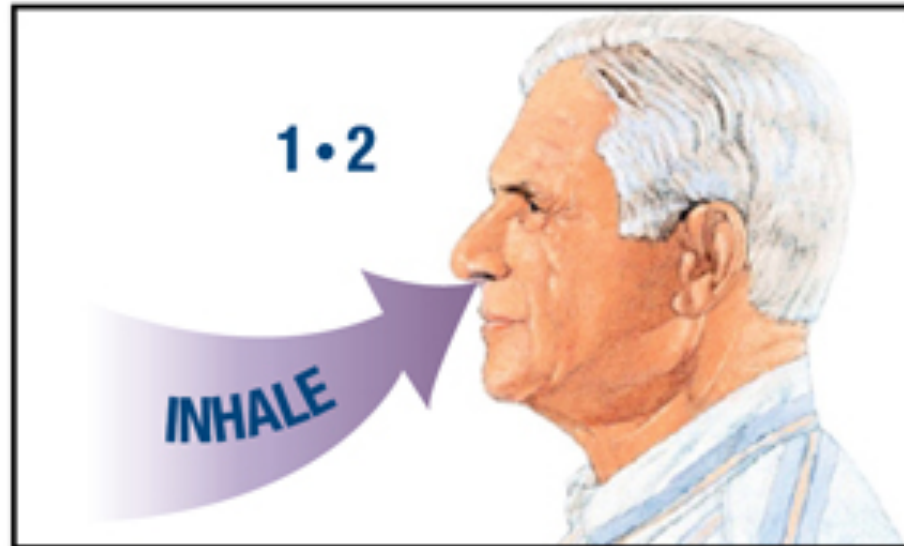
Figure out PaO2 multiply % x 500 (30% = .3 x 500)



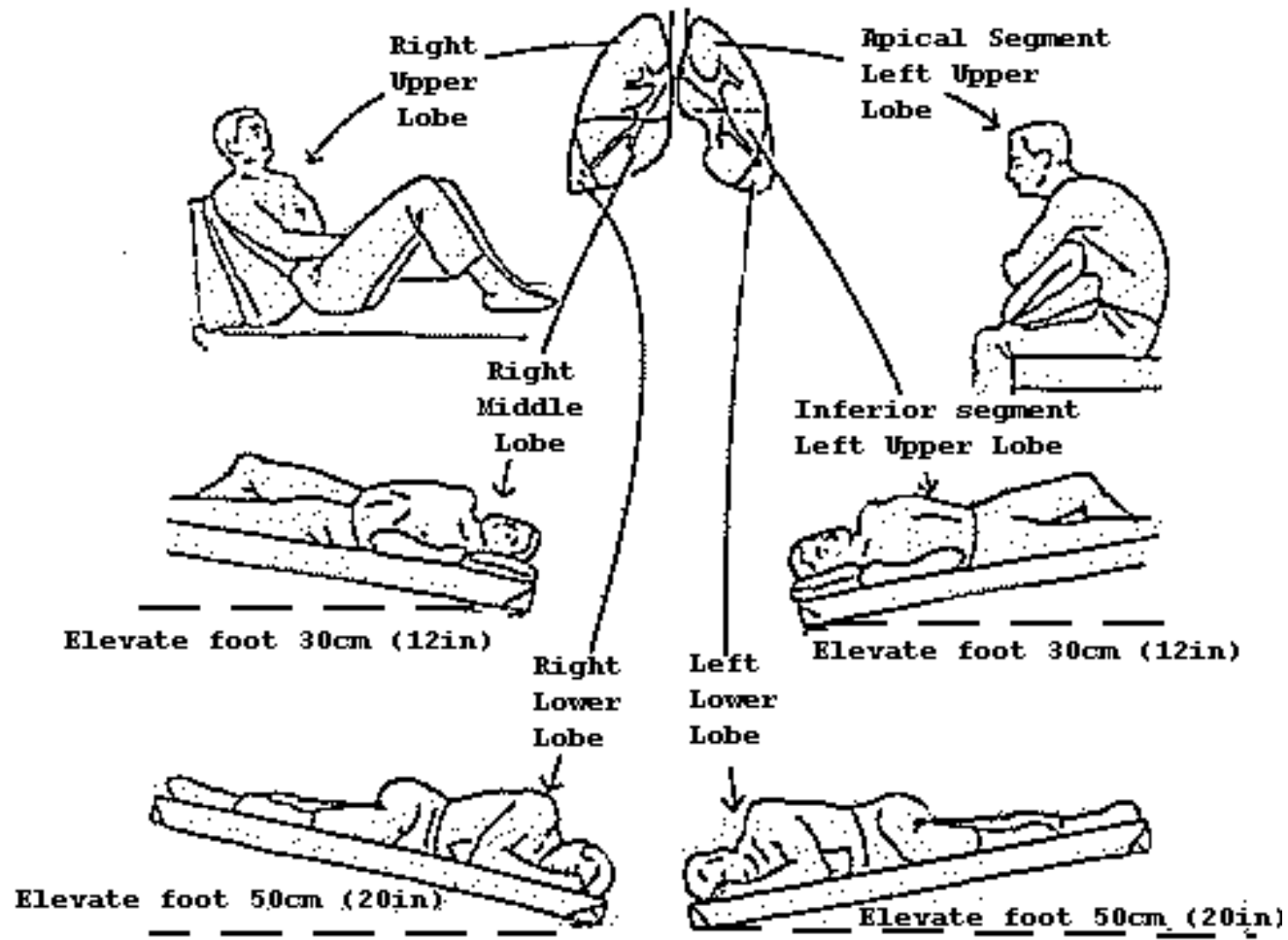
Incentive Spirometry



Breathing Exercises for COPD



Positioning



Airway Clearance: The Vest



Smaller, lighter with expanded features

Vest sizes fit small children to large adults



Cardiopulmonary Interventions

Problem: Decreased ventilation (Increased pCO₂)

