Exercise in ICU/CCU

Assist. Prof. Visal Kantaratanakul, MD,
* Board Certified in Rehabilitation Medicine
* Director, Samitivej Srinakarin Rehabilitation Center
* Member, Exercise Expert Committee,
Ministry of Public Health
* Inviting lecturer, Mahidol University,
Mae Fah Luang University, Kasetsart University

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My covers

- Background and rational perspectives
- supporting evidences
- Monitoring in ICU
- Our practices on early mobilisation protocol

Samitivej Hospital Group

is part of

Bangkok Dusit Medical Services

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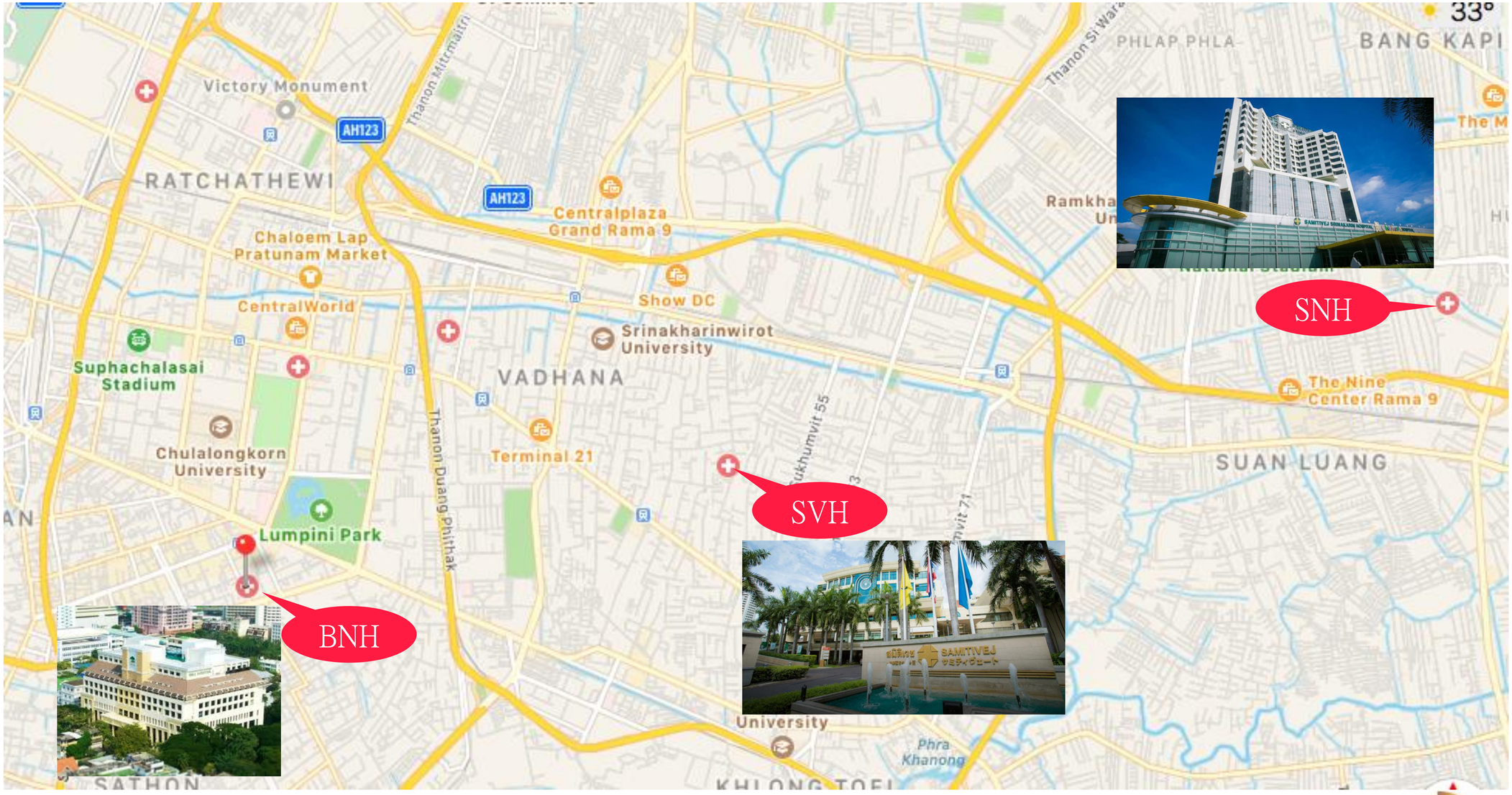
*



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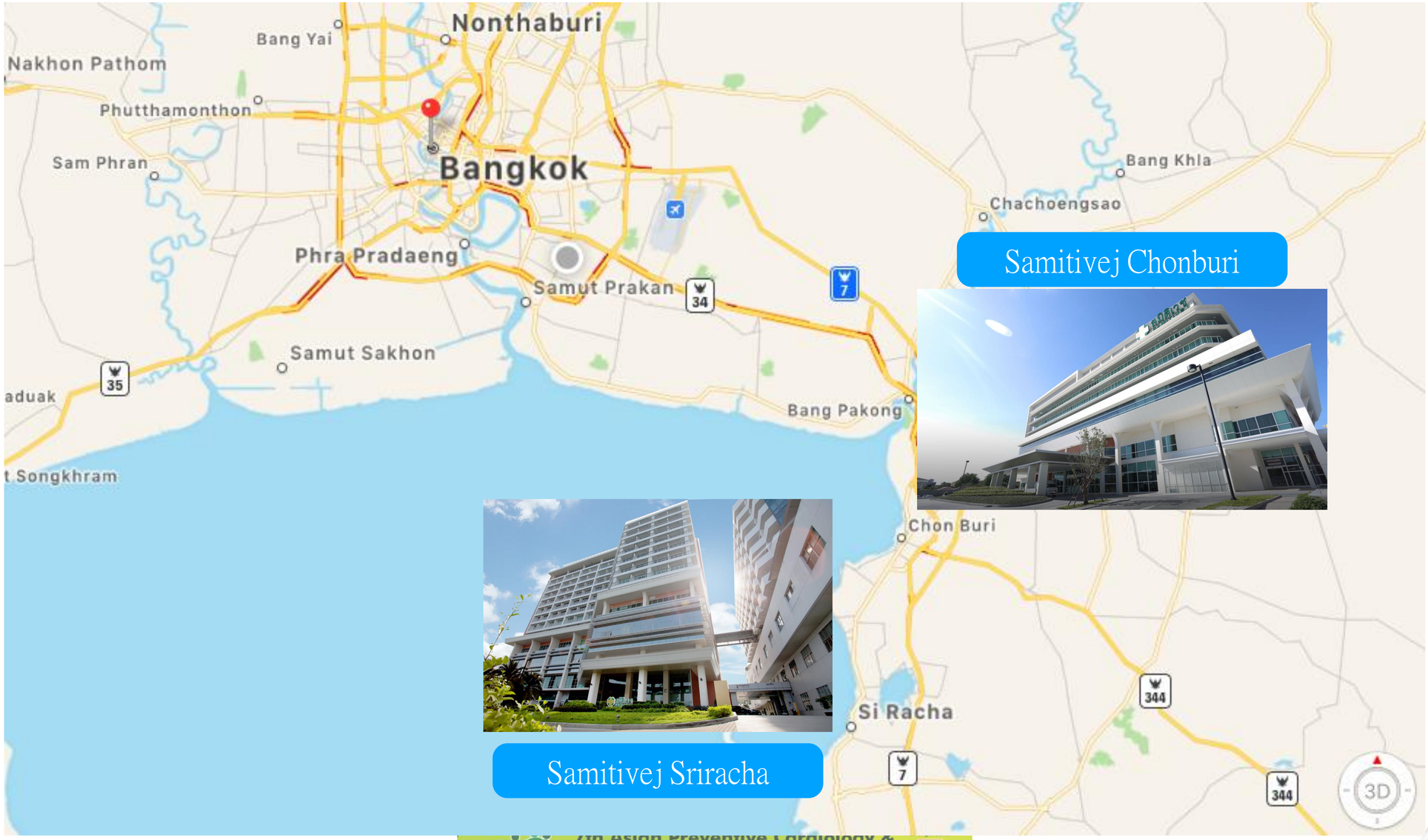

Rational thinking

- First unit of cardiac rehabilitation start Ramathibodi Hospital since 1995
- Under utilisation of phase II
- I have moved to private hospital since 2007 and have to set MSK, Neuro and Pediatric rehab., No CR unit for Samitivej Srinakarin
- Start phase I, emphasise during ICU @ Samitivej Sukhumvit
- JCI accredited for DSCS certified program

  for acute myocardial infarction @ Samitivej Sukhumvit

Samitivej Sukhumvit Hospital
Bangkok, Thailand
Program: Hospital
First Accredited: 27 January 2007
Re-accredited: 13 February 2010

Program: DCSC Certification Program
Lung Cancer Program
First Certified: 6 December 2008

Program: DCSC Certification Program
Acute Myocardial Infarction Program
First Certified: 4 December 2008

Program: DCSC Certification Program
Osteoarthritis of the Knee Program
First Certified: 15 August 2009

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So our cardiac rehabilitation

- Mainly in ICU and phase I
- KPI for JCI on rehabilitation:
  - early consultation: eligible patient is notified to CR team in 24 hrs
  - early ambulation: % of eligible patent who have no C/I could ambulate.
- Phase II: No space for phase II yet
  - METs@home program: metabolic syndrome group
  - Return to active life or sport activities: individual program@general gym.
  - Tele-monitoring (lecture on 11 of November)

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Interventions in ICU

- Weaning of ventilatory support: breathing training
- Early ambulation
- Proper exercise: calisthenic VS active exercises

Weaning in ICU

Published in final edited form as:
J Crit Care. 2018 October ; 47: 204–210. doi:10.1016/j.jcrc.2018.07.006.

A multimodal rehabilitation program for patients with ICU acquired weakness improves ventilator weaning and discharge home*

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J Crit Care. 2018 October ; 47: 204–210.

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Multimodal rehabilitation training program for older mechanically ventilated survivors of critical illness with ICUAW.

Activity	Bed Dependent —Stand,pivot,transfer (minimal assistance)→ Chair Dependent Bed Dependent —Ambulate (minimal assistance)→ Ambulatory		
Muscle strengthening and power activities (functional)	Leg pressure Hip extension/abduction (supine) Closed kinetic terminal knee extension Ankle dorsiflexion Proprioceptive Neuromuscular facilitation Scapular depression Latissiumus pull downs Tricep extensions Hand putty	Modified sit to stand Modified step-ups Hip extension/abduction (standing) Closed kinetic terminal knee extension Ankle dorsiflexion Proprioceptive Neuromuscular facilitation Shoulder flex/abduction Latissiumus pull downs Tricep extensions Hand putty	Squats Step-ups Hip extension/abduction (standing) Latissimus pull downs Deltoid flies Tricep extensions Biceps Hand putty

J Crit Care. 2018 October ; 47: 204–210.

Muscle endurance activities	Sitting edge of bed (30–60 seconds, rhythmic stabilization) Leg press (timed-30 seconds) Supine reverse leg raise, (timed-30 seconds)	Restorator upper & lower extremity (timed-30–60 seconds) Standing balance: Unilateral stance Rhomberg Modified sit to stand Modified step up	Stationary bicycle (timed-60–90 seconds) Upper body ergometry (timed 60–90 seconds) Squats Step-ups Modified military press Tricep extensions
Aerobic conditioning activities	Wheelchair mobility, restorator cycling for upper and lower body.	Stationary bicycle Upper body ergometry Pre gait activities	Treadmill Stationary bicycle Upper body ergometry Ambulation

Progression of mobility from left-most column (Bed Dependent) to right-most (Ambulatory).

Exercises categorized by row according to goals of therapy.

Muscle strengthening and endurance activities utilized elastic resistance bands and light weights.

J Crit Care. 2018 October ; 47: 204–210.

Results

Eighteen males and 14 females (age 60.3 ± 11.9 years) who received PMV for ≥14 days were enrolled. Despite no significant differences between groups in the changes in handgrip, gait speed, short physical performance battery or 6-min walk distance after treatment, the MRP + UC group had greater weaning success (87% vs. 41%, $p < 0.01$), and more patients discharged home than UC (53 vs. 12%, $p = 0.05$). Post hoc analyses, combining patients based on successful weaning or discharge home, demonstrated significant improvements in strength, ambulation and mobility.

Conclusion

The addition of an MRP that improves strength, physical function and mobility to usual physical therapy in LTACH patients with ICUAW is associated with greater weaning success and discharge home than UC alone.

