

Coordinating Spontaneous Breathing and Spontaneous Awakening*

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* Problems in Translating Clinical Research into Bedside Practice

Conflict of Interest

I have no real or perceived conflict of interest that relates to this presentation. Any use of brand names is not in any way meant to be an endorsement of a specific product, but to merely illustrate a point of emphasis.

Presentation Outline

- Ockham's Razor (as it applies to weaning)
- Pre-History or How we got here!
- Delirium and PTSD
- Different Sedation Practices
- Review of Important Clinical Trials on Sedation
- Pragmatic Issues of Coordinating DSI with SBT
- DSI in the era of targeted light sedation
- The impact of DSI-SBT-TLS in a non-research setting

Ockham's Razor (as it Applies to Weaning)



- The explanation requiring the fewest assumptions is most likely to be correct." ...
- "With all things being equal, *the simplest explanation tends to be the right one.*"
- patients sufficiently *recovered* from acute respiratory failure breathe without assistance when their minute ventilation demand decreases to the point that their respiratory muscles can handle the increased workload (imposed by *residual abnormalities in chest mechanics*).

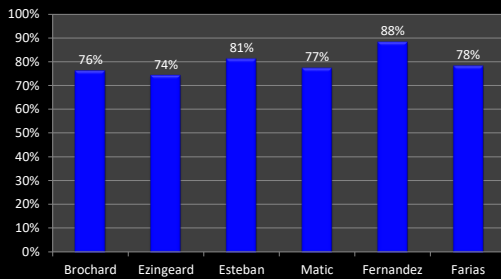
Pre-History of a Rational Approach to Discontinuing Mechanical Ventilation

- Two greatest impediments to past weaning practices: overly liberal sedation practices + overly conservative weaning practices.

Overly Conservative Weaning Practices

- 1970s: IMV concept of *gradual withdrawal*
- "almost all patients requiring ventilatory support for more than 24 hours develop *discoordinated breathing*" John Downs 1980 (Inventor of IMV)
- 1980s: PSV borrowed model *gradual withdrawal*
- IMV+PSV compounded the problem
- "Depending on the case mix of any ICU, the weaning success rate is usually higher than 70%. A prospective study made in our MICU showed that 19% of our patients who were mechanically ventilated for more than 24hrs had a weaning time longer than 2 days" Francois Lemaire 1993

RCTs (1994-2005): Successful Rate Extubation Following SBT



Protocolized weaning and SBT tends to reduce MV ~ 1 ½ to 2 Days

Overly Liberal Sedation Practices (part 1)

- Core Issue: “agitation...should not be regarded as a sedative deficiency...and it is critical that correctable problems be excluded”[†]
- “the most common error is inadequate use of analgesics particularly insufficient doses, too infrequent schedule or reliance on ultra-short-acting agents.”

[†]Wheeler AP. Sedation, analgesia and paralysis in the intensive care unit. Chest 1993

Overly Liberal Sedation Practices (part 2)

- Continuous Infusions → More even sedation/analgesia w/ less “breakthrough”.
- Reliance on ↑infusion rather than supplementing infusions with prn boluses contributed to problem. (ie. cont infusions take time to work→ illusory “lack of effect”
- Grey Area:
 - need for anesthetic doses of analgesia →↑ likelihood adverse effects.
 - Difficult to separate pain from anxiety
 - Benzodiazepines can lower analgesic requirements → seductive logic of adding sedative infusions to lower analgesic requirements

[†]Wheeler AP. Sedation, analgesia and paralysis in the intensive care unit. Chest 1993

Sedation & Analgesia in the ICU

- **The Good**
 - ↓ stress response (by ↓ pain, anxiety, dyspnea)
 - ↓ VO₂ and VCO₂
 - ↑ vent synchrony
 - ↓ risk of Harm (ETT, catheter loss, etc)
 - Facilitates nursing care
- **The Bad**
 - Respiratory depression: ↑ LOMV/ICULOS
 - ↑ Risk for delirium (33% of ICU admissions)
 - ↑ incidence of hypotension,
 - ↑ VAP
 - ↑ VIDD
 - ↓ ability to assess patient (↑costs : more CT, MRI exams)
 - ↓ GI Motility (risk of Ileus → sepsis)
 - Acute withdrawal syndrome
- **The Ugly**
 - ↑ mortality
 - Prolonged psychiatric issues following hospital discharge (PTSD)