Treatment interventions:

- Mobilization of secretions
- Positioning
- Breathing exercises

Airway Clearance: The Vest

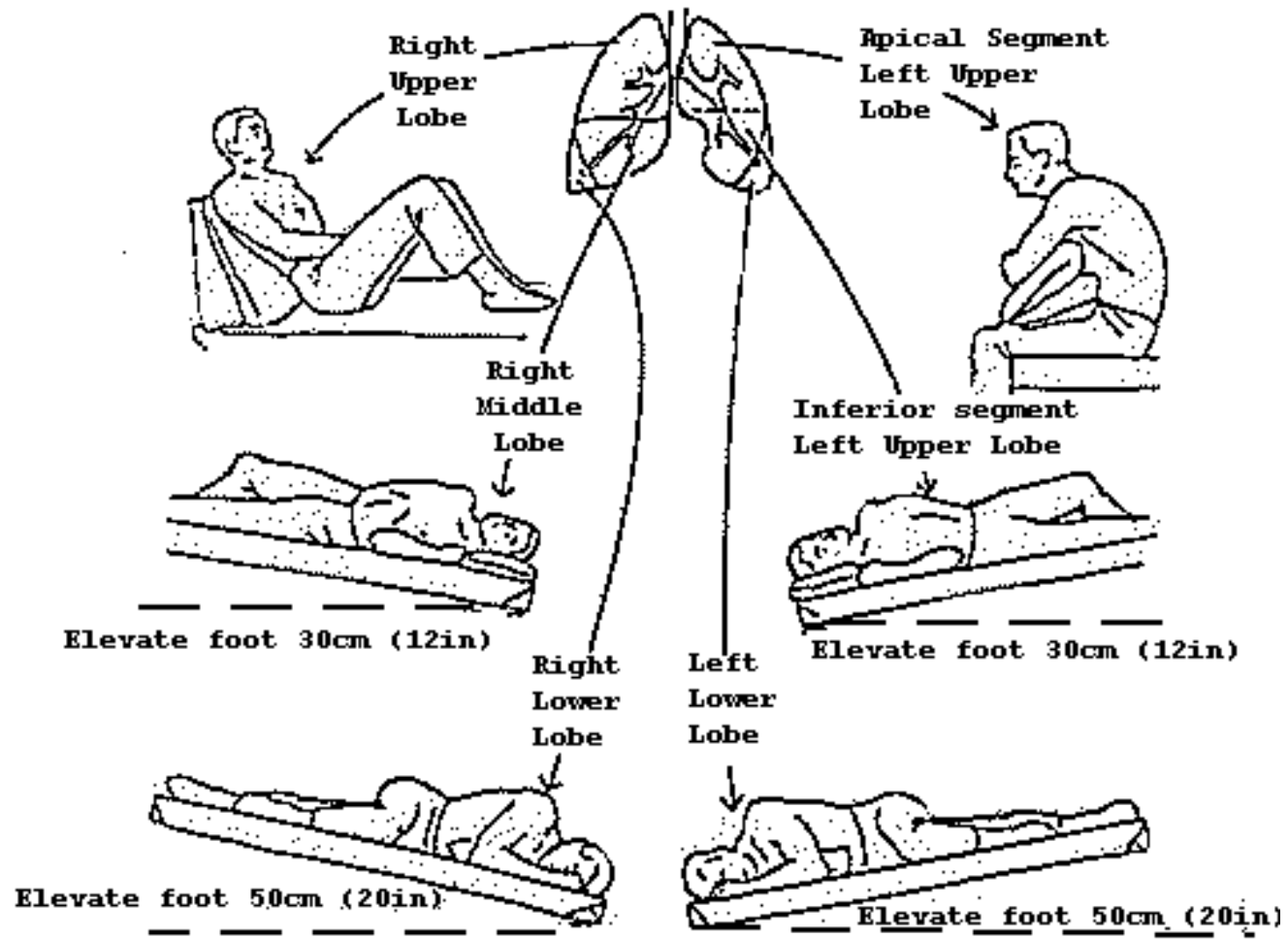


Smaller, lighter with expanded features

Vest sizes fit small children to large adults



Positioning



Prone Positioning

- Increases dorsal lung ventilation
- Opens areas to increased perfusion
- Do it EARLY in treatment



Gattinoni L Am J
Resp Crit care med
2013

Interventions

- Problem: Decreased airway clearance
- Assess:
 - Cough, abdominal strength, pain, position
- Interventions:
 - Abdominal support
 - Abdominal strengthening
 - Positioning
 - Cough instruction