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Breathing exercise

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Goals of breathing exercise

1. Improve ventilation
2. Increase the effectiveness of the cough mechanism
3. Prevent pulmonary impairments
4. Improve the strength, endurance and coordination of respiratory muscles
5. Maintain or improve chest and thoracic spine mobility

Goals of breathing exercise

6. Correct inefficient or abnormal breathing patterns
7. Promote relaxation
8. Teach the patient how to deal with short-of-breath attacks
9. Improve a patient’ s overall functional capacity

Precautions

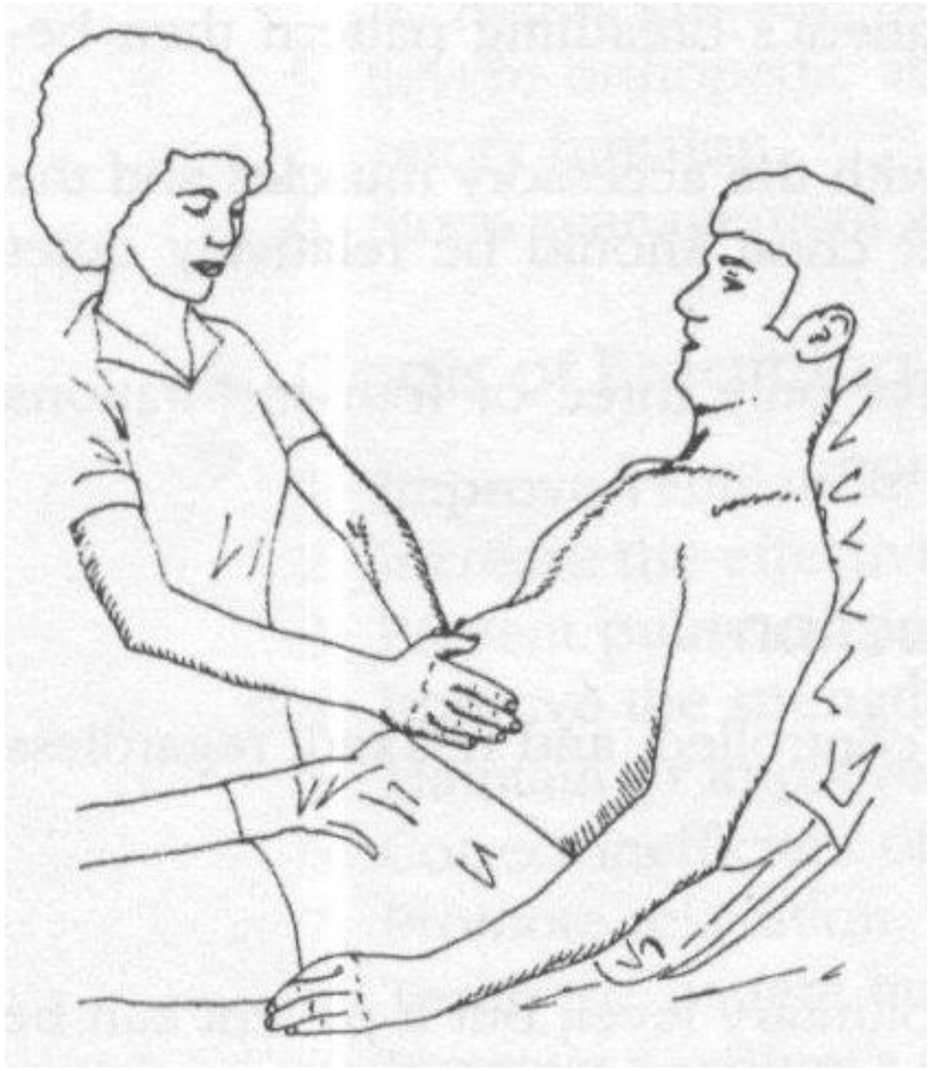
1. Force expiration
2. Very prolonged expiration
3. Initiate inspiration with the accessory muscles and the upper chest
4. Hyperventilation

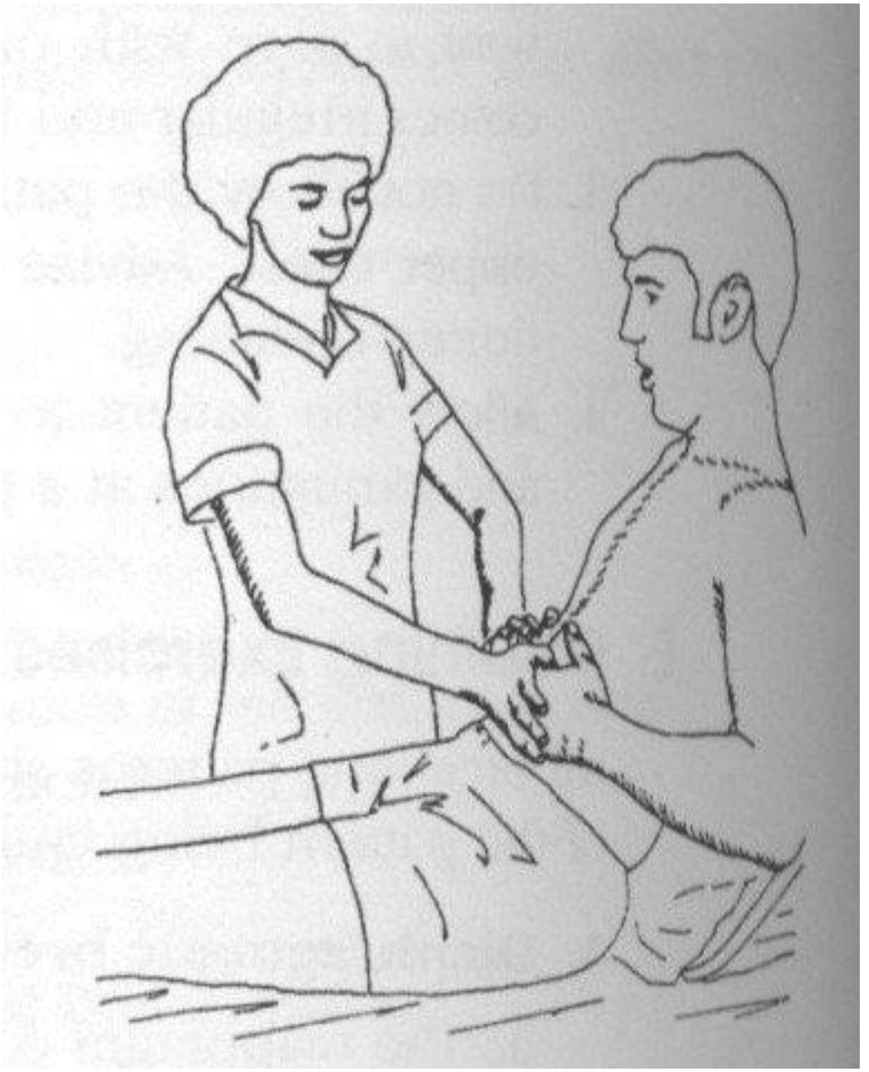
Diaphragmatic breathing

- Improve the efficiency of ventilation
- Decrease work of breathing
- Increase the excursion of diaphragm
- Improve gas exchange and oxygenation
- Mobilize lung secretions during postural drainage

Procedure

- Relaxed and comfortable position (semi-fowler’ s position)
- Place your hand on the rectus abdominis just below the anterior costal margin
- Breathe slowly and deeply through the nose
- Keep shoulder relaxed and upper chest quiet, allow abdomen to rise





Procedure

- Slowly let the air out
- 3 – 4 times and then rest
- Used patient’ s hand place below anterior costal margin and feel the movement
- Breathe in through the nose and out through the mouth
- Variety of position are suggested

Ventilatory muscle training

- The process of improving the strength or endurance of the muscle of breathing

- Treatment of the patients with acute or chronic pulmonary disorders associated with weakness, atrophy or insufficiency of the muscle of inspiration

Outcome of training

- Prevent acute deterioration of respiratory status and ventilatory failure
- Improve ventilatory function and decrease the work of breathing
- Facilitate the weaning process in patient, who have respiratory respiratory failure

Subjects

- Healthy persons
- COPD
- Chronic airflow limitation
- Cystic fibrosis
- Quadriplegia
- Facilitate to wean respirator

Ventilatory muscle training

Divide in 3 forms:

1. Diaphragmatic training using weight
2. Inspiratory resistance training
3. Incentive respiratory spirometry

Diaphragmatic training using weight

- Supine or slightly head up position
- Primarily using the diaphragm
- Place small weight (3 – 5 lb) over epigastric region
- Breathe in deeply, keep upper chest quiet
- Resistance should not interfere excursion of diaphragm or epigastric area

Diaphragmatic training using weight

- Gradually increase the time, if more than 15 min without the use of accessory muscles should increase weight
- Manual resistance or positioning can used to strengthen the diaphragm

(effectiveness of diaphragmatic training still questionable)

Inspiratory resistance training

Mode of training

- Voluntary isocapnic hyperpnea
- Resistive loading
- Pressure threshold loading
- Elastic loading
- Incremental threshold loading

Voluntary isocapnic hyperpnea

"Isocapnic hyperpnea"

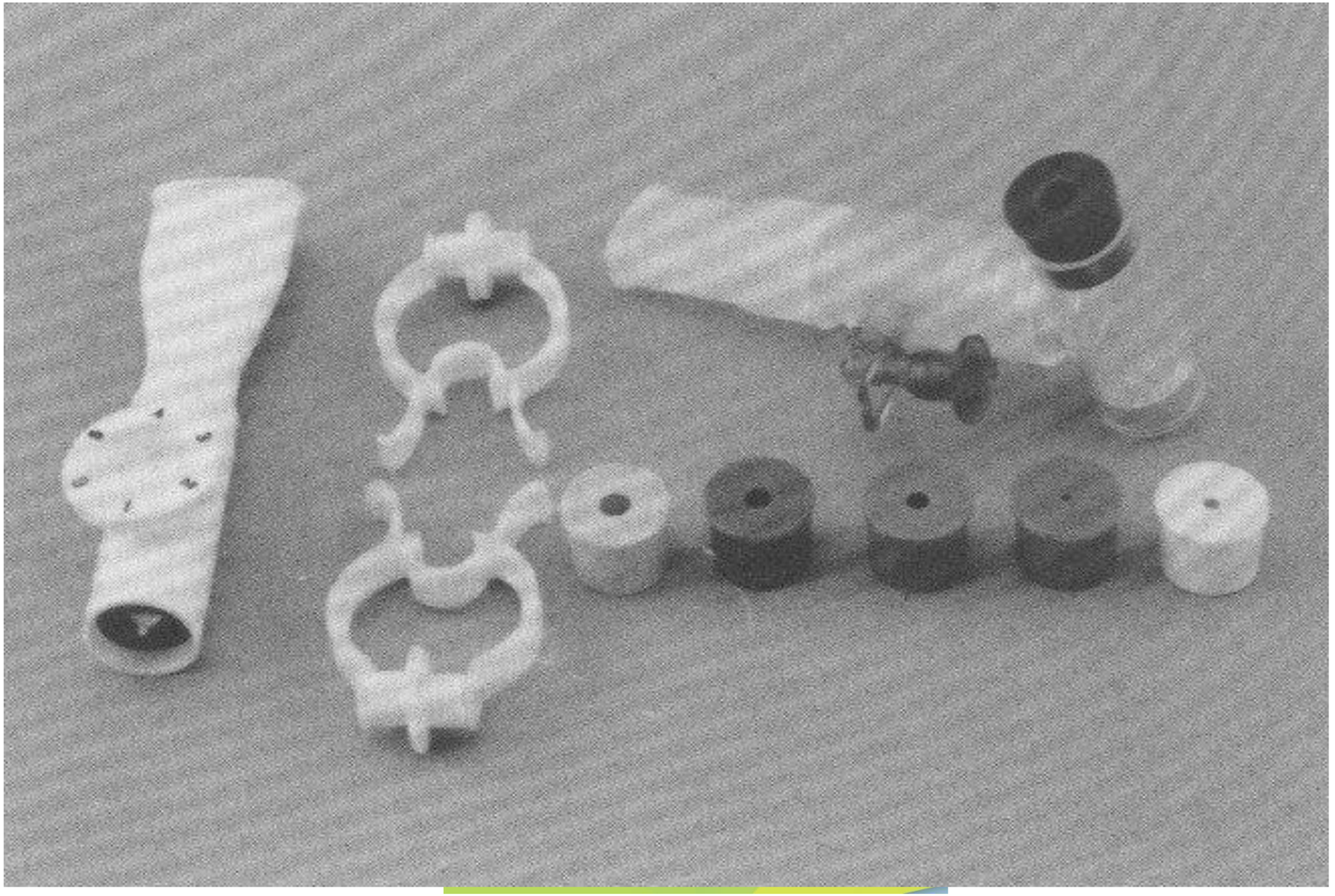
- Increase endurance of inspiratory muscle
- Instruct Patient to breath in highest rate as possible
- 15 - 30 min 3 - 5 times per week
- But need device that keeping $PaCO_2$ constant or re-breathe through a dead space

Resistive loading

- Used of breathing device (resistors)
- Inspire via a variable diameter orifice (smaller the orifice the greater the resistive load)
- Improve both strength and endurance
- Include isometric and isotonic exercises

Procedure

- Inhales through a hand-held resistive training devices (narrow tubes of varying diameters)
- The narrower the diameter of the airway, the greater the resistance
- Inhale through the tube for specific period of time, several times each day.
- Gradually increased to 20 – 30 min per session



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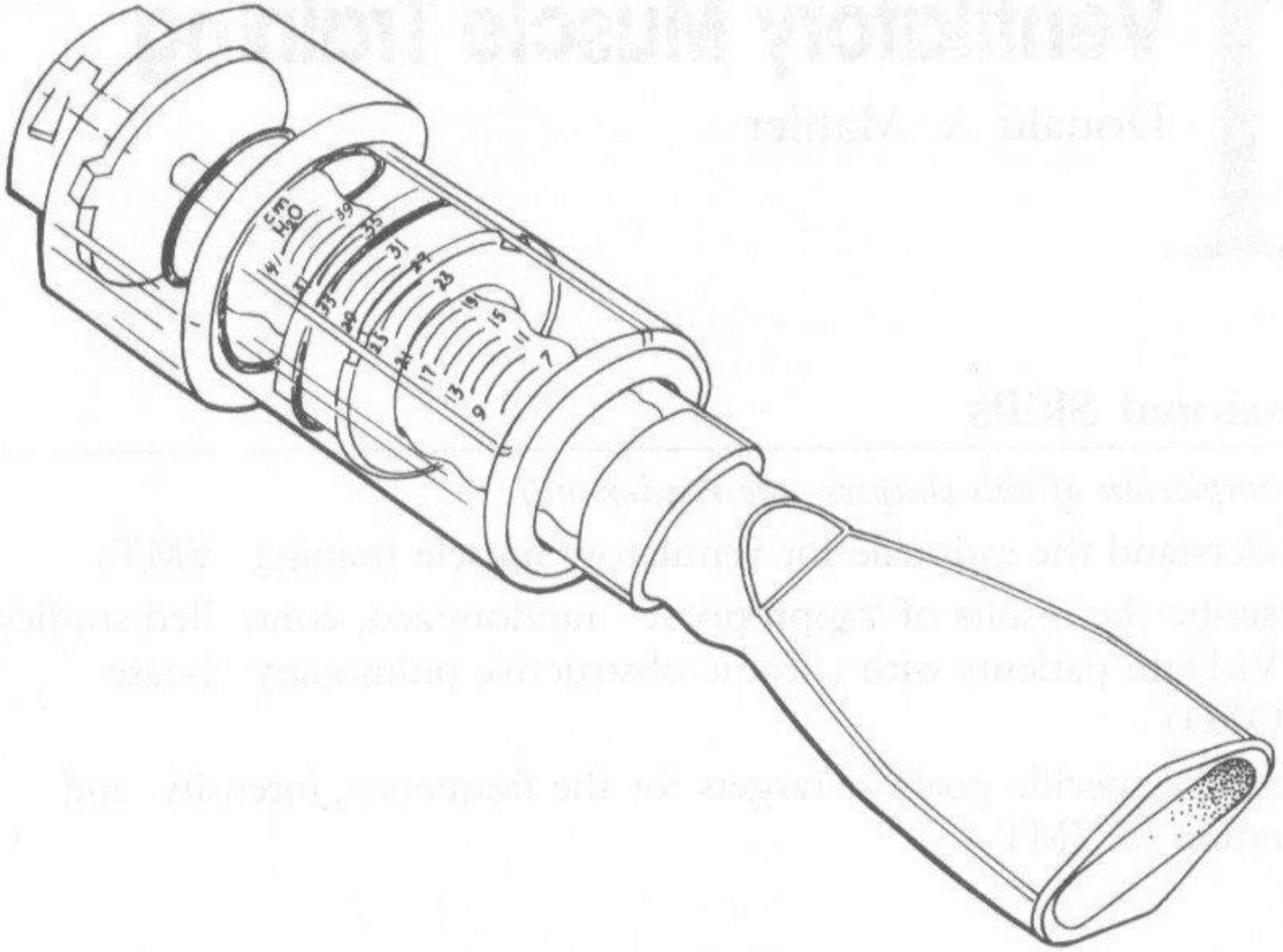
Procedure

