

# Early mobilization for mechanically ventilated patients in the icu

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# Effects of Prolonged hospital stays with mechanical ventilation

- Increased morbidity/mortality .
- Increased cost of care .
- Increased length of stay .
- Respiratory muscle weakness and increased duration of ventilation .
- Sleep deprivation .
- Lack of social interaction .
- Prolonged sedation .
- Delirium .



# Impairments seen with prolonged bed rest

- Increased respiratory dysfunction .
- Impaired strength .
- Physiologic impairments .
- Increased risk for skin breakdown .
- Decreased quality of life .



# What is Early Mobilization?

The initiation of mobility by sitting and standing out of bed when a patient is minimally able to participate, presents with hemodynamic stability and the patient receives acceptable levels of oxygen .



# Benefits of Early Mobilization

- Improve respiratory function .
- Reduce adverse effects of immobility .
- Increase levels of consciousness .
- Increase functional independence .
- Improve cardiovascular fitness .
- Increase psychological well-being
- Reduce the risk for delirium .



**Early  
mobilization**

**Daily wakeups**

**CAN  
ENHANCE  
FUNCTION  
AL STATUS**



**Spontaneous  
breathing trials**

# Spontaneous Breathing Trials

The best way to determine suitability for discontinuation of mechanical ventilation is to perform a spontaneous breathing trial :

- putting the patient on a minimum pressure support .
- PEEP ( 5cmH<sub>2</sub>O PEEP ) .
- performing mechanics and extubating .
- using CPAP alone or using a T-piece .