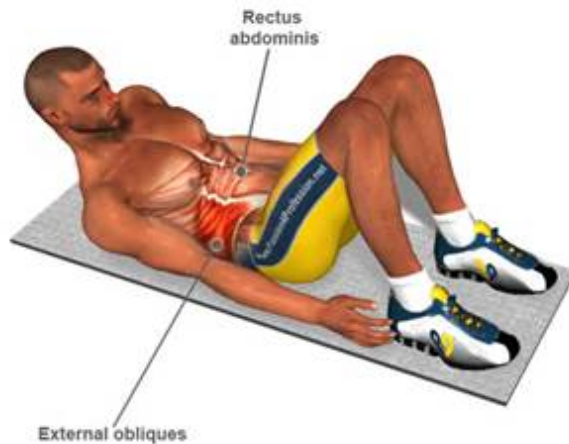
Abdominal support



Abdominal Strengthening



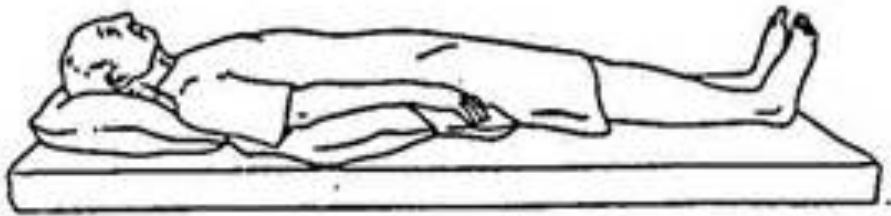
Abdominal Strengthening in post hospitalization patient



Cough Instruction

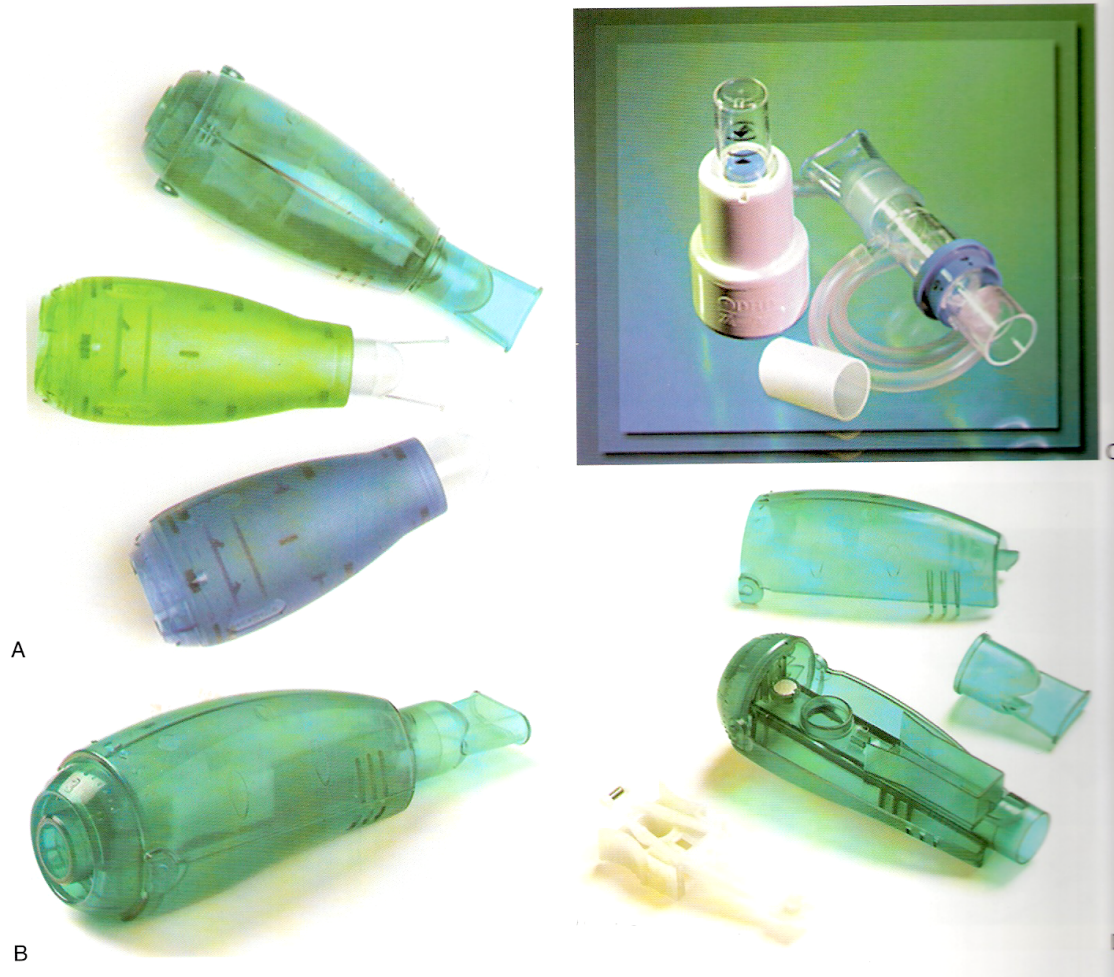


Which is a better position for coughing?



Airway Clearance Devices

6



Threshold PEP



Courtesy of Respironics

Cough Assist



FIGURE 22-16 Cough Assist Machine.