- 15 - 30 min 1 - 3 times per day

- If patient can breathing for 30 min without immediately exhausted, decrease diameter of device

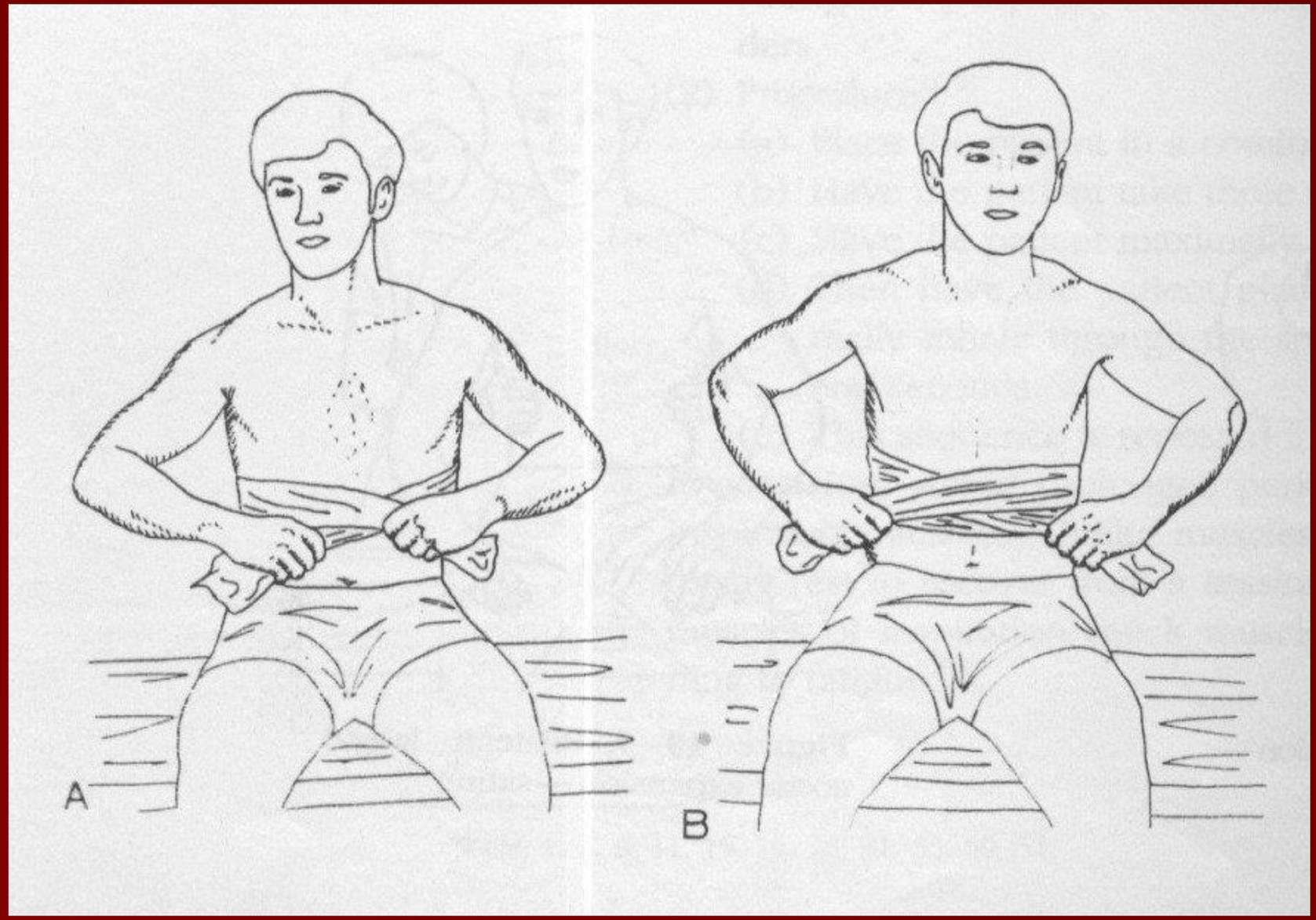
Pressure threshold loading

- Requires patient to produce a negative pressure to overcome a threshold load and thereby initiate inspiration
- Increase both strength and endurance of inspiratory muscle
- Can increase specific inspiratory pressure
- 15 – 30 min per day


cm
H2O

Elastic loading

- Require strapping of the rib cage or abdomen
- The higher tidal volume, the higher the pressure required
- Resistance depend on elasticity of strapping
- Simplify to use, but difficult to standardise and quantify work of breathing



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Incentive respiratory spirometry

"Sustained maximal inspiratory maneuver"

- Incentive spirometry is a form of low level resistance training
- Emphasizes sustained maximum inspiration
- Increase the volume of air inspired
- Prevent alveolar collapse
- Strengthen weak inspiratory muscles

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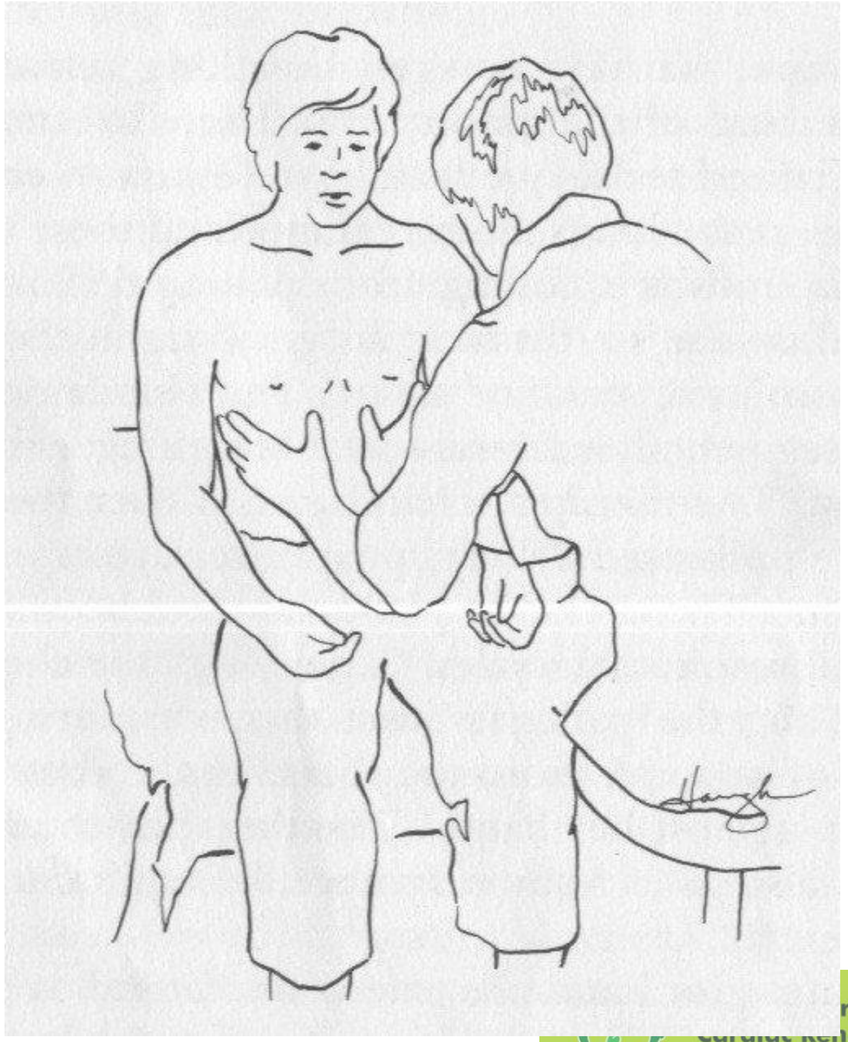
Procedure

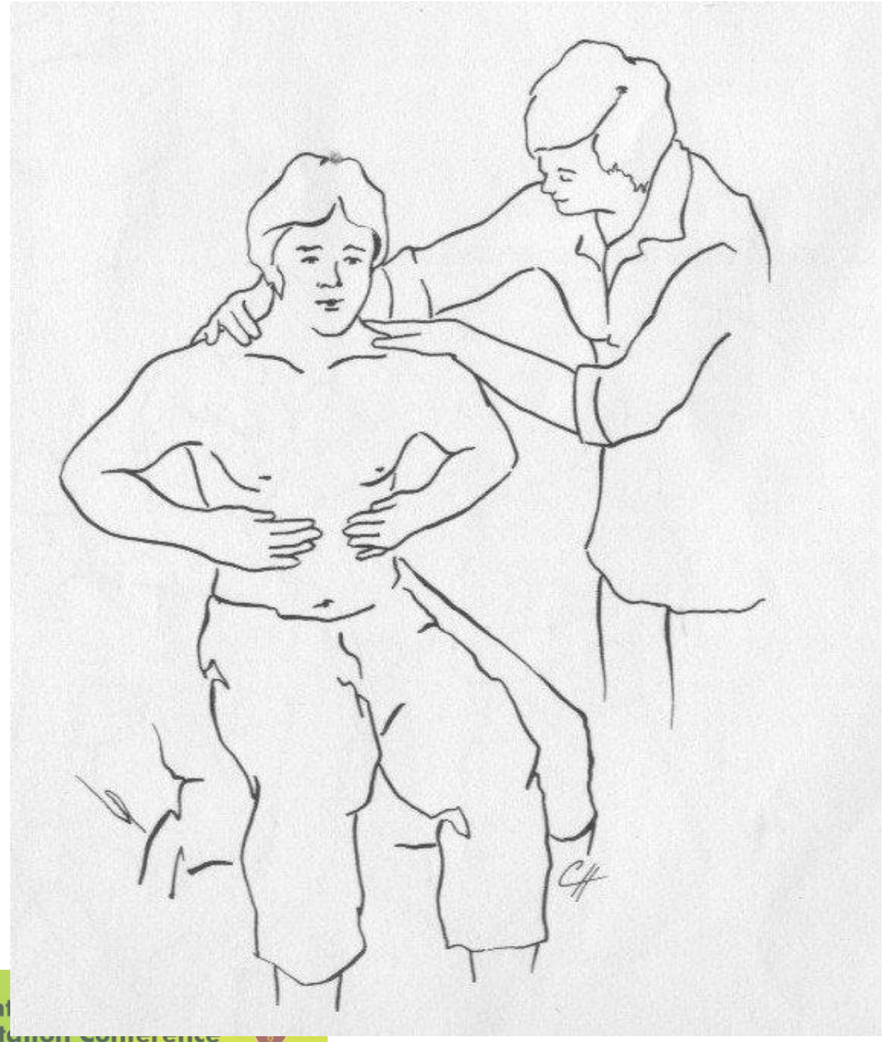
- Comfort position (supine or semiupright)
- Take 3 – 4 slow, easy breaths
- Maximally exhale 3 – 4 breaths
- Place spirometer in the mouth and maximally inhale through device and hold several seconds
- Repeated 5 – 10 times several times per day

Segmental breathing

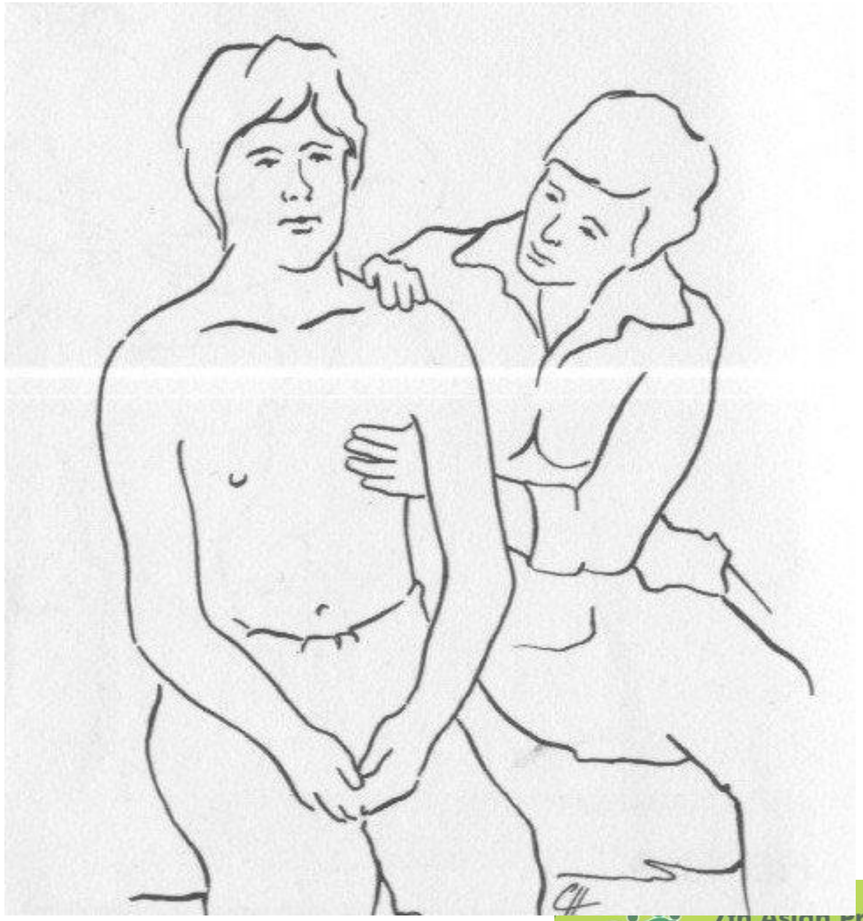
- For expand localized areas of the lung
- Area that pain, muscle guarding after surgery, atelectasis and pneumonia
- Include
  - Lateral costal expansion
  - Posterior basal expansion
  - Right middle lobe or lingular expansion
  - Apical expansion