Delirium

- Syndrome of acute cerebral dysfunction or “acute confusional state” characterized by:
 - change in mental status ,
 - inattention
 - disorganized thinking
 - or altered level of consciousness
- Affects up to 80% of MV, critically-ill pts
- Independent risk factor for death
- 10% ↑ mortality risk per day of delirium

Many Factors Contribute to the Development of Delirium

- Benzodiazepines
 - Opiates
 - Antihistamines
 - furosemide
 - Systemic corticosteroids
 - Acute stress*
 - Sleep deprivation, fractured sleep
- } Central anticholinergic effect

Post-Traumatic Stress Disorder

Table 1
Examples of "Common" Clinical Complaints in ICU Survivors With PTSD

| Everyday "Expressions" of Symptoms |
|--|
| Avoidance of medical clinics, hospitals, and participation in medical procedures |
| Intense, future-oriented concerns about the reemergence of illness |
| Hypervigilant preoccupation with somatic symptoms – large or small |
| Preoccupation with thoughts of "delusional memories" from ICU hospitalization |
| Confusion over which memories were of critical illness and intensive care were "real" |
| Social disengagement and isolation related to fear of "germs" or "getting sick" |
| Claustraphobia, related to memories of being restrained or held down in the ICU |
| Refusal to watch medically oriented news or television shows that dramatize hospital life – e.g., <i>ER</i> or <i>Grey's Anatomy</i> |
| Reactivity related to noises similar to those occurring in an ICU – e.g., "beeping" sounds |

Note. ICU = intensive care unit; PTSD = posttraumatic stress disorder.

Jackson JC et al. Rehab Psych 2016

Sedation Scales

Ramsey Sedation Scale

1. Anxious+ Agitated, Restless
2. Cooperative, Oriented, Tranquil
3. Responds to Commands
4. Brisk Response to Stimuli
5. Sluggish Response to Stimuli
6. No Response to Stimuli

Richmond Agitation Sedation

- 4+ Combative
- 3+ Very Agitated
- 2+ Agitated
- 1+ Restless
- 0 Alert & Calm
- 1 Drowsy
- 2 Light Sedation
- 3 Moderate Sedation
- 4 Deep Sedation
- 5 Unarousable Sedation

Sedation Strategies

Pt Targeted Sedation:

- Sedation based on clinician assessment of an "appropriate level" of arousal & comfort
- Sedation assessed by RASS or Ramsey Sedation Scale

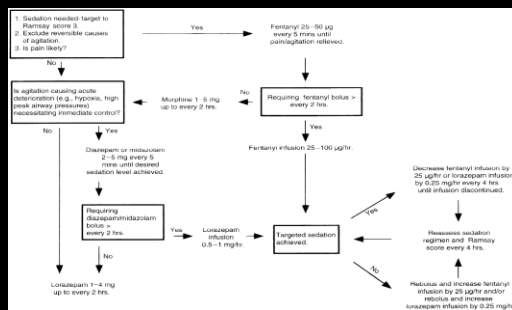
Targeted Light Sedation:

- Ramsey of 3 (respond commands)
- Relies of frequent small boluses of sedatives and analgesics (~ q5m) for 2 h.
- >2h w/o control → start infusions w/ boluses if needed.
- Potentially very labor intensive

Spontaneous Awakening Trial

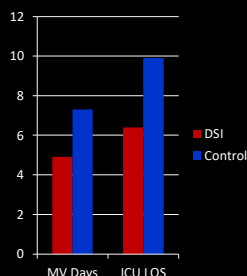
- (Kress) 48hr after enrollment
- Randomized Propofol/Midazolam cont infusion (+Morphine)
- Ramsey of 3-4
- DSI of all infusions
- RN remained at bedside until awake or uncomfortable
- Awake: Further evaluated
- Uncomfortable: Re-start @ 50% dose and titrated further.
- Same for those awake but judged to require further sedation