Quit sleeping on the webinar



At home after work

Questions

- Your patient has just had abdominal aortic aneurysm surgery with an incision (not a minimally invasive surgery). The patient has a history of COPD and frequent bouts of pneumonia and has not been moving out of bed since surgery. On auscultation you hear rhonchi and patient demonstrates a poor cough. What would be the optimal interventions for this patient?
 - A. Prone positioning, pursed lip breathing and abdominal support
 - B. Incentive spirometry, coughing/huffing instruction with splinting and practice, mobility
 - C. Attempt mobilization of secretions with pursed lip breathing and coughing, and if not successful use prone positioning
 - D. The vast airway clearance and pursed lip breathing

Interventions

- Problem: Retained secretions
- Interventions include
 - Postural drainage
 - Percussion/vibration
 - Mobility
 - Breathing exercises
 - Cough
 - Humidity/medications

Percussion/Vibration Techniques



Interventions

- Problem: Weak accessory respiratory muscles
- Interventions
 - Breathing exercises – incentive spirometry
 - Inspiratory Muscle Training

Inspiratory Muscle Training (IMT)



Inspiratory Muscle Training - Pflex



Incentive Spirometry

Can use incentive spirometer as an inspiratory muscle trainer



IMT evidence

- Van Adrichem EJ, Meulenbroek RL, Plukker JT, Groen H, van Weert E Comparison of two preoperative inspiratory muscle training programs to prevent pulmonary complications in patients undergoing esophagectomy: a randomized controlled pilot study. *Ann Surg Oncol* 2014 21(7):L 2353-60.
- Post op pulmonary complications significantly decreased and LOS decreased in the IMT high intensity group versus endurance group.

IMT evidence

- Mans CM, Reeve JC, Elkins MR Postoperative outcomes following preoperative inspiratory muscle training in patients undergoing cardiothoracic or upper abdominal surgery: a systematic review and meta-analysis. Clin Rehabil 2015;29(5): 426-38.
- Preop inspiratory muscle training significantly improved respiratory muscle function in post op period, reducing risk of pulmonary complications by 1/2

AM I LOSING YOU?



5:01 PM

Question

- Retained secretions and weak respiratory muscles are a sign of:
 - A. COPD
 - B. increased risk of post op complications
 - C. too much sedation in ICU
 - D. Restrictive lung disease with poor mobility

Interventions

- Problem: Poor thoracic mobility and posture
- Interventions
 - Thoracic mobility techniques
 - Pulleys
 - Sidelying stretch
- Thoracic postural exercises
 - UE exercises seated on therapy ball
- ***Paced BREATHING!!!***
 - Prone extension

Mary Massery, PT
I'd like to buy the world a Coke@...