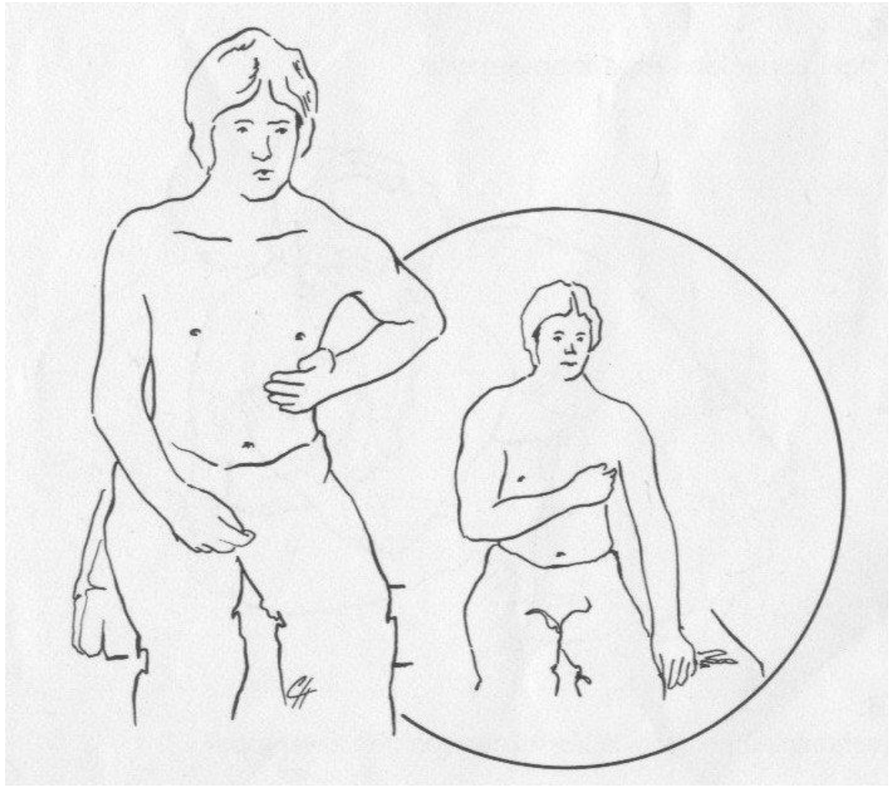
Lateral costal expansion





Right middle lobe or lingular expansion



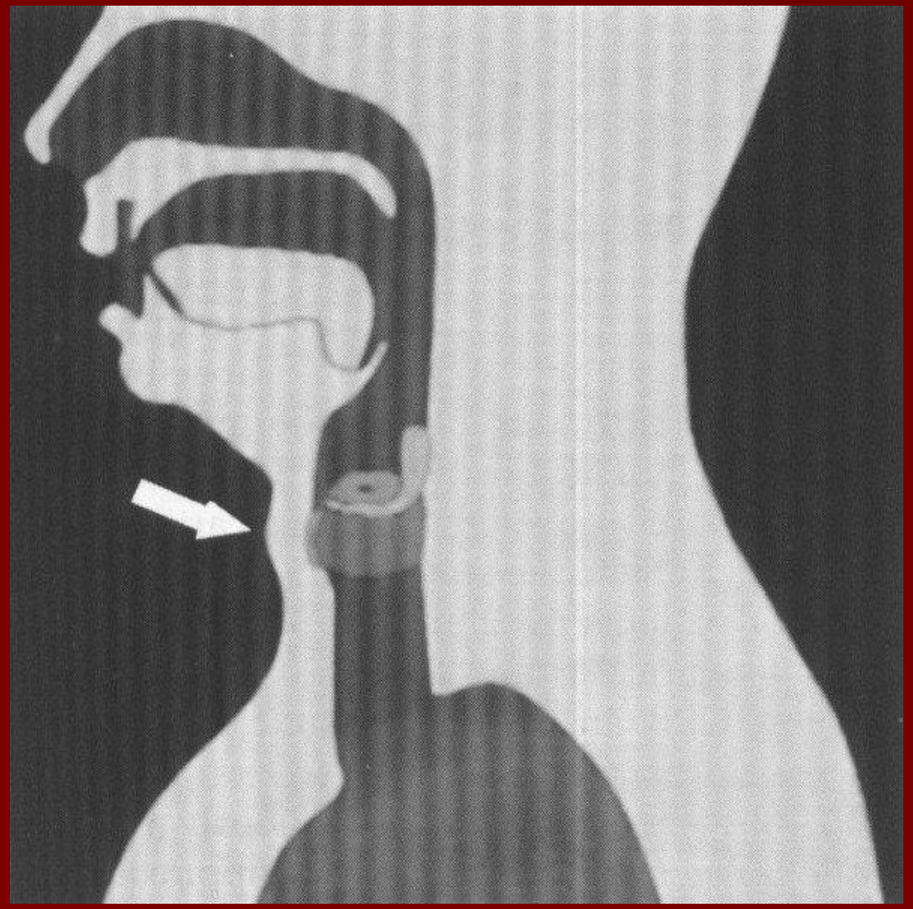


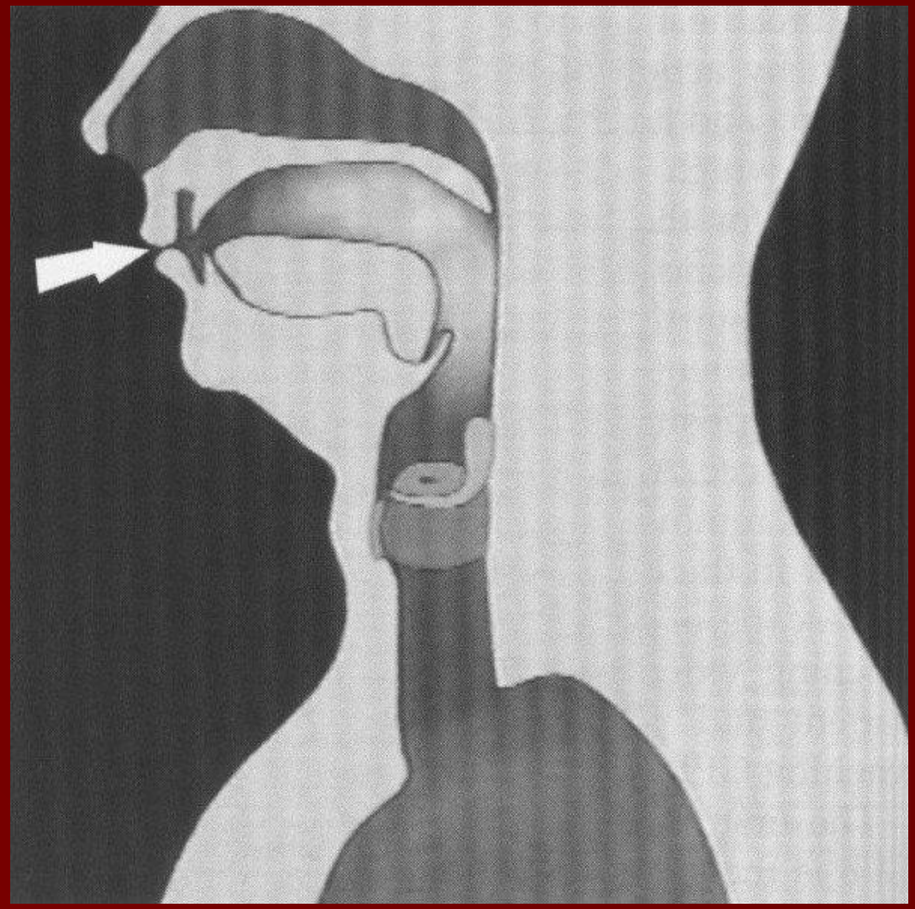
Glossopharyngeal breathing

- Increasing of a patient’ s chest capacity and compliance
- Used when there is severe weakness of the muscles of inspiration, patients who have difficulty taking in a deep breath
- Usefull in patient with tetraplegia that vital capacity < 2 L

Procedure

- Enlarge mouth and throat cavity by depress trachea and laryngeal cartilage
- Maintain first position and close lip
- Floor of mouth and throat return to normal position
- The air is then forced into the lungs when the glottis is opened





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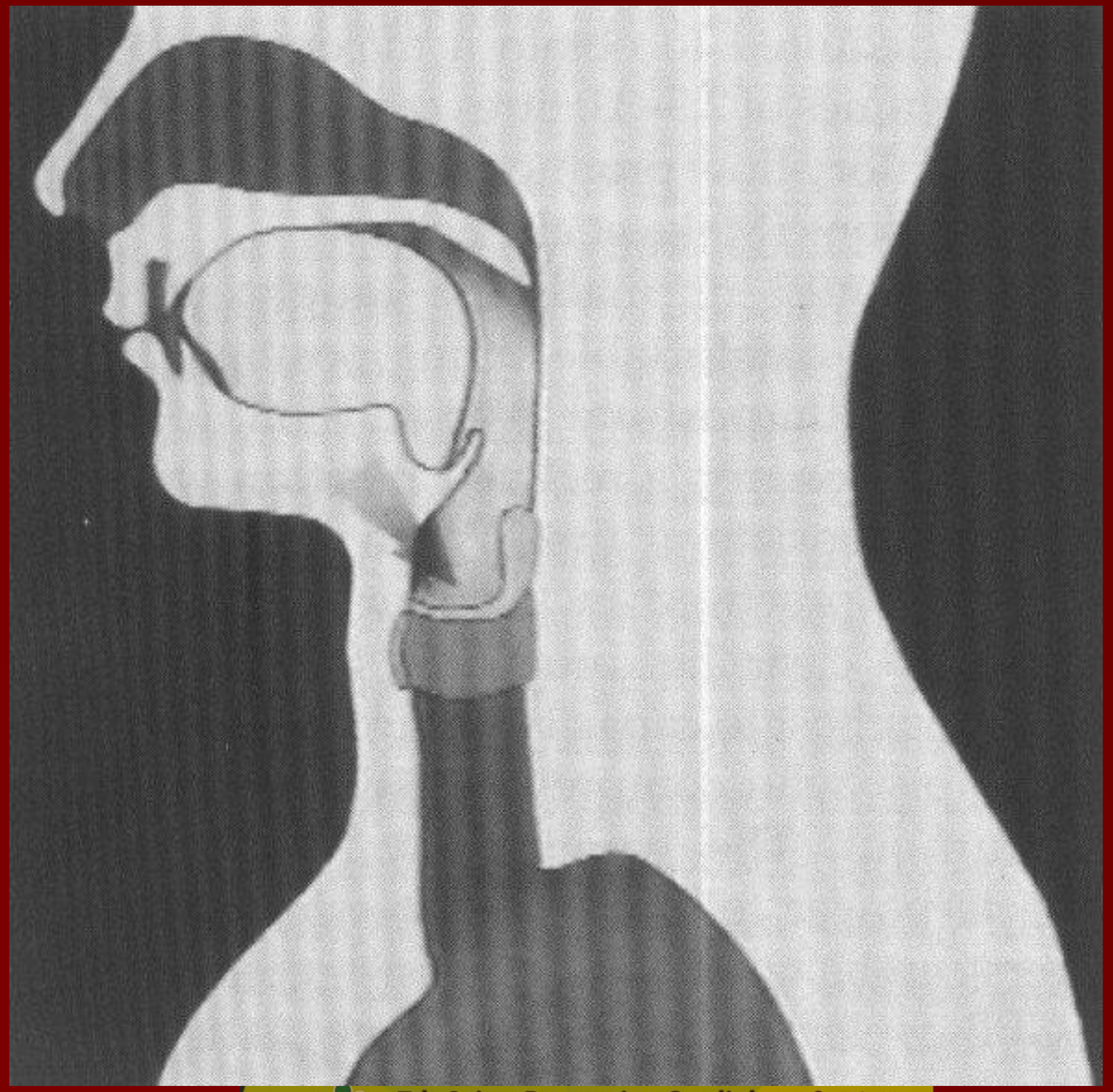

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Glossopharyngeal breathing

- GPB 6 – 8 gulps equal 1 normal tidal breathing
- GPB 10 – 25 gulps for secretion clearance (2.5 – 3 L)
- Fail GPB may due to
  - Soft palate is not close
  - Vocal cord weakness

Pursed-lip breathing

- Keep airways open by creating a backpressure in the airways
- More benefit in patient with COPD with attacks of shortness of breath
- Improve gas exchange and respiratory muscle recruitment
- Precaution the use of force expiration during purse-lip

Procedure

- Comfortable position and relax
- Closes mouth and slowly and deeply inhales through the nose
- Expiration must be relax (passive)
- Contraction of abdomen must be avoided
- Exhalation is through firmly pursed lips
- I : E = 1 : 2
- Practice until they are automatic

Mechanical ventilation weaning:

An evidence-based review

By Breanna Hetland, PhD, RN, CCRN-K; Jennifer Heusinkvelt, BSN, RN; Lisa Krabbenhoft, MSN, RN; and Erin Grotts, BSN, RN

Nursing2018CriticalCare l Volume 13, Number 6

charge.[29-31] In addition, promoting early mobility for patients in the ICU can reduce the incidence and duration of delirium and improve functional outcomes. Achieving light sedation levels will further increase the success of early mobility protocols.[19]

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Recommendation #3: Use ventilator liberation protocols. Weaning success hinges in part on the ability to assess whether a patient demonstrates readiness for an SBT. Studies show that patients who are managed with ventilator liberation protocols spend less time on MV and discharge from the ICU earlier than those not managed by a protocol. Criteria such as PEEP level, oxygen requirement, and resolution of acute disease state may be key factors in the protocol. It is recommended that liberation protocols be enacted for patients who have been on MV for 24 hours.[29]

In addition, the Rapid Shallow Breathing Index (RSBI) is a tool that can help assess readiness to wean and extubate. The RSBI is the ratio of respiratory rate to tidal volume. A value greater than 105 breaths/min/L is predictive of weaning failure, while an RSBI less than 105 breaths/min/L is associated with weaning success.[32] Although this protocol is simple and found to be effective, it may not accurately predict extubation readiness in certain patient populations, such as those with cardiopulmonary disease (ineffective inspiratory efforts do not trigger the ventilator leading

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ESC European Society of Cardiology

European Heart Journal (2018) **39**, 119–177
doi:10.1093/eurheartj/ehx393

ESC GUIDELINES

2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC)

6.2 Monitoring

ECG monitoring for arrhythmias and ST-segment deviations is recommended for at least 24 h after symptom onset in all STEMI

- ECG monitoring for arrhythmias and ST-segment deviations is recommended for at least 24 h after symptom onset in all STEMI patients. Longer monitoring should be considered in patients at intermediate- to high-risk for cardiac arrhythmias (those with more than one of the following criteria: haemodynamically unstable, presenting major arrhythmias, LVEF <40%, failed re-perfusion, additional critical coronary stenoses of major vessels, or complications related to PCI).