Targeted Light Sedation



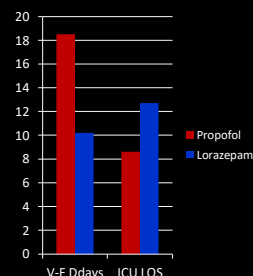
Evidence for DSI (Kress 2000)

- RCT
- MICU, N = 128
- ~30% ARDS, 21% Sepsis, 38% COPD/Asthma
- DSI only
- Both sedatives & analgesia interrupted until awake or uncomfortable.
- Following evaluation those requiring sedation restarted at 50% & titrated after wards
- Control group: SI done only at clinician discretion



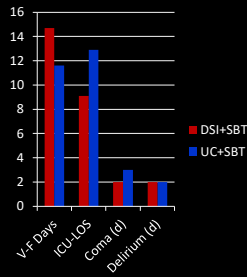
Evidence for DSI: Carson 2006

- RCT Open Label
- MICU, N = 132
- ~40% ARDS, 20% Septic Shock
- >48h MV + Lorazepam > 10mg/h (or other sed)
- Lorazepam Bolus 2-4 mg/Q-4 (+ 2-4 mg prn sups) vs.
- Propofol 5ug/kg/m up to 80 titrated Q-10min
- Target: Ramsey 4 (brisk respn)
- Protocol for analgesics
- DSI in both groups

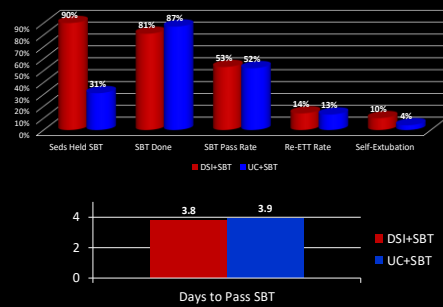


Evidence for DSI + SBT (Girard 2008)

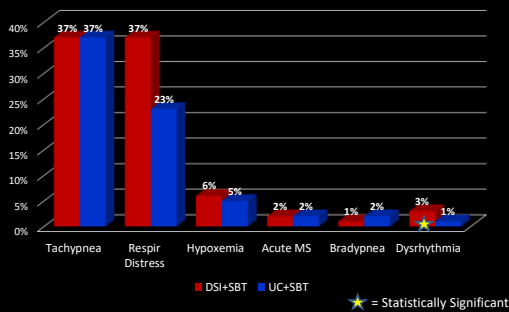
- RCT
- MICU, N = 336
- DSI+SBT vs. UC + SBT
- Pt-targeted sedation
- 50% ARDS, ~10% COPD, ~15% Cardiac
- DSI: all sedatives & analgesics stopped.
- + DSI: opened eyes to stimuli or tolerated 0 sedx x 4hr
- Failure: restarted at 50% dose



Girard Study: A Closer Look

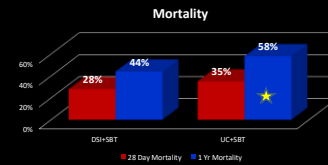


Girard Study: A Closer Look #2



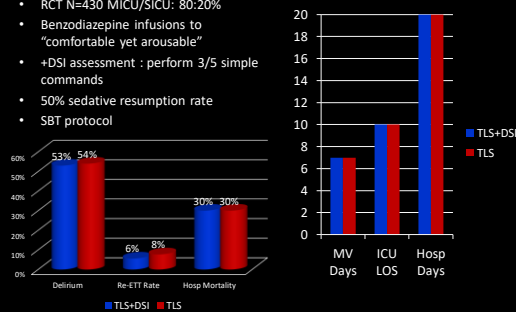
Girard Study: Important Points

- Patients in the DSI+SBT were more alert on the day an SBT was passed.
- Hence 54% were extubated vs. 40% in SBT+UC group.