Strength

- Anterior neck flexors
- Rhomboids
- Middle and lower Trapezii
- Lattissimus

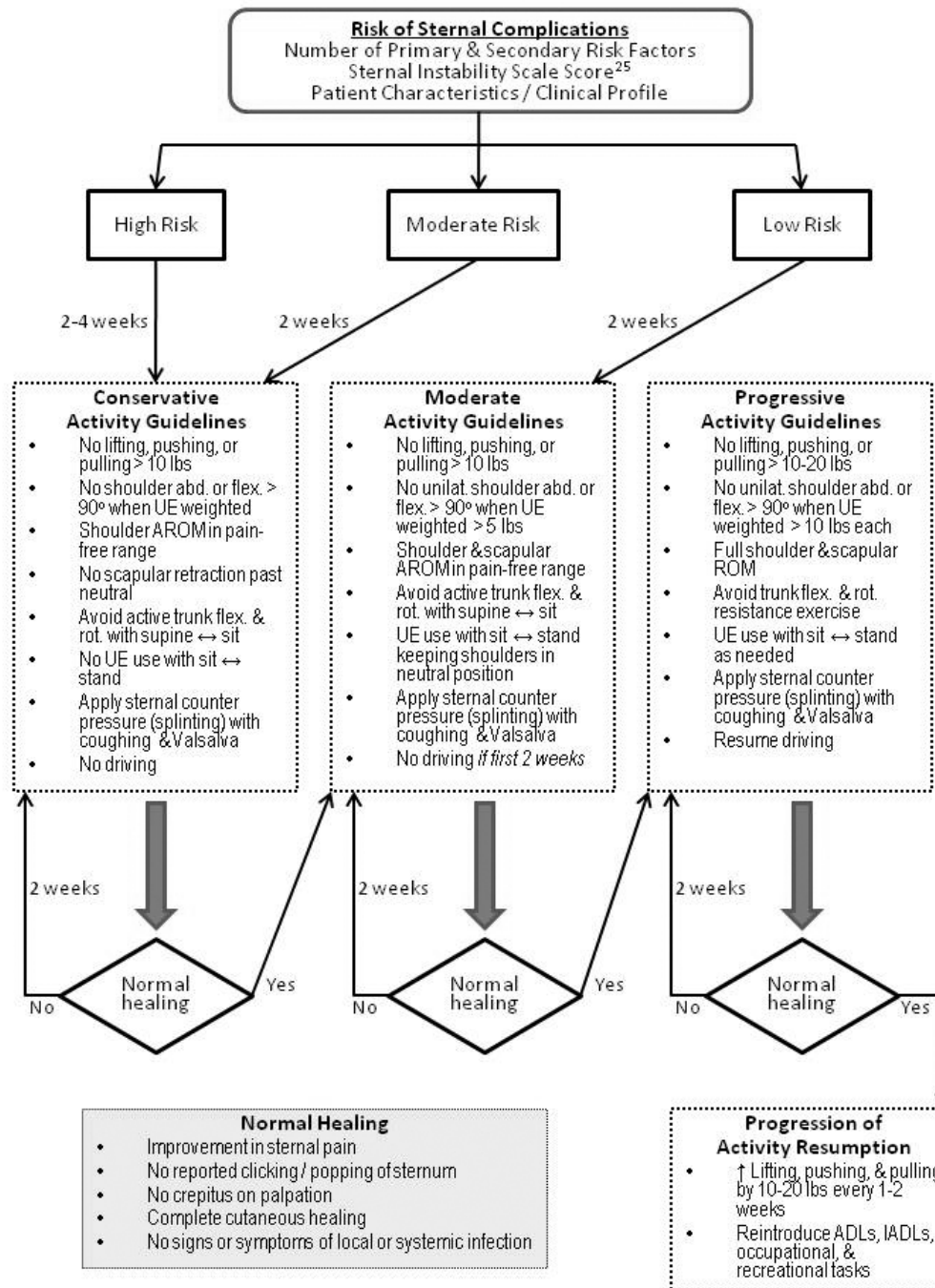
Interventions for thoracic mobility



Sternal Precautions

Cahalin LP, LaPier TK, Shaw DK. Sternal Precautions: Is It Time for Change? Precautions versus Restrictions – A Review of Literature and Recommendations for Revision Cardiopulmonary Physical Therapy Journal 2011 22(1).