6.2 Monitoring

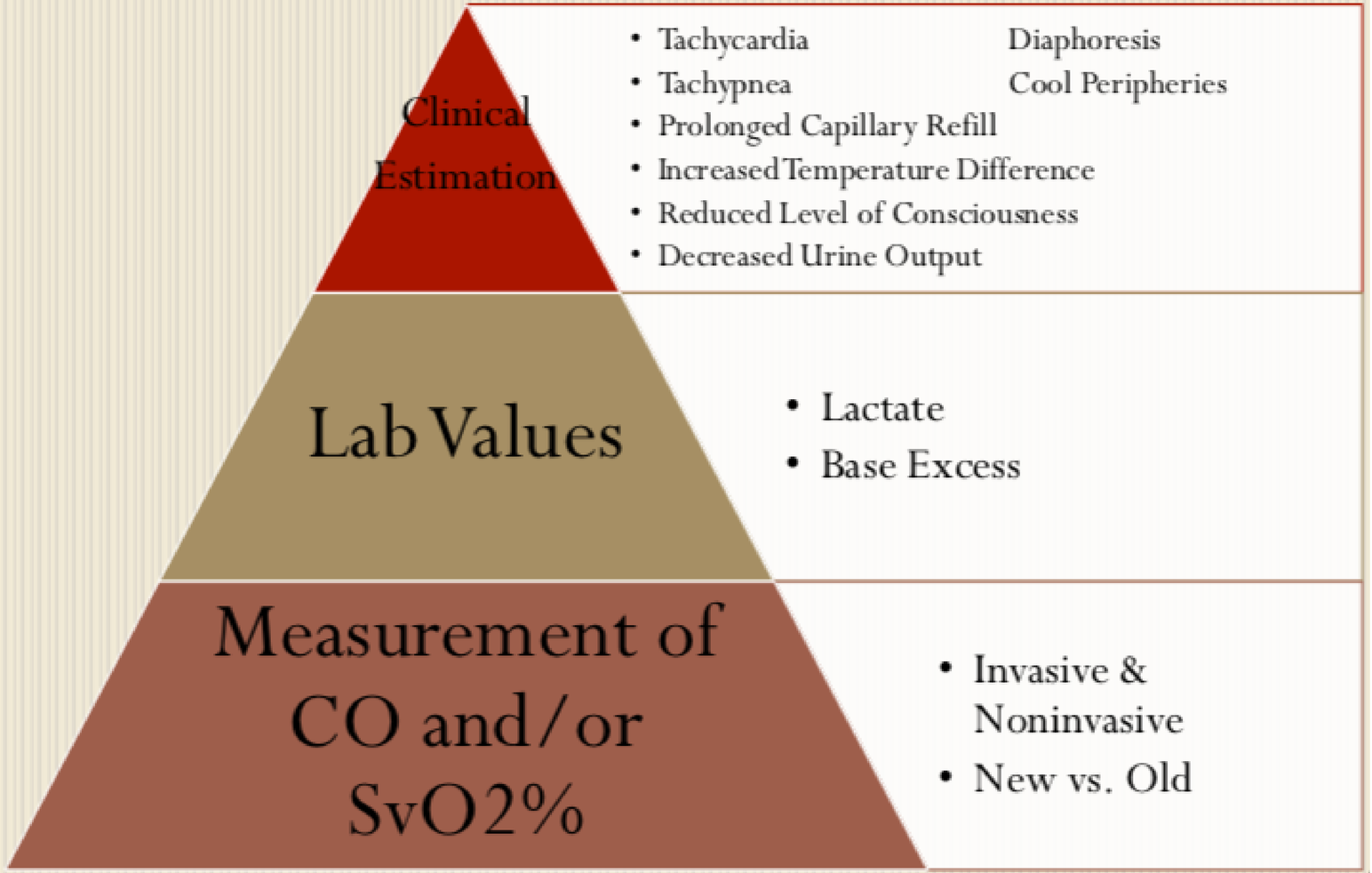
ECG monitoring for arrhythmias and ST-segment deviations is recommended for at least 24 h after symptom onset in all STEMI

- Further monitoring for arrhythmias depends on estimated risk. When a patient leaves the CCU/ICCU or equivalent, monitoring may be continued by telemetry. It is recommended that personnel adequately equipped and trained to manage life-threatening arrhythmias and cardiac arrest accompany patients who are transferred between facilities during the time-window in which they require continuous rhythm monitoring.

Degree of invasiveness of monitoring

- Non invasive e.g. ECG
- Minimally invasive e.g. I.V cannula
- Penetrating e.g. ECHO
- Invasive e.g. Arterial cannula
- Highly invasive e.g. Brain, heart cannula

Assessment of Adequate Oxygen Delivery



Limitation of monitoring

- Delay. **
- Danger.
- Decrease skill.
- Doubt of results.**
- Distracting set up.

CVS monitors

- Peripheral pulse.
- Tissue perfusion: Pulse oximeter
- ECG.
- Arterial blood pressure: NIBP, Arterial lines (a-lines)
- Central venous catheterization
- Pulmonary artery catheterization: Swan-Ganz catheter
- Cardiac output measurement.
- TEE.
- Blood loss measurement.

Respiratory system monitors

- Clinical monitors.
- Airway pressure measurement.
- Disconnection alarm.
- Stethoscope
- Spirometery.
- O2 monitoring.
- Co2 monitoring.
- Anesthetic gas analysis.
- H+ ions measurement.

Monitoring of metabolism

- Temperature monitoring.
- Tissue oxygenation monitoring.
- Indirect calorimetry.
- Fluid & electrolyte status monitoring.
- Blood gases & acid base status monitoring.
- Hormonal status monitoring.

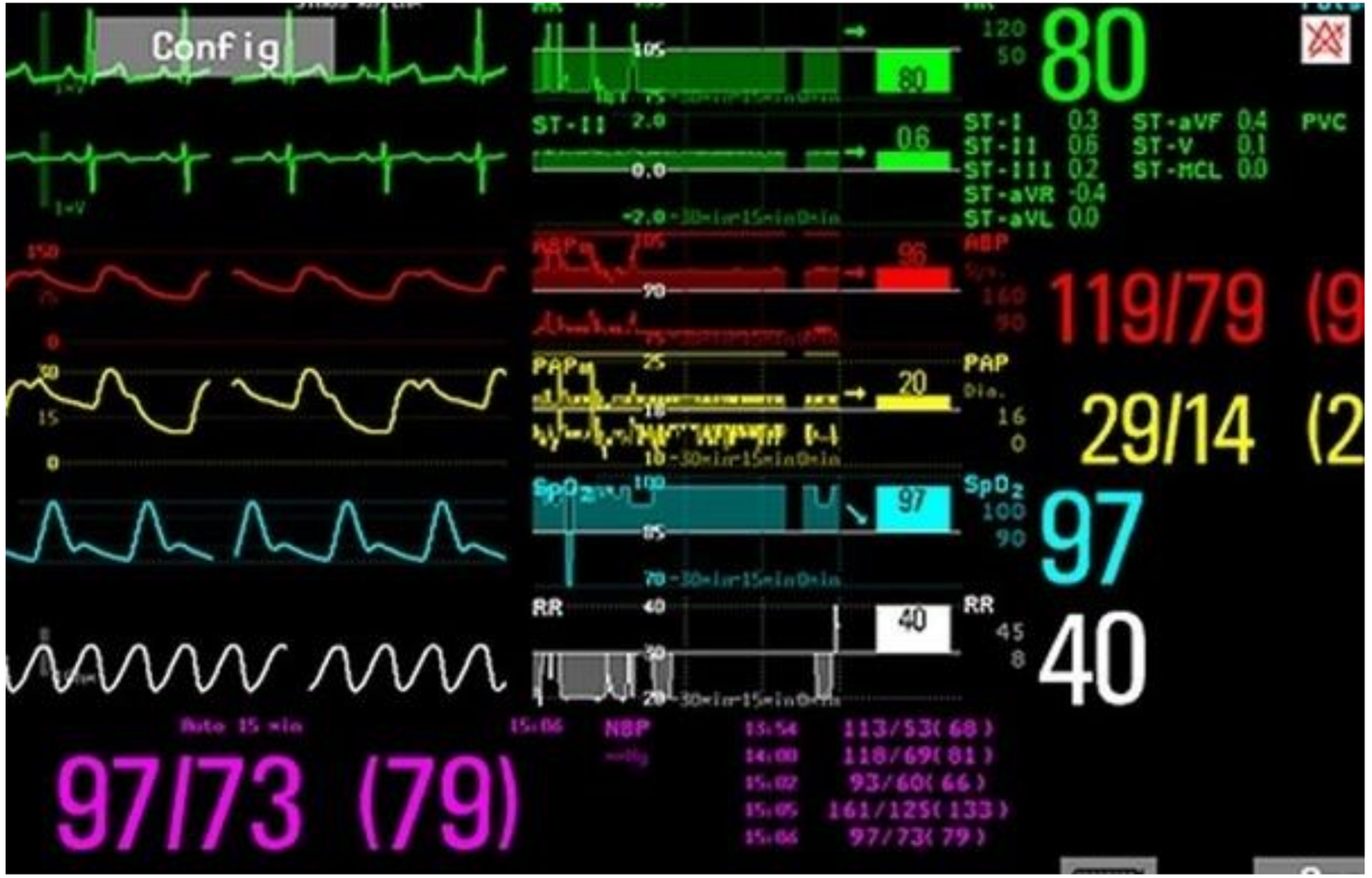
Pulse oximetry

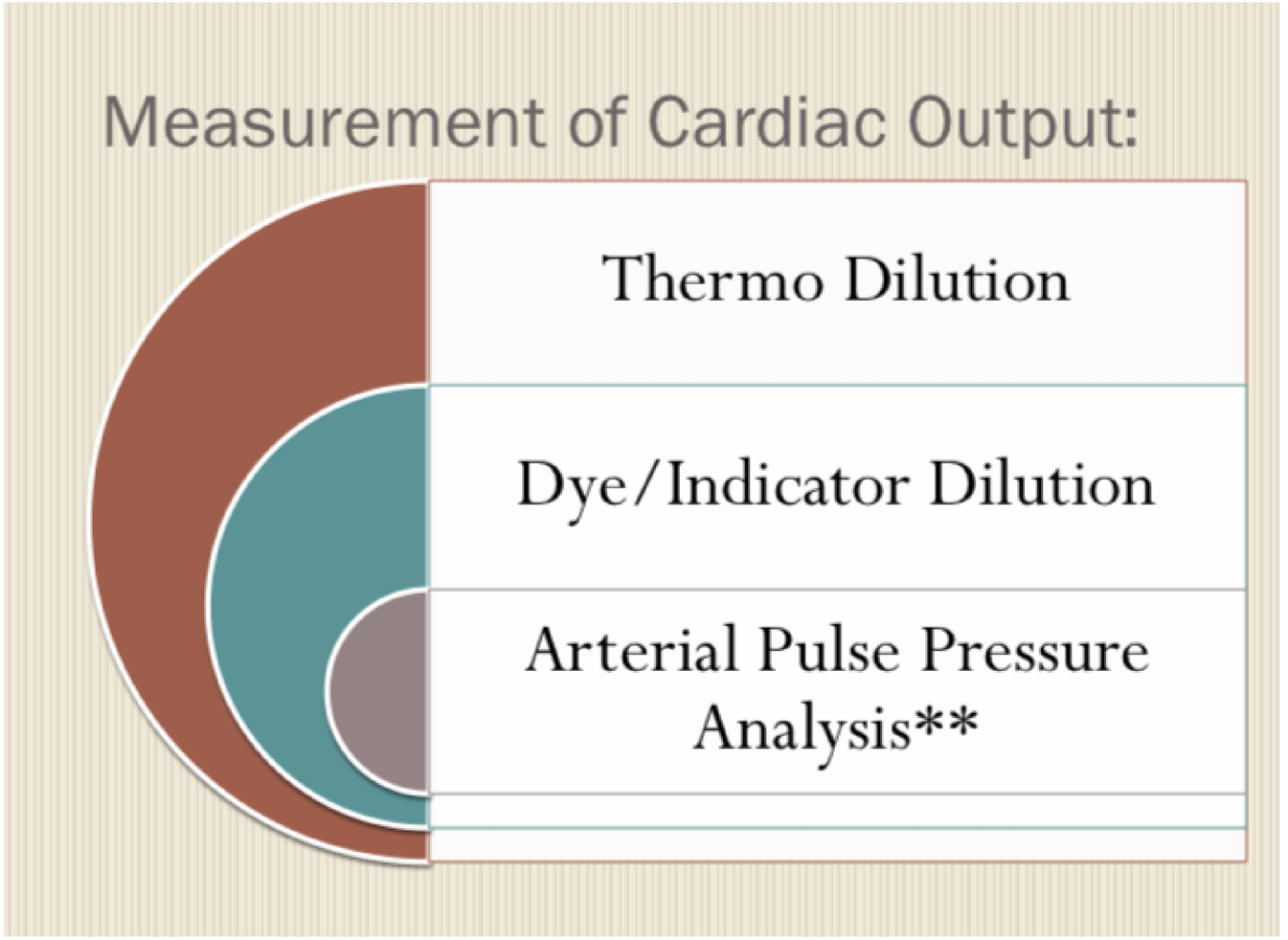
Value:

- **O2 saturation of arterial blood.**
- **Heart rate.**
- **Tissue perfusion.**

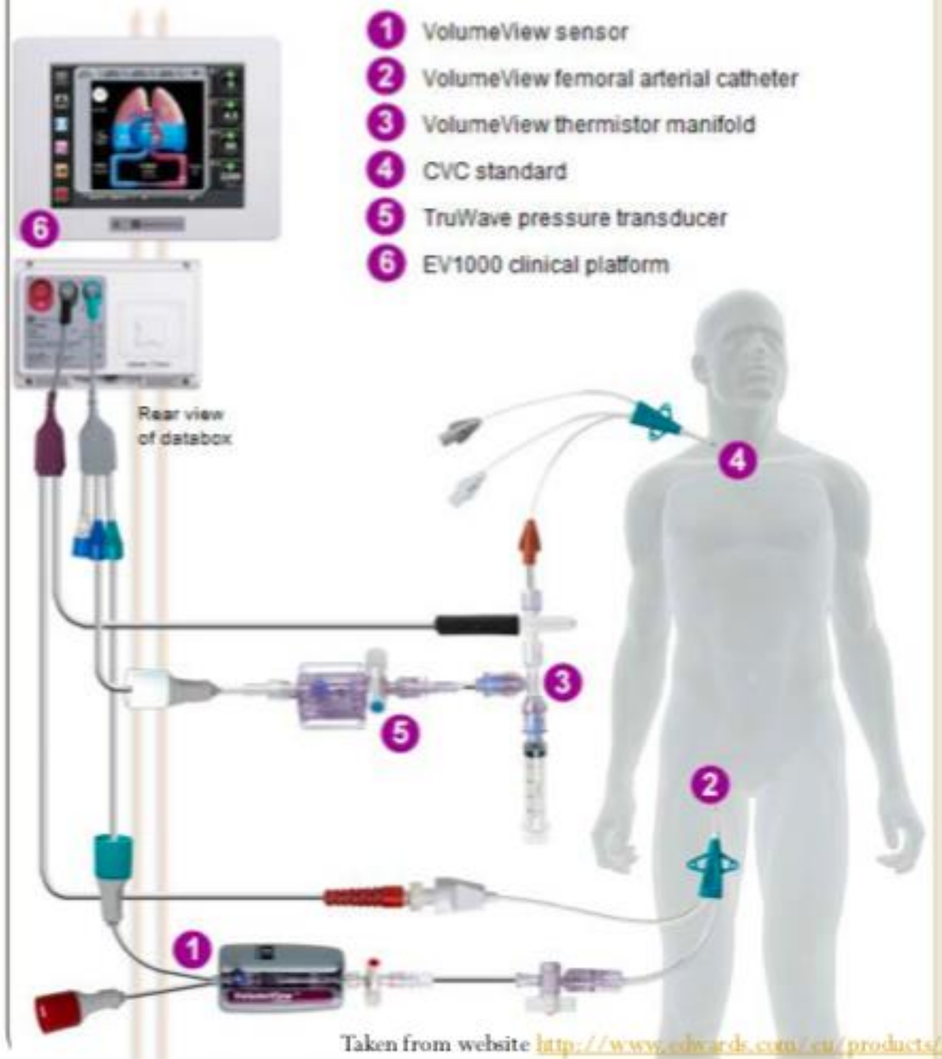
Disadvantages:

- Inaccuracy…….if O2 sat less than 70%
- Insensitivity …..significant decrease in PaO2 before significant decrease in SaO2 is detected.
- Interference…..
- Intrinsic e.g. co-Hb, Met-Hb, I.V dyes, bilirubine, fetal Hb……
- Extrinsic e.g. temperature motion, cautery, nail bed infection, polish……




Measurement of Cardiac Output:
Thermo Dilution
Dye/Indicator Dilution
Arterial Pulse Pressure Analysis**

VolumeView System Set Up



VolumeView

Edwards Lifesciences

Taken from website http://www.edwards.com/eu/products/minimallyinvasive/Pages/volumeview.aspx?volumeview=1

Hypoxemia

Definition:

- Simply, hypoxia means decreased O2 any where; air, blood or tissue.
- Hypoxemia is the reduction of O2 in the blood resulting in:
  - PaO2 is < 60 mmHg or
  - SaO2 is < 90 %

With age there is progressive decline of PaO2
That is to say subtracting 1 mmHg from the minimal PaO2
for adult (80 mmHg)
for every year over 60 years of age.

Types of Hypoxia

Hypoxic hypoxia:

- When FiO2 < 0.21
- Hypoventilation.
- Pulmonary V/Q mismatch.
- Rt to Lt shunt.

Types of Hypoxia

Circulatory Hypoxia

- Due to reduced COP.

Demand Hypoxia

- Due to increased O2 utilization.

Types of Hypoxia

Hemic Hypoxia

- Due to:
  - decreased Hb content
  - decreased Hb function.

Histotoxic Hypoxia

- Due to inability of cells to utilize O2 e.g. cyanide toxicity.

C/P of Hypoxemia:

- Cyanosis.
- Sympathetic stimulation in form of:
  - tachycardia
  - hypertension
  - sweating, arrhythmias, agitation,….
- Arrest….in sever persistent hypoxia.
- C/P of the cause.

tubes and life support devices monitoring

- **Central venous catheter (CVC)**
- **Intravenous (IV)**
- **Chest tubes**
- **Urinary catheter**

tubes and life support devices monitoring

- Ventilator:
- Endotracheal tubes
- tracheostomy tube

AIBP

ESC European Society of Cardiology

European Heart Journal (2018) **39**, 119–177
doi:10.1093/eurheartj/ehx393

ESC GUIDELINES

2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC)

6.3 Ambulation

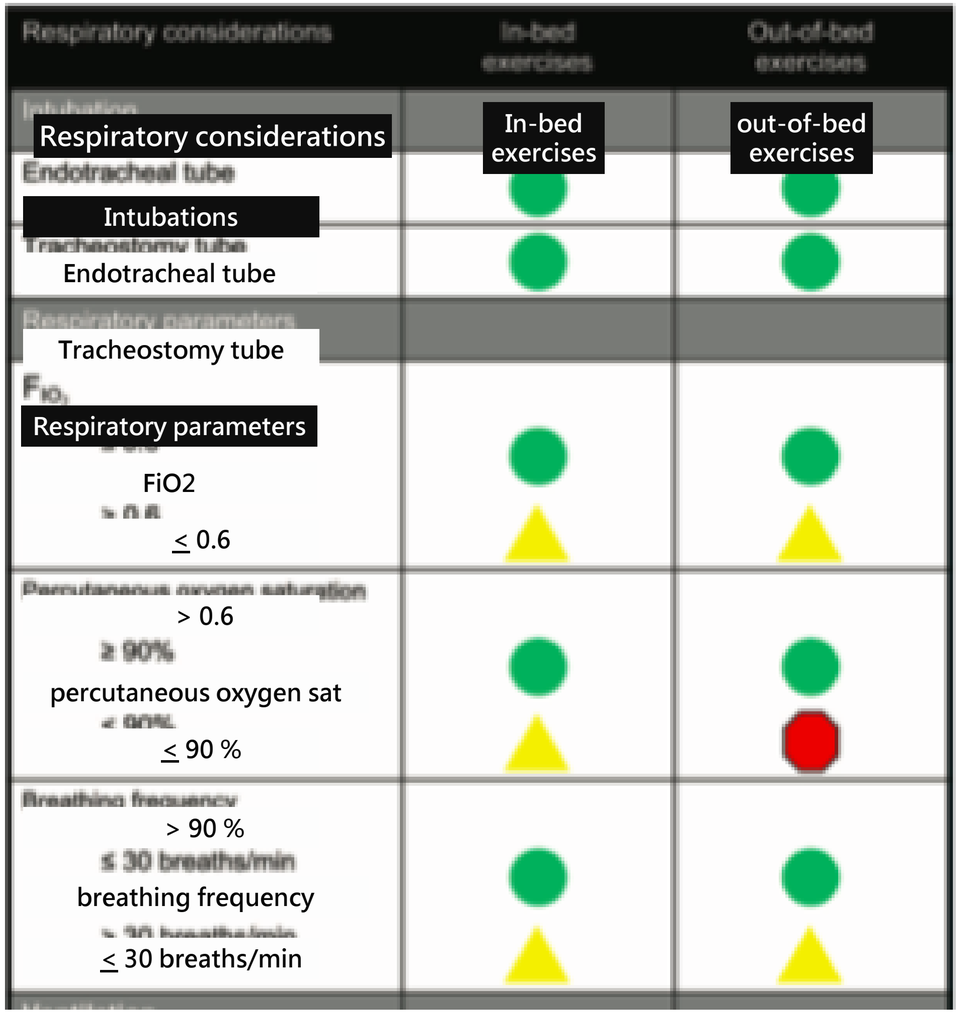
Early ambulation (day 1) is recommended in the majority of patients and is facilitated by using the radial access for PCI. Patients with extensive myocardial damage, heart failure, hypotension, or arrhythmias may initially rest in bed before assessment of myocardial function and achievement of clinical stabilization. Prolongation of bed rest and limitation of physical activity may occasionally be needed for patients with large infarcts or with severe complications depending on symptoms and ability.

- Early ambulatio jority of patients and is facilitated by using the radial access for PCI. Patients with extensive myocardial damage, heart failure, hypotension, or arrhythmias may initially rest in bed before assessment of myocardial function and achievement of clinical stabilization. Prolongation of bed rest and limitation of physical activity may occasionally be needed for patients with large infarcts or with severe complications depending on symptoms and ability.

Early Mobilization and Rehabilitation in the ICU: Moving Back to the Future

Mohamed D Hashem MD, Archana Nelliot, and Dale M Needham MD PhD

RESPIRATORY CARE • JULY 2016 VOL 61 NO 7



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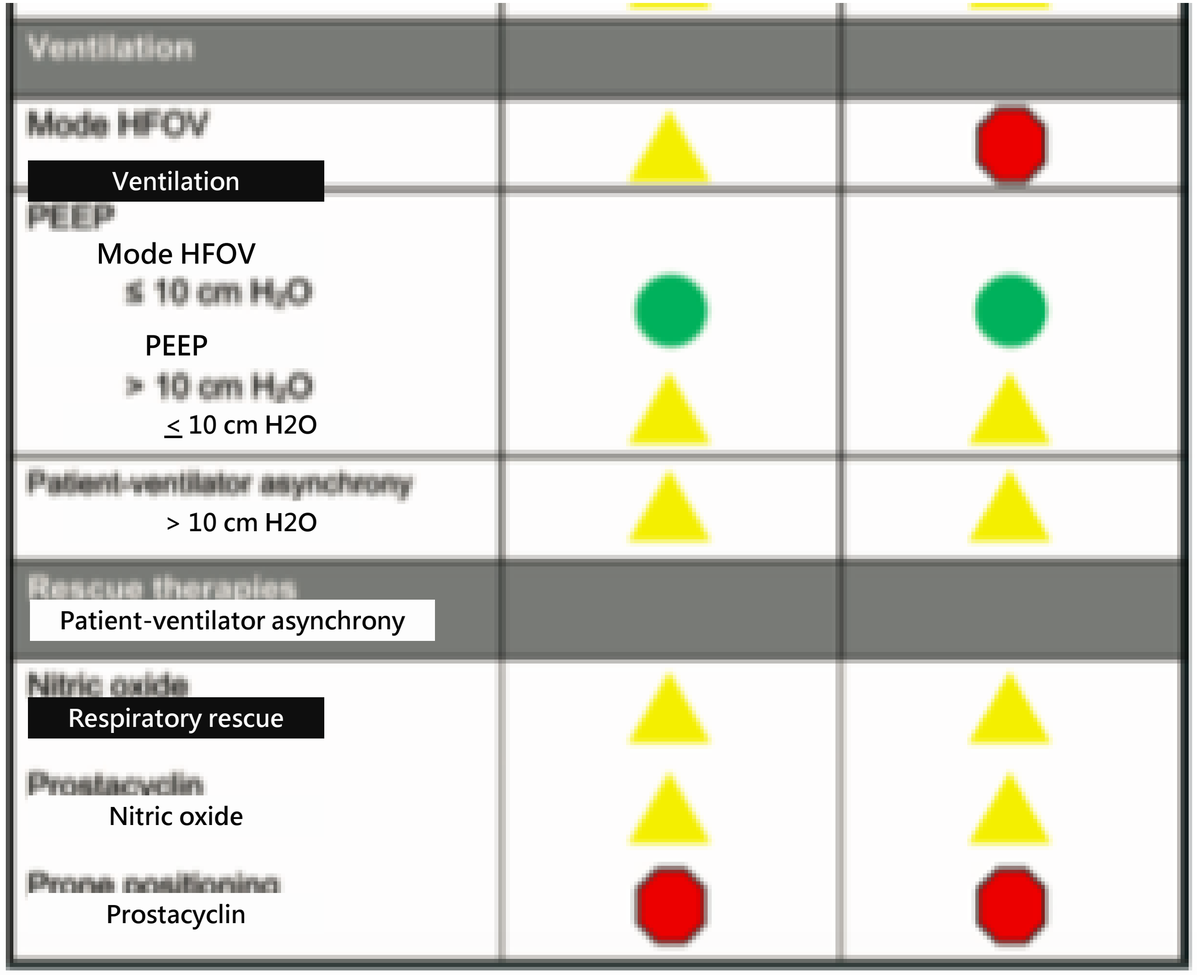

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Early Mobility in the Intensive Care Unit

Early ICU Mobility Therapy in the Treatment of Acute Respiratory Failure[1]

Design: Nonrandomized, controlled trial

Subjects: 330 medical ICU (MICU) patients requiring ventilation on admission

Interventions:

- Use of a mobility team
  - ICU registered nurse
  - ICU restorative nursing assistant
  - Physical therapy (PT)
- Implementing a rehabilitation protocol 7 days a week, starting within 48 hours of mechanical ventilation (MV)

1. Morris PE, Goad A, Thompson C, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Crit Care Med. 2008 Aug;36(8):2238-43. PMID: 18596631.