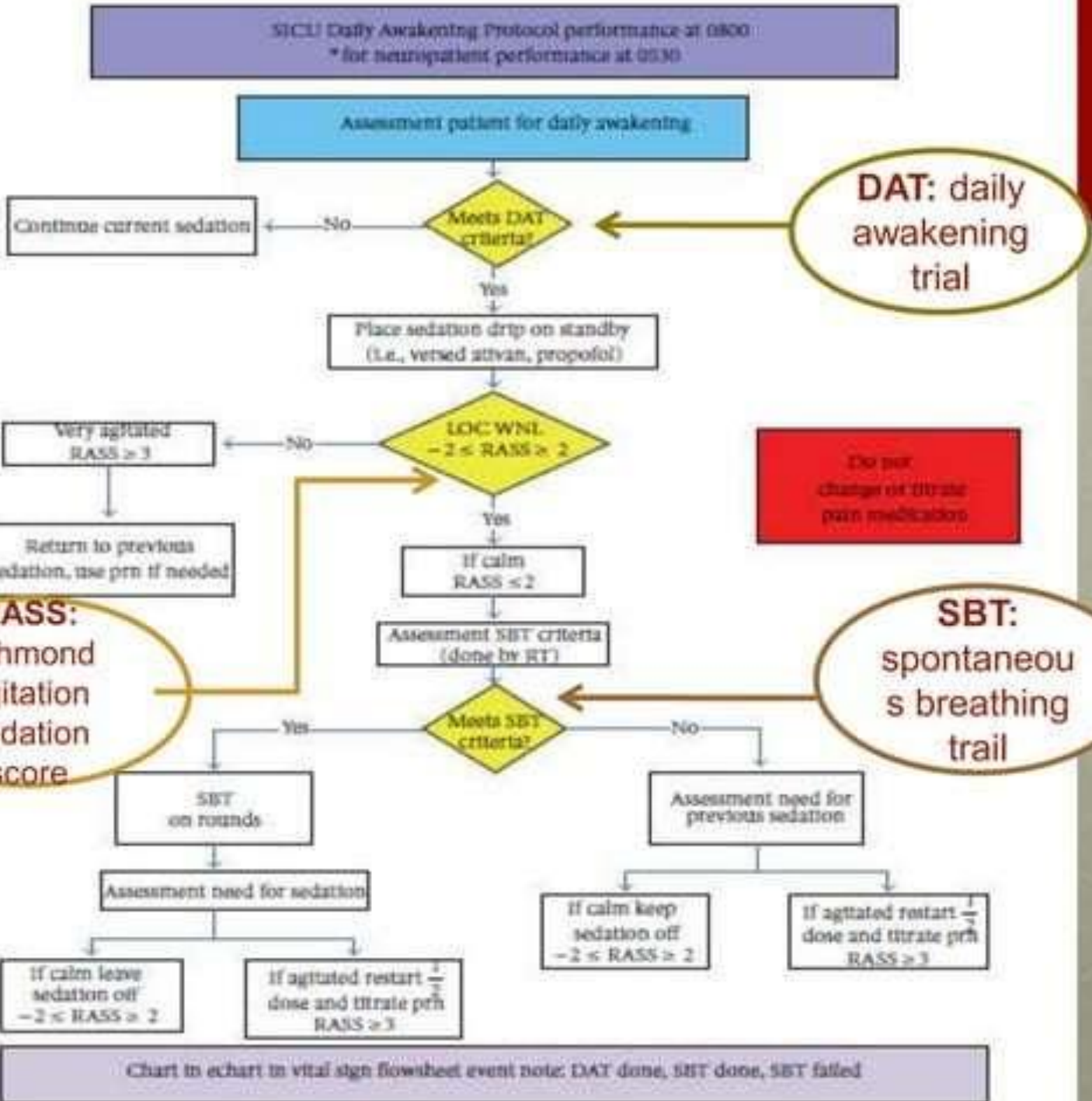
### DAT failure

- anxiety
- agitation
- Pain
- respiratory distress
- RR >30
- SPO2 <90

### SBT failure:

- HR > 120
- Arrhythmia
- RR >30
- SPO2 <90
- Rapid shallow breathing
- use of accessory muscle
- deterioration ABG

**RASS:**  
richmond  
agitation  
sedation  
score



DAT: daily awakening trial

Do not change or titrate pain medication


SBT: spontaneous breathing trial

Chart in chart in vital sign flowsheet event note: DAT done, SBT done, SBT failed



# RISK FACTORS for immobility

- > 4 days in an ICU
- mechanically ventilated
- confined to the bed
- Sedated
- acute illness



lose up to  
25%  
**peripheral  
muscle  
weakness**  
within 4 days

# Physical debilitation following critical illness



↓ functional status

# The upright position

- Whilst getting the ventilated weak patient up standing by using a standing/tilting device, the physiotherapists will be able to work with the patient on weight bearing, lower limb exercises, passive stretches and balance; it works as a support in the progression towards active mobilization. (*Chang et al 2004a*)
- Standing position during mechanical ventilation improves the respiratory function, compliance and oxygen, and it stimulates autonomic activity, and reduces cardiac stress from compression. (*Hoste 2005, Zhu Chang 2004b, Gosselink*



## Sitting in a reclined seating position is an alternative:

- Using a positioning device where the degree of reclining can be altered to meet the patient's need, provide an important advantage for patients who are very weak. (*Dean et al 2008*)
- For patients unable to stand, sitting in a chair helps prevent hypovolemia (*Wenger 1982*)



# Is it safe for our patients and staff ?



**If the patient is awake why can't she sit on the side of the bed, stand by the bed, pivot or walk to a chair, or walk in the hall? And if she's not awake, why not?**



# What are true physical and physiologic barriers

- Didn't walk before admission .
- Trauma/surgical constraints .
- Hemodynamic “instability” :
  - Hypoxia .
  - PEEP .
- Additional exclusions:
  - Active ischemia .
  - Active bleeding .
  - Therapeutic sedation :
    - Status epilepticus .
  - Devices IABP .



## Initiating an early mobilization protocol for mechanically ventilated patients

- Heart rate <130 beats per minute .
- Mean arterial pressure: 60-100 mm Hg .
- FiO<sub>2</sub>:<60% .
- PEEP ≤10 cm H<sub>2</sub>O .
- SpO<sub>2</sub> > 88% .





## When should an Early Mobilization Intervention be deferred/stopped ?

- HR  $<40$  or  $>130$  bpm .
- RR  $<5$  or  $>35$  bpm .
- SpO<sub>2</sub>  $<88\%$  for  $<1$  minute .
- SBP  $<90$  mm Hg or  $>180$  mm Hg .
- Elevated ICPs .
- Changes in patient presentation occur .
- New medical findings occur .