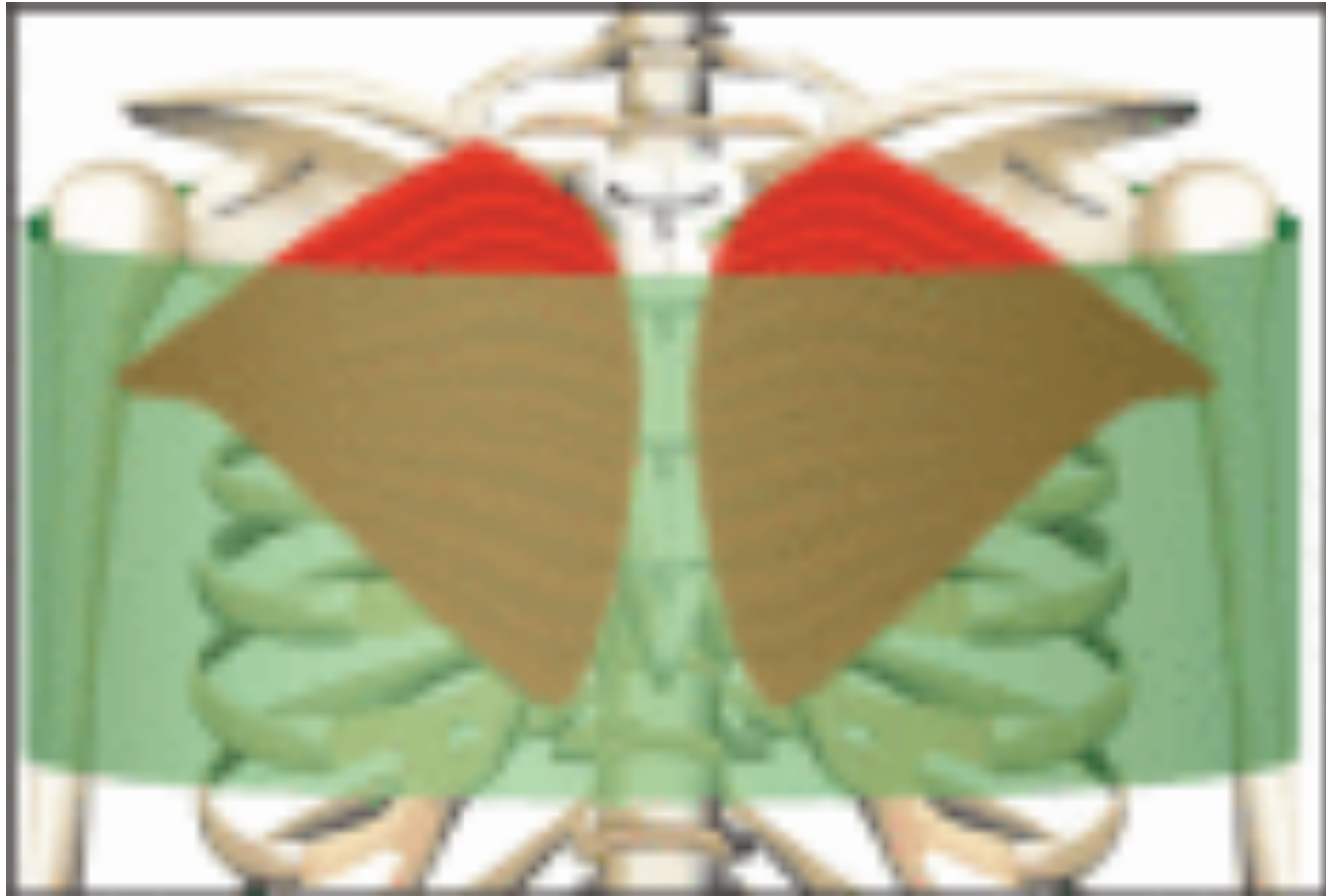
Sternal Precautions Algorithm



Sternal Precautions: New Info

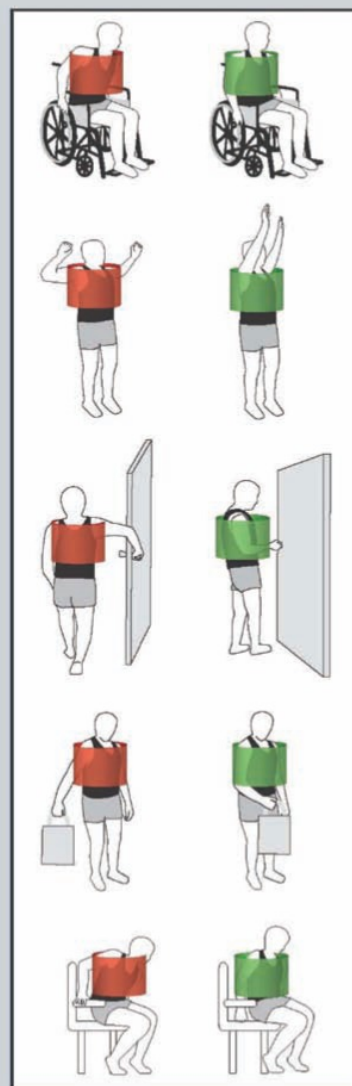
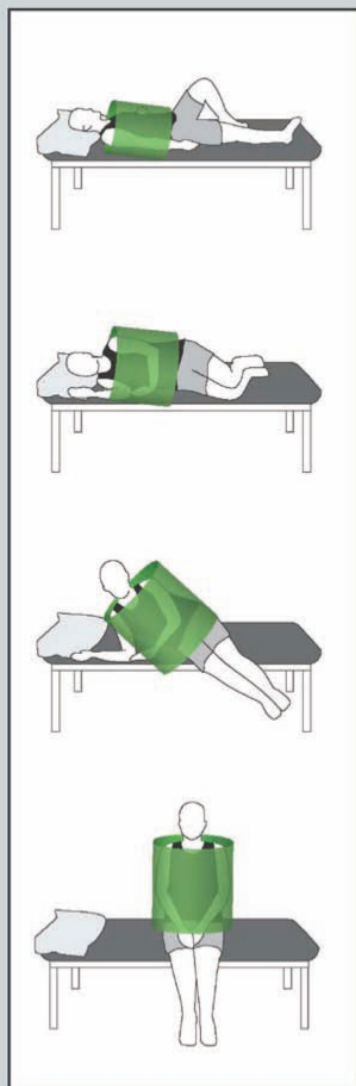
- Proc (Bayl Univ Med Cent). 2016 Jan; 29(1): 97–100.
- PMCID: PMC4677872
- An alternative approach to prescribing sternal precautions after median sternotomy, “Keep Your Move in the Tube”
- Jenny Adams, PhD, Ana Lotshaw, PT, PhD, CCS, Emelia Exum, PT, DPT, Mark Campbell, BSc, MSc, Cathy B. Spranger, 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

Sternal Precautions



Keep Your Move in the Tube™

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Yoga

Interventions

- Problem: Orthostatic hypotension
- Interventions
 - First assess for orthostatic hypotension
 - BP, HR, Symptoms in Supine, Sit, Stand
 - Orthostatic hypotension: drop in systolic BP > 10 mm Hg AND symptomatic
 - Check patient's medications if orthostatic
 - Meds that can cause orthostasis
 - Vasodilators
 - Calcium channel blockers
 - Nitrates
 - New PAH medications: vasodilators
 - ACE inhibitors
 - Beta Blockers

Interventions

- Problem: Orthostatic hypotension
- Interventions
 - UE activity to increase pressure



Interventions

- Problem: Orthostatic hypotension
 - Must start increasing time in upright position
 - May need to do ace wraps and belly binders to help with compression and decreasing blood pooling

Interventions

- Problem: Oxygen desaturation with activity
- Interventions:
 - Supplemental O₂ with activity
 - Evidence:
- Hillegass et al: Supplemental Oxygen Utilization during physical therapy interventions. *Cardiopulmonary Physical Therapy Journal* 2014 25(2):38
- **Somfay A, Porszasz J, Lee SM and Casaburi R.** Effect of Hyperoxia on Gas Exchange and Lactate Kinetics Following Exercise Onset in Nonhypoxemic COPD Patients.
***Chest* 2002;121;393-400**
 - Lower ventilatory requirements and less lactate produced with exercise when supplemental oxygen provided to normoxemic patients

Official Guidelines from the Cardiovascular and Pulmonary Section

Supplemental Oxygen Utilization During Physical Therapy Interventions

*Task Force on Supplemental Oxygen: Ellen Hillegass, PT, EdD, CCS, FAACVPR, FAPTA;
Ann Fick, PT, DPT, MS, CCS; Amy Pawlik, PT, DPT, CCS; Rebecca Crouch, PT, DPT, CCS, FAACVPR;
Christiane Perme, PT, CCS; Rohini Chandrashekar, PT, DPT, CCS;
Susan Butler McNamara, PT, MMSc, CCS; Lawrence P. Cahalin, PT, PhD, CCS*

ABSTRACT/SUMMARY

INTRODUCTION AND PURPOSE

Interventions

- Problem: Oxygen desaturation with activity
- Interventions:
 - Supplemental O₂ with activity
 - Evidence:
- **Emtner M, Porszasz J, Burns M, Somfay A, Casaburi R.** Benefits of supplemental oxygen in exercise training in nonhypoxemic chronic obstructive pulmonary disease patients. **Am J Respir Crit Care Med 2003;168(9):1034-42.**
 - Supplemental oxygen improved exercise training performance and tolerance in both hypoxemic and nonhypoxemic subjects

I see you yawning!!!!