Main Outcomes[1]

Outcomes* (survivors)	Usual care (n=135)	Protocol (n=145)	p-value
% received PT	47%	80%	<0.001
Days to first out of bed	11.3	5.0	<0.001
Ventilator days	10.2	8.8	0.163
ICU length of stay (LOS)	6.9	5.5	0.025
Hospital LOS	14.5	11.2	0.006

*Outcomes were adjusted based on body mass index, the Acute Physiology and Chronic Health Evaluation II (APACHE II), and vasopressor use.

1. Morris PE, Goad A, Thompson C, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Crit Care Med. 2008 Aug;36(8):2238-43. PMID: 18596631.

Conclusions[1]

- Mobility therapy delivered early in the course of acute respiratory failure was shown to be—
  - Feasible
  - Safe
  - Cost effective
  - Associated with decreased ICU and hospital LOS

1. Morris PE, Goad A, Thompson C, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Crit Care Med. 2008 Aug;36(8):2238-43. PMID: 18596631.

Early Physical and Occupational Therapy[2]

Design: Randomized controlled trial (RCT) at University of Chicago and University of Iowa

Subjects: 104 MICU patients requiring MV

Interventions: Physical therapy (PT) and occupational therapy (OT) starting at day 1-2 versus usual care (PT and OT starting at day 6-10)

2. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. Lancet. 2009 May 30;373(9678):1874-82. PMID: 19446324.

Main Outcomes[2]

Primary Outcome of RCT	Intervention (n=49)	Control (n=55)	p-value
Return to independent functional status at hospital discharge	29 (59%)	19 (35%)	0.02
Barthel Index score at hospital discharge	75 (7.5-95)	55 (0-85)	0.05
ICU-acquired paresis at hospital discharge	15 (31%)	27 (49%)	0.09
Duration of mechanical ventilation (days)	3.4 (2.3-7.3)	6.1 (4.0-7.0)	0.02
ICU delirium (days)	2.0 (0.0-6.0)	4.0 (2.0-7.0)	0.03
LOS in the ICU	5.9 (4.5-13.2)	7.9 (6.1-12.9)	0.08
Hospital mortality	9 (18%)	14 (25%)	0.53
Discharge to home	21 (43%)	13 (24%)	0.06

2. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. Lancet. 2009 May 30;373(9678):1874-82. PMID: 19446324.

How was PT/OT provided to get benefits?[2]

Intervention

- -Passive range of motion
- -Active assistive range of motion
- -Active range of motion
- -Bed mobility
- Transfers (sitting)
- -Sitting balance
- -Activities of daily living
- -Transfers (standing)
- -Ambulation

Benefit is from receiving PT/OT EARLY while on mechanical ventilation

2. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. Lancet. 2009 May 30;373(9678):1874-82. PMID: 19446324.

Early Activity Is Feasible and Safe[4]

Design: Prospective cohort study

Subjects: Eight-bed respiratory ICU in a community hospital

- 103 patients

Interventions: Activity events

- Sit on bed
- Sit on chair
- Ambulate

4. Bailey P, Thomsen GE, Spuhler VJ, et al. Early activity is feasible and safe in respiratory failure patients. Crit Care Med. 2007 Jan;35(1):139-45. PMID: 17133183.

Activity Level on Last Day of Admission[4]

Activity	Total Group (n=85)	Age <65 (n=49)	Age ≥ 65 (n=36)
No activity	2 (2.4)	0	2 (5.6)
Sit on bed	4 (4.7)	2 (4.1)	2 (5.6)
Sit in chair	13 (15.3)	5 (10.2)	8 (22.2)
Ambulate ≤ 100 feet	7 (8.2)	6 (12.2)	1 (2.8)
Ambulate > 100 feet	59 (69.4)	36 (73.5)	23 (63.8)

4. Bailey P, Thomsen GE, Spuhler VJ, et al. Early activity is feasible and safe in respiratory failure patients. Crit Care Med. 2007 Jan;35(1):139-45. PMID: 17133183.

Adverse Events[4]

- 9 patients had 14 adverse events (<1% of activities)
  - Falls to knees without injury (5)
  - Systolic blood pressure <90 mmHg (4)
  - Oxygen saturation <80% (3)
  - Nasal feeding tube removal (1)
  - Systolic blood pressure >200 mmHg (1)
- No extubations
- No patients required added therapy or increased LOS
- No extra cost was incurred

4. Bailey P, Thomsen GE, Spuhler VJ, et al. Early activity is feasible and safe in respiratory failure patients. Crit Care Med. 2007 Jan;35(1):139-45. PMID: 17133183.

Conclusions

Conclusions – Benefits

- Decreased ICU and hospital length of stay[1,2]
- Decreased duration of mechanical ventilation and days with delirium[2]
- Increased return to independent functional status at hospital discharge[2]

1. Morris PE, Goad A, Thompson C, et al. Early intensive care unit mobility therapy in the treatment of acute respiratory failure. Crit Care Med. 2008 Aug;36(8):2238-43. PMID: 18596631.
2. Schweickert WD, Pohlman MC, Pohlman AS, et al. Early physical and occupational therapy in mechanically ventilated, critically ill patients: a randomized controlled trial. Lancet. 2009 May 30;373(9678):1874-82. PMID: 19446324.

Conclusions – Safety

- Adverse events ranged from agitation to transient physiological events to dislodgements and to falls (none of the falls were considered serious)
- Adverse events ranged from 2.3 to 8.7 per 100 patients[3-5]

3. Hodgson CL, Bailey M, Bellomo R, et al. TEAM Study Investigators. A binational multicenter pilot feasibility randomized controlled trial of early goal-directed mobilization in the ICU. Crit Care Med. 2016 Jun;44(6):1145-52. PMID: 26968024.

4. Bailey P, Thomsen GE, Spuhler VJ, et al. Early activity is feasible and safe in respiratory failure patients. Crit Care Med. 2007 Jan;35(1):139-45. PMID: 17133183.

5. Sricharoenchai T, Parker AM, Zanni JM, et al. Safety of physical therapy interventions in critically ill patients: a single-center prospective evaluation of 1110 intensive care unit admissions. J Crit Care. 2014 Jun;29(3):395-400. PMID: 24508202.

Conclusions – Feasibility

- There are significant barriers to overcome[6,7]
- However, the authors of all studies were in agreement that their early mobility program was feasible and it is a benefit to the patient

6. Clark DE, Lowman JD, Griffin RL, et al. Effectiveness of an early mobilization protocol in a trauma and burns intensive care unit: a retrospective cohort study. Phys Ther. 2013 Feb;93(2):186-96. PMID: 22879442.

7. Zanni JM, Korupolu R, Fan E, et al. Rehabilitation therapy and outcomes in acute respiratory failure: an observational pilot project. J Crit Care. 2010 Jun;25(2):254-62. PMID: 19942399.

Conclusions – Sustainability

- Dinglas et al. were able to show a 5-year sustainability in their early mobility program[8]
- Clark et al. plan to sustain their improvements by hiring more physical therapists to assure their success[6]

6. Clark DE, Lowman JD, Griffin RL, et al. Effectiveness of an early mobilization protocol in a trauma and burns intensive care unit: a retrospective cohort study. Phys Ther. 2013 Feb;93(2):186-96. PMID: 22879442.

8. Dinglas VD, Parker AM, Reddy DR, et al. A quality improvement project sustainably decreased time to onset of active physical therapy intervention in patients with acute lung injury. Ann Am Thorac Soc. 2014 Oct;11(8):1230-8. PMID: 25167767.

Early Mobilization in the Intensive Care Unit: A Systematic Review

Joseph Adler, PT, DPT, CCS[1]
Daniel Malone, PhD, MPT, CCS[2]

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[2]Physical Therapy Program, Department of Physical Medicine and Rehabilitation; University of Colorado; Denver, CO

Cardiopulmonary Physical Therapy Journal
Vol 23 No 1 March 2012

Physical& Physiologic barriers

- Did not walk before admission
- Trauma/surgical constrains
- Hemodynamic instability
- Additional exclusion
  - active ischemia or acr=tive bleeding
  - therapeutic sedation in status epileptics
  - On AIBP

initiating an early mobilisation protocol for mechanically ventilated pt.

- HR < 130 BPM
- Mean arterial pressure 60-100 mmHg
- FiO2 < 60 %
- PEEP ≤ 10 cm H2O
- SpO2 > 88 %

Cardiopulmonary Physical Therapy Journal
Vol 23 No 1 March 2012

When should EMP be deferred

- HR < 40 pr > 130 BPM
- RR < 5 or > 35 BPM
- SpO2 < 88 % for 1 minute
- BP < 90 mmHg or > 180 mmHg
- Elevated ICPs
- Change in patient presentation occurs
- New medical findings occurs

Cardiopulmonary Physical Therapy Journal
Vol 23 No 1 March 2012

A/E of EMP

- Fall to knees
- Hypoxemia
- Unschedules extubation
- orthostatic hypotension

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Early Mobilization Protocol @SAMITIVEJ (ADAPTED FROM OHSU)

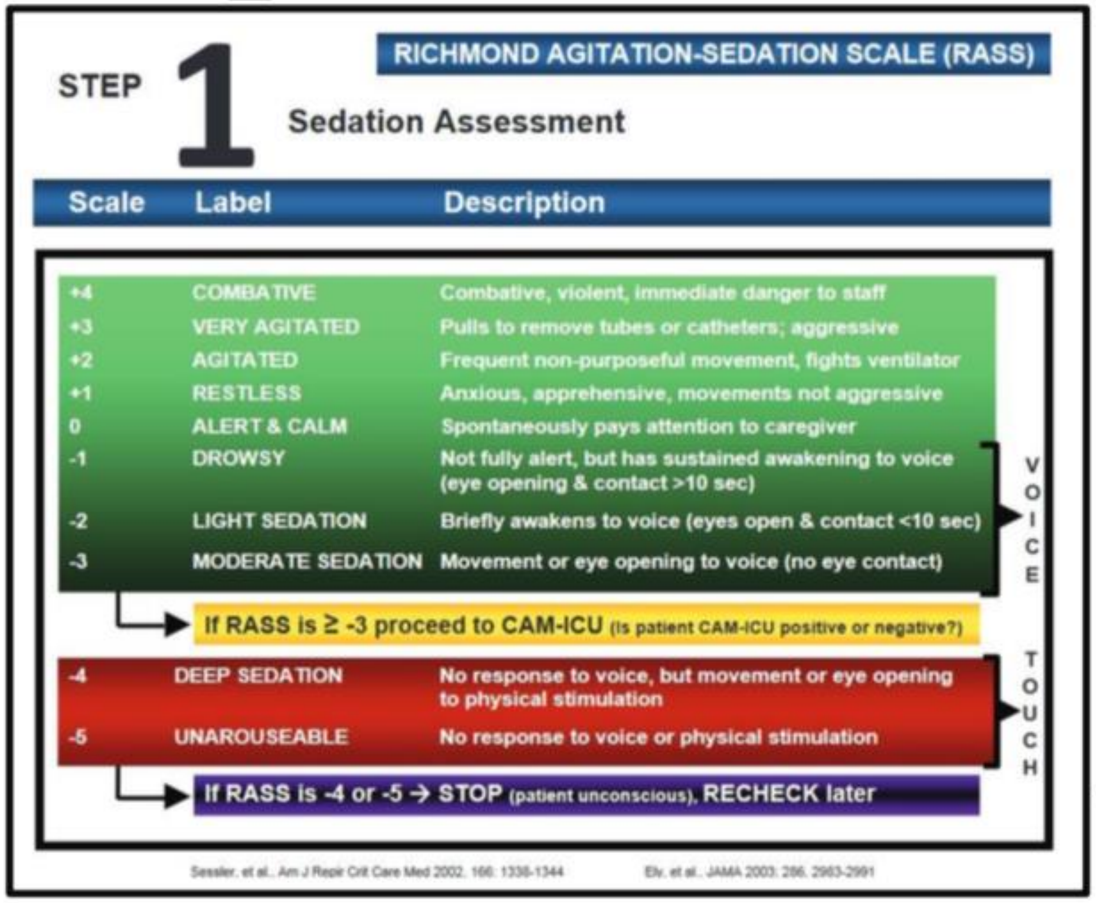
- Benefits of Early mobilization
  - Reduced length of ICU
  - Reduced length of hospital stays
  - Fewer days of detrimental bedrest
  - Fewer ICU readmissions (within one year)
  - Less post ICU mortality (within one year)
  - Decreased duration of mechanical ventilation • Improved walking distance
  - Minimal adverse or unsafe events