Evidence: TLS+DSI vs. TLS (Mehta 2012)

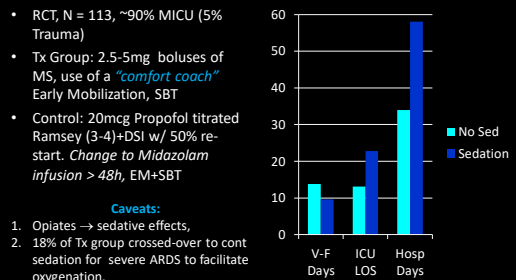
- RCT N=430 MICU/SICU: 80:20%
- Benzodiazepine infusions to "comfortable yet arousable"
- +DSI assessment : perform 3/5 simple commands
- 50% sedative resumption rate
- SBT protocol




Strom Study: Analgesia w/o Sedation

- RCT, N = 113, ~90% MICU (5% Trauma)
- Tx Group: 2.5-5mg boluses of MS, use of a "comfort coach" Early Mobilization, SBT
- Control: 20mcg Propofol titrated Ramsey (3-4)+DSI w/ 50% re-start. Change to Midazolam infusion > 48h, EM+SBT

- Caveats:**
1. Opiates → sedative effects,
 2. 18% of Tx group crossed-over to cont sedation for severe ARDS to facilitate oxygenation.
 3. Use of coaches impractical





Healthcare Delivery as an Industry

Solve the following problem

Reality Based-Scenario: 14 bed Med-Surg ICU & 12 intubated pts:
 8: meet or have already met weaning-readiness criteria.
 4: failed previous SBT (2 failed x 1, 1 x 2, 1 x 6)
 4: require first time trial
 3: have 1:1 pt/RN ratio,
 5 have 2:1 pt/RN ratio
 4: ICU team is ambivalent whether +SBT/DSI will be followed by extubation trial.
 2: are scheduled for procedures (CT, MRI and endoscopy)

Solve for: A.) 1 RT assigned to the unit, B.) 2 RTs assigned along with MERT/Code Blue beeper

Practical Solution

- **High Priority Likely Expedited to Extubation**
- $MV \leq 2$ days
- Condition unambiguous resolution (CHF, intra-op fluid overload, prolonged PAR)
- Absence of neurological/neuromuscular issues
- $V_E < 10$ L/m; $C_{RS} > 50$ mL/cmH₂O
- **No pending procedures**
- No pressors

- **Lower Priority: Less-likely to be Extubated**
- $MV \geq 5$ days
- Ambiguous resolution: ARDS, Sepsis, Post-Arrest, abdominal compartment syndrome, morbid Obesity
- neurological/neuromuscular issues
- $V_E \geq 12$ L/m; $C_{RS} < 40$ mL/cmH₂O
- Pending procedures
- Low-moderate pressors *

* Technically pressors ≠ meeting WR Criteria. Gets violated quite frequently

Who Truly Needs Anesthetic Levels of Sedation/Analgesia in the ICU ?

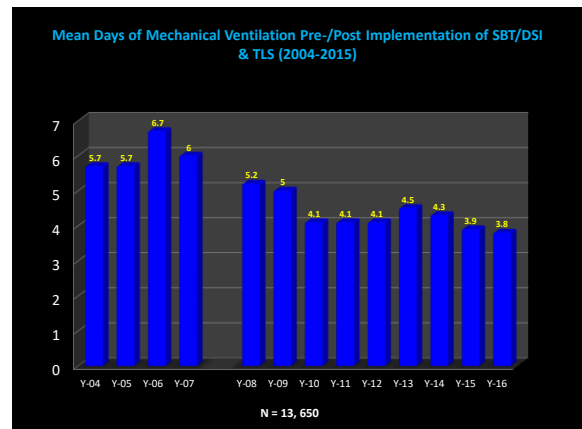
The Golden Hours of Critical Illness

- Severe infection and trauma, often leading to ARDS result in a profound proinflammatory state believed to be maladaptive
- Evidence suggests that therapies perpetuating or amplifying inflammation during the early phase may tip the balance towards greater mortality.
- $\uparrow V_p$, $\uparrow V_E$, $\uparrow Pplat$ -PEEP, hyperoxia, *severe asynchrony*, insufficient PEEP are likely culprits.
- There is *suspicion* that the first 2-3 days may be crucial
- These are only a minority of patients in whom anesthetic levels of sedation/analgesia should be targeted, particularly in the first few days.