Questions

- Medications that can cause orthostatic hypotension include all of the following EXCEPT:
 - A. Calcium Channel Blockers
 - B. Nitrates & new PAH medications
 - C. ACE Inhibitors
 - D. Vasopressors such as levophed

Interventions

- Problem: Poor endurance
- Interventions:
 - Progressive activity
 - Increase mobility with frequent bouts of exercise and rest
 - Bouts works for walking or any other exercise
 - Work to a certain level of dyspnea or perceived exertion

Modified Dyspnea Scale (Breathing)

Scale Severity



0 Nothing At All



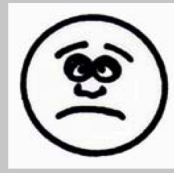
1 Very Slight

2



3 Slight

4



5 Moderate

6



7 Severe

8



9 Very Severe

10 Maximum

Interventions

- Problem: Decreased strength
 - UE vs LE?
 - UE frequent bouts of activity, as well as weight bearing on UE activity to improve core strength
 - LE: best LE activity is sit to stand activity
 - Frequent bouts of walking and resting by sitting
 - Teach patients to work to a specific RPE or dyspnea level
 - Steroid use?
 - CORE/proximal muscle groups need to be worked on

Interventions

- Problem: Poor Balance
- Interventions
 - Must work on both sitting and standing balance activities
 - Frequent bouts
 - Sitting supported in bed versus edge of bed

Interventions

- Problem: Poor Mobility
- Intervention:
 - MOBILITY
 - Start with rolling
 - Supine to sit
 - Edge of bed sitting
 - Sit to stand
 - Stand to walking

EARLY Mobility



Interventions for patients with hx of mechanical ventilation

- Early mobility as soon as possible
 - Requires aggressive reduction in sedation
 - In cardiac chair
 - Sit edge of bed
 - Sit to Stand
 - Sit in chair
 - Mobility with portable ventilator or with NIV
 - Options: CPAP, BiPAP
 - NIOV BREATHE

Arjo Sara Plus for standing/walking



Interventions for Patients with HF

- Frequent bouts with rests in-between
- Teach daily weighing to check for changes in fluid
- Teach daily checks on activity by instructing in RPE or dyspnea monitoring
- Teach about watching for dyspnea when laying down
- Energy conservation

Strength and endurance training versus endurance training only

- Bicycle ergometer training (ET) versus aerobic and strength training (CT) resulted in improved EF in CT group by 18% over 3 mos. And decreased EF in ET alone group (-11.4%)

» DELAGARDELLE, C., P. FEIEREISEN, P. AUTIER, R. SHITA, R. KRECKE', and J. BEISSEL. Strength/endurance training versus endurance training in congestive heart failure. Med. Sci. Sports Exerc., Vol. 34, No. 12, pp. 1868–1872, 2002

10-Year Exercise Training in Chronic Heart Failure

A Randomized Controlled Trial

Romualdo Belardinelli, MD,* Demetrios Georgiou, MD,† Giovanni Cianci, MD,*
Augusto Purcaro, MD*

Ancona, Italy; and New York, New York



Background:

- **500,000 new cases of CHF reported each year**
 - **Age at diagnosis has shifted from 65 ± 9 years from 1950 through 1969 to 80 ± 10 years from 1990-1999**
 - **A common finding in patients with CHF is exercise intolerance, which causes a progressive functional deterioration**
- Circulation 1999**

Clinical Outcomes

- Events:
 - more frequent in Non-Tr than in Tr patients (35 vs. 12,)
- *Hospital readmissions:
 - 8 in the Tr group vs. 25 in the NT
- Cardiac deaths
 - more frequent in Non-Tr patients (10 vs. 4)

Ex Training with HF PEF

- Improved diastolic function with exercise training in patients with HF PEF
- [Marshall KD, Muller BN, Krenz M, Hanft LM, McDonald KS, Dellsperger KC, Emter CA. Heart failure with preserved ejection fraction: chronic low intensity interval exercise training preserves myocardial O2 balance and diastolic function. J Appl Physiol \(1985\). 2013 Jan 1;114\(1\):131-47.](#)

Safety with Ex and LVAD

6 studies reviewed:

Only one reported adverse effects in 4
“minor” out of 32 patients.

Morrone et al

- ❖ decrease in pump flow that did not result in a change of patient morbidity or mortality
- No other adverse effects requiring life saving measures or alterations in medical treatment.