# Adverse Effects with Early Mobilization

## Adverse events are rare

- Fall to knees .
- Hypoxemia  $< 88\%$  SpO<sub>2</sub> for  $> 1$  minute .
- Unscheduled extubation .
- Orthostatic Hypotension  $< 80$  mm Hg SBP .

# RT's Role



## Table 1 Steps involved in coordinating awakening and breathing trials<sup>a,b</sup>

**Step 1. Spontaneous Awakening Trial (SAT) Safety Screen, Nurse-Driven:** The nurse will determine if it is safe to interrupt sedation by responding to a set of predefined safety screening questions. For example,

1. Is patient receiving a sedative infusion for active seizures?<sup>a</sup>
2. Is patient receiving a sedative infusion for alcohol withdrawal?<sup>a</sup>
3. Is patient receiving a paralytic agent (neuromuscular blockade)?<sup>a</sup>
4. Is patient's score on the Richmond Agitation Sedation Scale (RASS)  $>2$ ?<sup>a</sup>
5. Is there documentation of myocardial ischemia in the past 24 hours?<sup>a</sup>
6. Is patient's intracranial pressure (ICP)  $>20$  mm Hg?<sup>a</sup>
7. Is patient receiving sedative medications in an attempt to control intracranial pressure?<sup>b</sup>
8. Is patient currently receiving extracorporeal membrane oxygenation (ECMO)?<sup>b</sup>

**Step 2. Perform SAT—Nurse-Driven:** The nurse will determine if the patient tolerated interruption of sedation by assessing if the patient demonstrates any predefined criteria for SAT failure. For example,

1. RASS score  $>2$  for 5 minutes or longer<sup>a</sup>

2. Pulse oximetry reading  $<88\%$  for 5 minutes or longer<sup>a</sup>

3. Respirations  $>35/\text{min}$  for 5 minutes or longer<sup>a</sup>

4. New acute cardiac arrhythmia<sup>a</sup>

5. ICP  $>20$  mm Hg<sup>b</sup>

6. 2 or more of the following symptoms of respiratory distress<sup>a</sup>:

Heart rate increase 20 or more beats per minute, heart rate less than 55 beats per minute, use of accessory muscles, abdominal paradox, diaphoresis, dyspnea

# RT's Role

**Step 3. Spontaneous Breathing Trial (SBT) Safety Screen, Respiratory Therapist-Driven:** The **respiratory** therapist will determine if it is safe to perform an SBT by responding to a set of predefined safety questions. For example,

1. Is patient a long-term/ventilator-dependent patient?<sup>a</sup>
2. Is patient's pulse oximetry reading <88%?<sup>a</sup>
3. Is patient's fraction of inspired oxygen ( $F_{iO_2}$ ) >50%?<sup>a</sup>
4. Is patient's set positive end-expiratory pressure (PEEP) >7 cm H<sub>2</sub>O?<sup>a,b</sup>
5. Is there documentation of myocardial ischemia in the past 24 hours?<sup>a</sup>
6. Is patient's ICP >20 mm Hg?<sup>a</sup>
7. Is patient receiving mechanical ventilation in an attempt to control ICP?<sup>b</sup>
8. Is the patient currently taking vasopressor medications?<sup>a,b</sup>
9. Does the patient lack inspiratory effort?<sup>a</sup>

**Step 4. Perform SBT, Respiratory Therapist-Driven:** The **respiratory** therapist will determine if the patient tolerated the SBT by assessing if the patient demonstrates any predefined criteria for SBT failure. For example,

1. **Respiratory** rate >35 breaths per minute for 5 minutes or longer<sup>a</sup>
2. **Respiratory** rate <8/min<sup>a</sup>
3. Pulse oximetry reading of <88% for 5 minutes or longer<sup>a</sup>
4. ICP >20 mm Hg<sup>b</sup>
5. 2 or more of the following symptoms of **respiratory** distress<sup>a</sup>
  - a. Use of accessory muscles
  - b. Abdominal paradox
  - c. Diaphoresis
  - d. Dyspnea
  - e. Abrupt changes in mental status
  - f. Acute cardiac arrhythmia

<sup>a</sup> Criteria used in the Awakening and Breathing Controlled Trial (evidence-based).<sup>16</sup>

<sup>b</sup> Criteria added by example institution after interdisciplinary discussion.