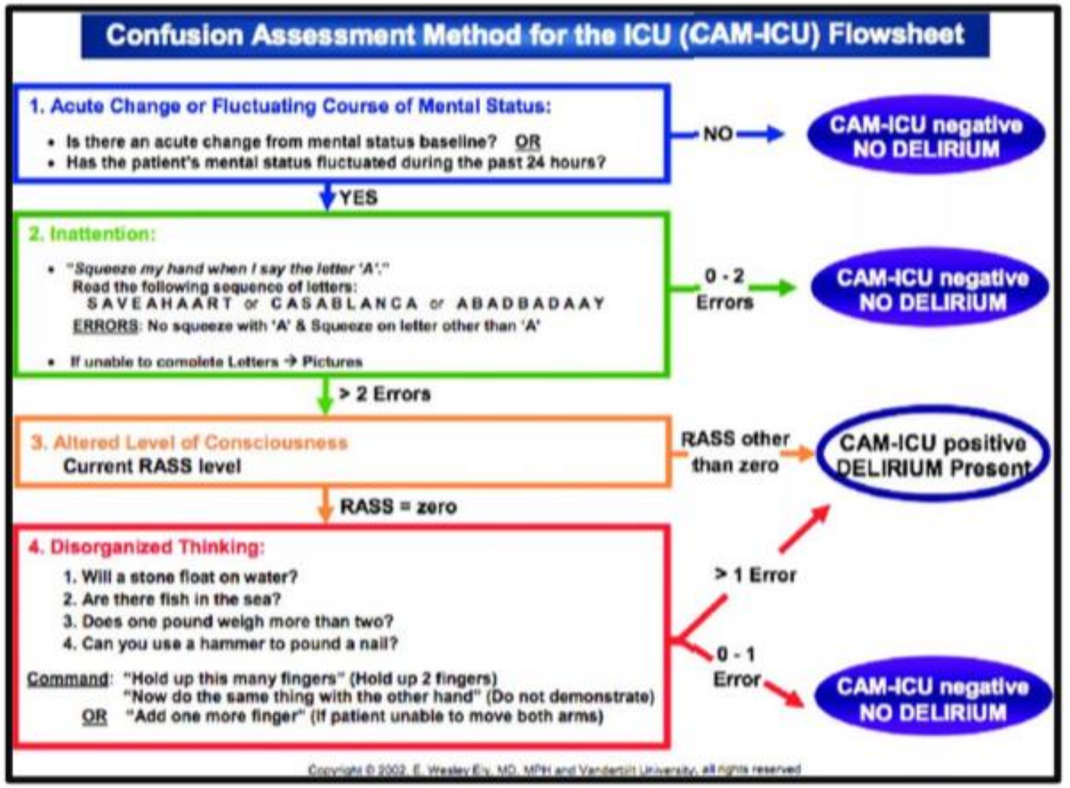
Spontaneous Breathing trials

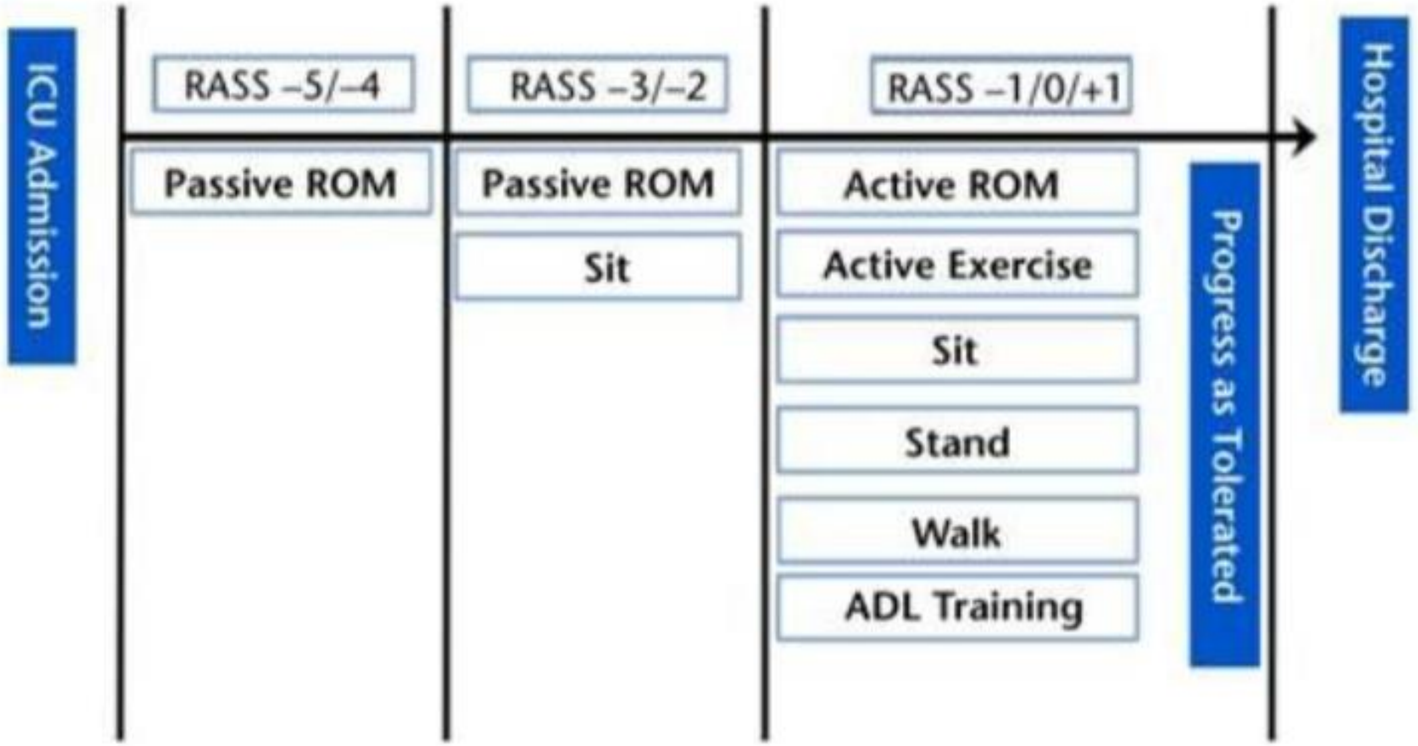
- Putting the patient on a minimum pressure support.
- PEEP (5cmH2O PEEP)
- Performing mechanics and extubating
- Using CPAP along or using a T-piece

ICU Liberation: ABCDEF Bundles

Symptoms Pain, Agitation, Delirium Guidelines	Monitoring Tools	Care ABCDEF Bundle
Pain	Critical-Care Pain Observation Tool (CPOT) NRS Numeric Rating Scale BPS Behavioral Pain Scale	**A:** Assess, Prevent and Manage Pain **B:** Both Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT) **C:** Choice of Analgesia and Sedation **D:** Delirium: Assess, Prevent and Manage **E:** Early Mobility and Exercise **F:** Family Engagement and Empowerment
Agitation	Richmond Agitation-Sedation Scale (RASS) Sedation-Agitation Scale (SAS)	
Delirium	Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) Intensive Care Delirium Screening Checklist (ICDSC)	

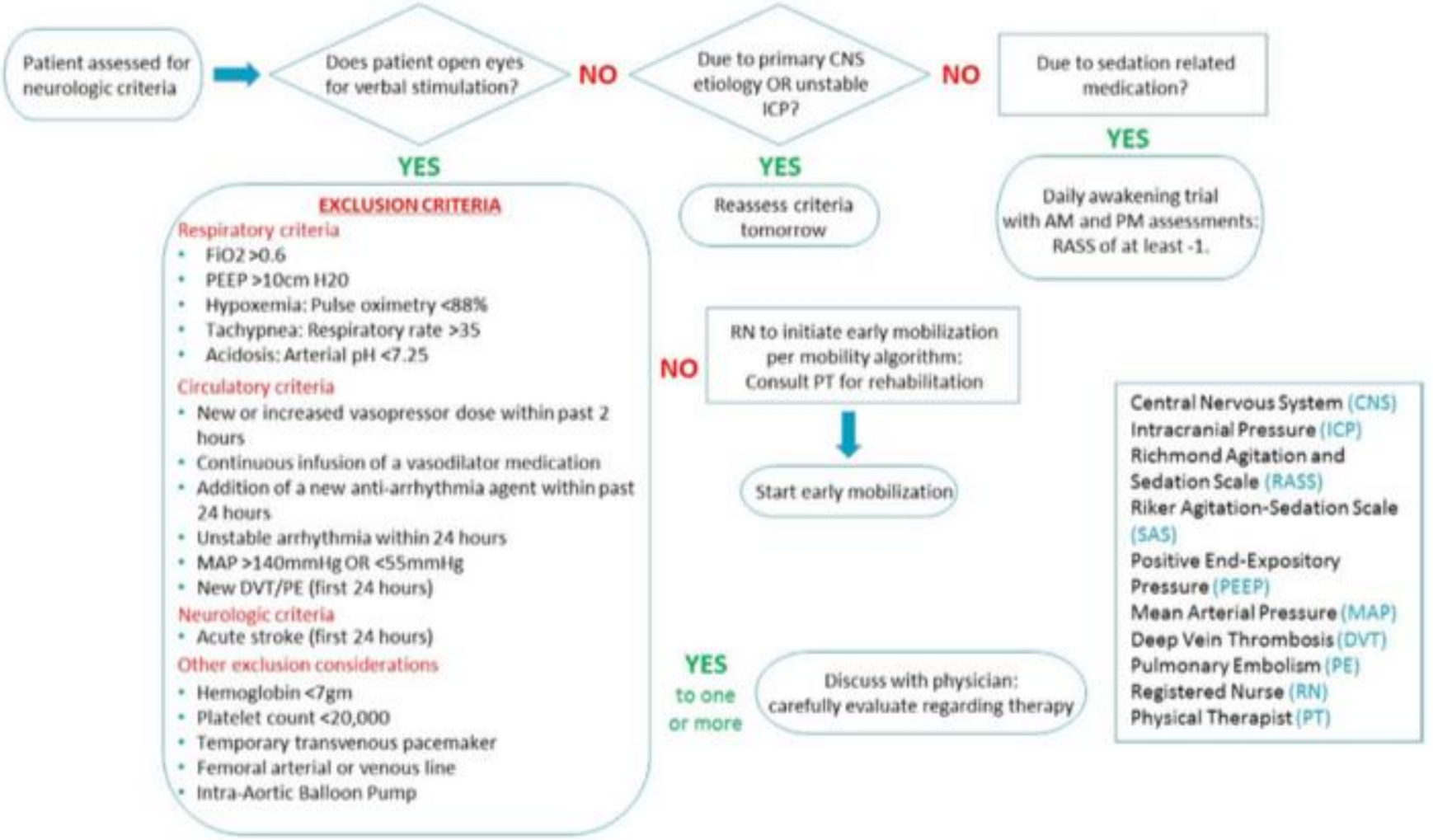


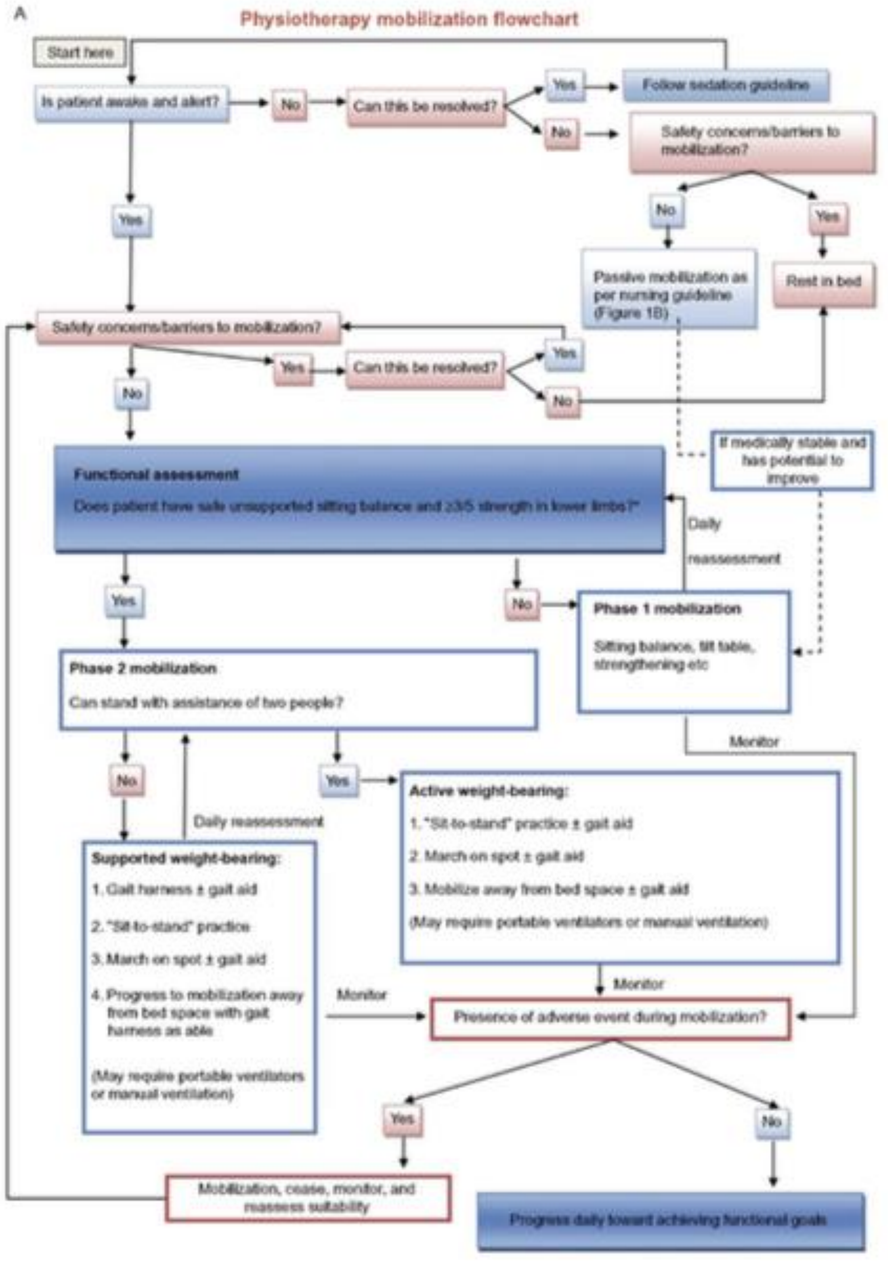




Appendix B. Medical Screening Algorithm

Medical screening algorithm to evaluate patient appropriateness for rehabilitation.





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Take home massages

- Exercise in ICU is benefit
- Exercise in ICU is safe (already monitoring)
- Can be a part of cardiac rehabilitation / starting of cardiac rehabilitation

Thank for your attention

ANY QUESTION ??

ชมรมป้องกันและฟื้นฟูหัวใจ

7th Asian Preventive Cardiology & Cardiac Rehabilitation Conference
Cum 11th Certificate Course in Cardiac Rehabilitation
8-11 November 2018 | Hong Kong Convention and Exhibition Centre
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