Scheiderer et al CPJ June 2013

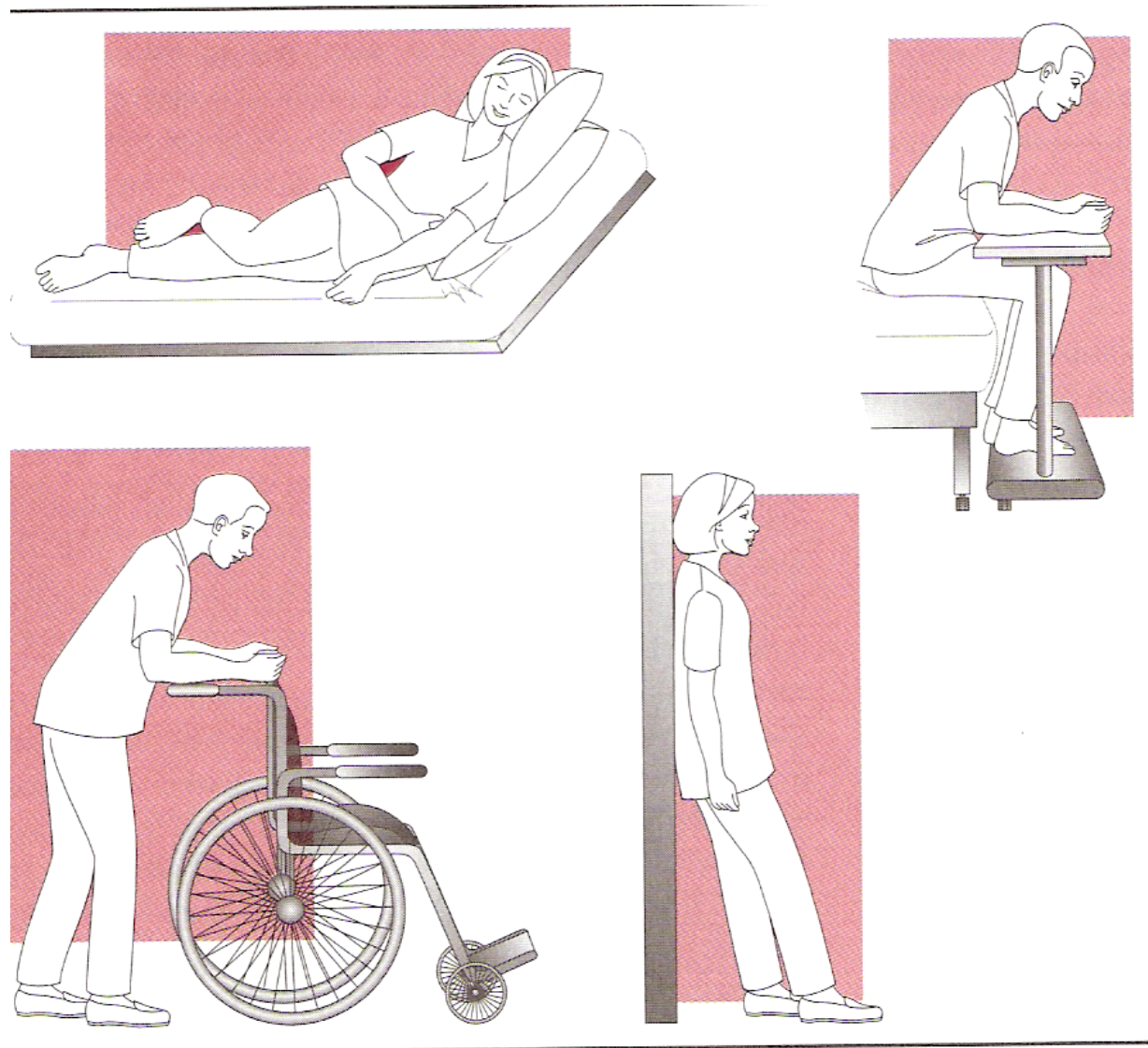
Exercise Training with COPD

- Impairments: endurance, muscle weakness, risk for rehospitalization, hypoxemia
- Exercise training: frequent bouts short duration with rests when SpO₂ drops or dyspnea too high; also optimize oxygen to maintain SpO₂>90
- Strength training, particularly quad strengthening and ADL functional training
- Education: self management of disease: what to do with increased dyspnea, change in color of secretions

Exercise Training with IPF

- Impairments: mobility, endurance, hypoxemia, increased work of breathing, weakness
- Optimize oxygen with ALL activities and maintain SpO₂>90
 - Short bouts of exercise with frequent rests
 - Breathing exercises: incentive spirometry
 - Strengthening, especially LE with chair rises
- Education: self management of disease

Positions to Relieve Dyspnea



Hat? Or Risk for a Problem?



Questions

- Cardiopulmonary Interventions for the Heart failure population include all of the following EXCEPT:
 - A. continuous aerobic training in the stable chronic heart failure
 - B. High intensity interval training of 95% of peak heart rate for 4 minutes in stable chronic heart failure
 - C. High intensity interval training in the acute heart failure in the acute care setting
 - D. Strength training to moderate level of dyspnea, aerobic training to moderate level of dyspnea for heart failure patient in acute care setting

Case Study: HF

- AL...admitted with one week history of worsening dyspnea and 8 lbs wt gain
- Exercise interventions:
 - Multiple bouts of walking with frequent rests
 - Strength training consisting of UE functional strengthening and LE strengthening with chair rises
 - Education: teaching self management with wt monitoring and RPE monitoring of all activities

Case Study: COPD

- Patient admitted for Acute exacerbation
- Once ABGs show pH in normal range: begin activity
 - Breathing exercises: pursed lip
 - Airway clearance for secretions
 - Mobility out of bed
 - Optimize oxygen – maintain SpO₂ > 90
 - LE strengthening: EOB to stand activities
 - Short bouts of walking coordinating breathing exercises and frequent rests
 - Education: color of secretions, increased dyspnea should call MD

Patient with Restrictive Lung Disease

- Optimize oxygen
- Incorporate aerobic training to tolerance...
- Determine level of dyspnea and exercise patient in multiple bouts of aerobic and strength activities
- Incorporate sit to stand exercises
- Instruct in self management by monitoring dyspnea
- Refer to outpatient for pulmonary rehabilitation