**What is the Evidence  
Supporting  
Early ICU Mobilization**

# **Early activity is feasible and safe in respiratory failure patients**

Bailey P , Thomsen GE , Spuhler VJ , et al. Department of Medicine, Pulmonary and Critical Care Division, LDS Hospital, Salt Lake City, UT, USA.2007



**Purpose** :To determine whether early activity is feasible and safe in respiratory failure patients .

- This descriptive prospective cohort study evaluated a consecutive group of patients with respiratory failure admitted to the respiratory ICU at LDS Hospital in Salt Lake City, Utah.
- Patients were mechanically ventilated for > 4 days and were cared for in a respiratory ICU.
- Patients had typically been cared for in another ICU for an average of 10 days prior to transfer to the respiratory ICU.

- In order to initiate mobilization, patients were required to be:
  - responsive to verbal stimulation
  - have both respiratory and cardiovascular "stability"
    - $FiO_2 < 0.6$ ,
    - $PEEP < 10$  cm H<sub>2</sub>O
    - Absence of orthostatic hypotension
    - Absence of catecholamine
- Mobilization occurred under the direction of:
  - physical therapist
  - respiratory therapist
  - nurse
  - critical care technician

# ACTIVITIES :

- sitting on the edge of the bed
- sitting in a chair after bed transfer
- and ambulating.

- The investigators studied 103 patients undergoing 1,449 activity events
  - More than one-half of the activity events were actual ambulation
  - 40% occurred in intubated, mechanically ventilated patients.

# RESULT :

- 85% of 103 patients survived to hospital discharge;
  - their median ambulation distance was 200 feet.
  - Adverse events were extremely rare.
  - There were five falls to knees without injury,
  - four systolic BP decreases below 90 mm Hg,
  - one systolic BP increase above 200 mm Hg,
  - three decreases in oxygen saturation as measured by pulse oximetry below 80%
  - one enteral feeding tube removal.
  - There were no unplanned extubations.

# CONCLUSIONS :

- We conclude that early activity is feasible and safe in respiratory failure patients.
- A majority of survivors (69%) were able to ambulate >100 feet at RICU discharge.
- Early activity is a candidate therapy to prevent or treat the neuromuscular complications of critical illness.

**Patients with respiratory failure  
increase ambulation after transfer  
to an intensive care unit where  
early activity is a priority**

Thomsen GE , Snow GL , Rodriguez L , Hopkins RO .  
Department of Medicine, LDS Hospital, Salt Lake City,  
UT, USA. *Crit Care Med* . 2008



# One year later ,

- The same group of investigators sought to determine whether mobilization was improved upon transfer to their respiratory ICU, where a culture of early ambulation had been established.

# RESULT :

- Ambulation was noted to be more likely in females (P , .019),
- in those who were less sick (ie, lower APACHE P , .017),
- in those who did not receive sedation (P , .009)
- in those who were transferred to the respiratory ICU from another location (P , .0001)

# CONCLUSIONS :

- Transfer of acute respiratory failure patients to the respiratory intensive care unit substantially improved ambulation, independent of the underlying pathophysiology.
- The intensive care environment may contribute unnecessary immobilization throughout the course of acute respiratory failure.
- Sedatives, even given intermittently, substantially reduce the likelihood of

Take up thy bed and walk!



# References

- Developing a Mobility Protocol for Early Mobilization of Patients in a Surgical/Trauma ICU , Meg Zomorodi, Darla Topley, and MaireMcAnaw, 11 July 2012.
- Clinical review: Early patient mobilization in the ICU, Carol L Hodgson\*1,2, Sue Berney3,4, Megan Harrold5,6, Manoj Saxena7,8,9 and Rinaldo Bellomo1
- Bailey P , Thomsen GE , Spuhler VJ , et al . Early activity is feasible and safe in respiratory failure patients . *Crit Care Med* . 2007 ; 35 ( 1 ) : 139 - 145 .
- Thomsen GE , Snow GL , Rodriguez L , Hopkins RO . Patients with respiratory failure increase ambulation after transfer to an intensive care unit where early activity is a priority . *Crit Care Med* . 2008 ; 36 ( 4 ) : 1119 - 1124 .