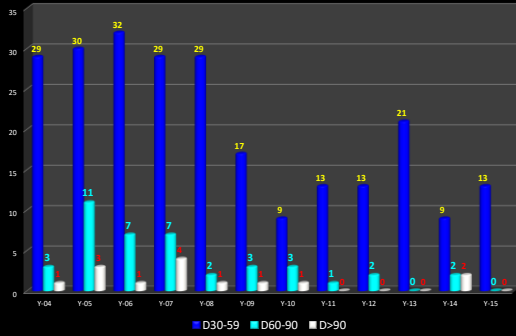
Does ICU Population Characteristics Matter?

- Most sedation studies focused on MICU pts
- Sedative requirements in trauma victims may be > medical or surgical ICU patients
 - Severe anxiety disorders often develop following exposure to severe stressor (e.g. MVA, assault, GSW, SW)
 - Intense fear, helplessness, horror that manifests in the ICU
 - “Fight or Flight”
 - Magnified by ETT/MV, restraints, unfamiliar environment
- Critically-ill patients with complicated psychiatric and drug abuse histories present greater challenges and are more likely to be victims of trauma

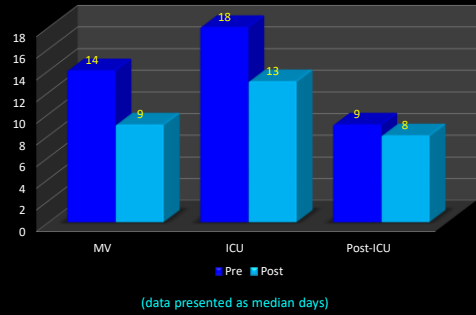
Impact of SBT,DSI,TLS in a Major Urban Area Pubic Hospital and Level I Trauma Center



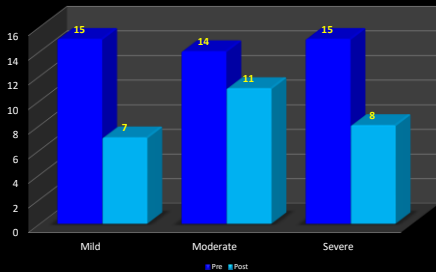
Special Issues: Long-Term MV Cases (≥ 30 days)



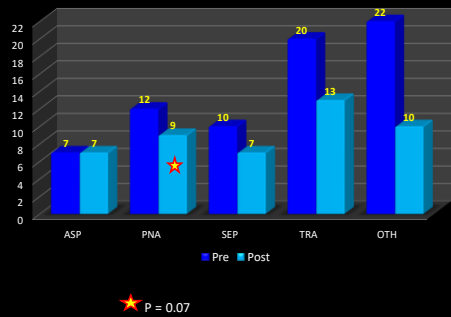
SBT/DSI Reduced MV Days, ICU LOS in ARDS Survivors



SBT/DSI Reduced MV Days Regardless of ARDS Severity



SBT/DSI Impact on Reducing MV Days in ARDS Associated w/ Sepsis Trauma and Other Causes



Summary

- Many, often unavoidable factors associated with ICU care ↑ likelihood for delirium
- Delirium ↑ risk of death, likelihood of PTSD
- Generous sedative use substantial risk factor for developing delirium and PTSD
- Hx weaning & sedation practices primary culprits in the problem of delirium (and PTSD)
- Difficulty in differentiating pain from anxiety
- Incorporation of DSI, SBT and TLS, along with other practices (early mobility, sleep promotion) improve outcomes