Society of Thoracic Surgeons
Adult Cardiac Surgery Database

Quality Improvement Series: Decreasing Vent Times

NorthShore University HealthSystem
Evanston Hospital

September 20, 2023

Agenda

- Welcome and Introductions
- STS Updates
- NorthShore University HealthSystem

STS National Database™
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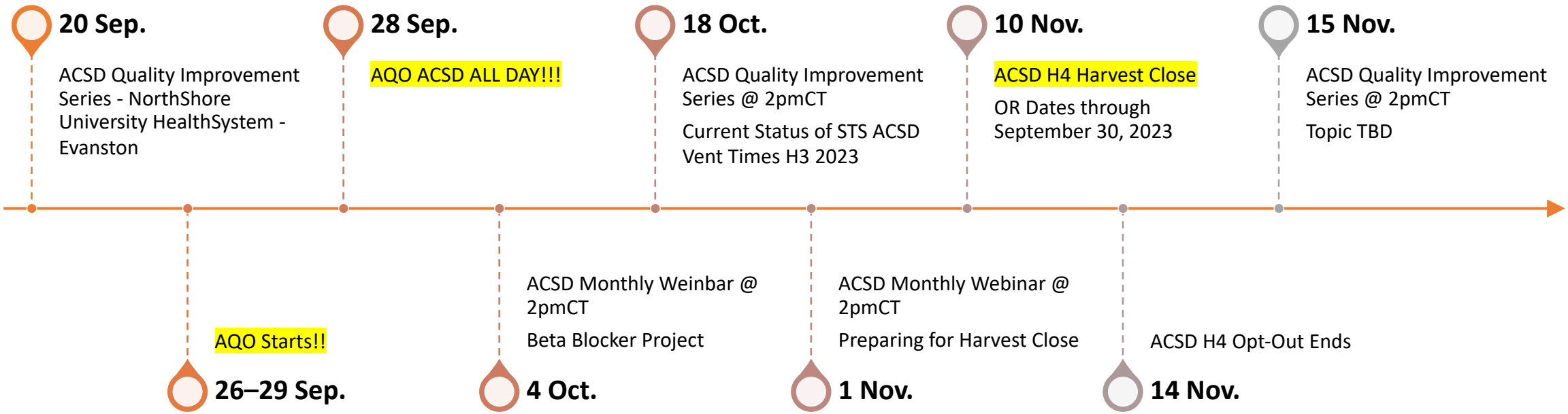
Important Dates for Adult Cardiac



STS National Database™
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STS Updates

AQO Platform is Now OPEN!

H3 data is in Analysis

Still In-Hospital Patients

NorthShore University HealthSystem
Evanston Hospital

Affiliated with The University of Chicago Pritzker School of Medicine

STS ACSD Data Drives Quality Improvement and Furthers Research Decreasing Intubation Time for Cardiovascular Surgery

Hyde M. Russell, MD Chief, Division of Cardiac Surgery

Hannah Whitney RN AACC CV Surgery Quality Manager

Valerie Reed, MSN, AG ACNP-BC, CCRN

Steven Greenberg, MD, FCCP, FCCM Chair of Anesthesiology Research and Education

Noah Ben-Isvy BS Research Assistant, Department of Anesthesia

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NorthShore University HealthSystem:

STS Adult Cardiac Surgery Database Drives Quality Improvement

Valuable Source of Validated Data

Hyde M. Russell, MD , FCCP, FCCM

Chief, Division of Cardiac Surgery

NorthShore University HealthSystem

Clinical Professor, Department of Surgery University of Chicago

NorthShore University HealthSystem

Cardiovascular Institute NorthShore University HealthSystem

Cardiac Surgery performed at both Evanston Hospital & Highland Park Hospital

Team covers both hospitals

4 Cardiac Surgeons 2 APNs 5 PAs 6 Perfusionists

Evanston Hospital

17 Operating Rooms 2 Heart Rooms 1 Hybrid Room

165 Annual Case Volume 2022

60 isoCAB 20 MVRR 15 isoAVR 20 isoValve+Valve/CAB+Valve

50 Other In 2022: 22 Aortic Procedures (includes 9 dissections) 13 AVRs+other

Does NOT include TVT procedures, LVAD or ECMO

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STS Adult Cardiac Surgery Database Drives Quality Improvement

1. CV Surgery STS Iso CAB Quarterly Summary
2. CV Surgery M&M Review Report qtr
3. CV Surgery STS ACSD RA Dashboard qtr
4. CV Surgery Quality Initiatives
   - MVRR Appropriateness Audit annually
   - Monitoring Aortic Dissections
   - Identify EMR and documentation issues
5. Research

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CV Surgery ICU Handoff
&
ICU Nurse-Driven Spontaneous Awakening Trial (SAT) and Spontaneous Breathing Trial (SBT)

Valerie Reed, MSN, AG ACNP-BC, CCRN

CV Surgery

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NorthShore University HealthSystem CV Surgery ICU Handoff

Participants: CV Surgery, Anesthesia, Critical Care, ICU RN, Perfusion, Respiratory

CV Surgery

- Patient Name / Height / Weight
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NorthShore University HealthSystem CV Surgery ICU Handoff cont.

Post Operative Plan

CV Surgery

- Plan: A or Plan: B Patient *
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- Fast Track to Extubation? If yes, note goal extubation time
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Critical Care

- Ventilator Settings
- Sedation (Weaning) Plan
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RN to clarify any questions/concerns prior to termination of huddle

* Plan A-"Fast track"
Plan B-"Delayed" or "Other"

02/2023

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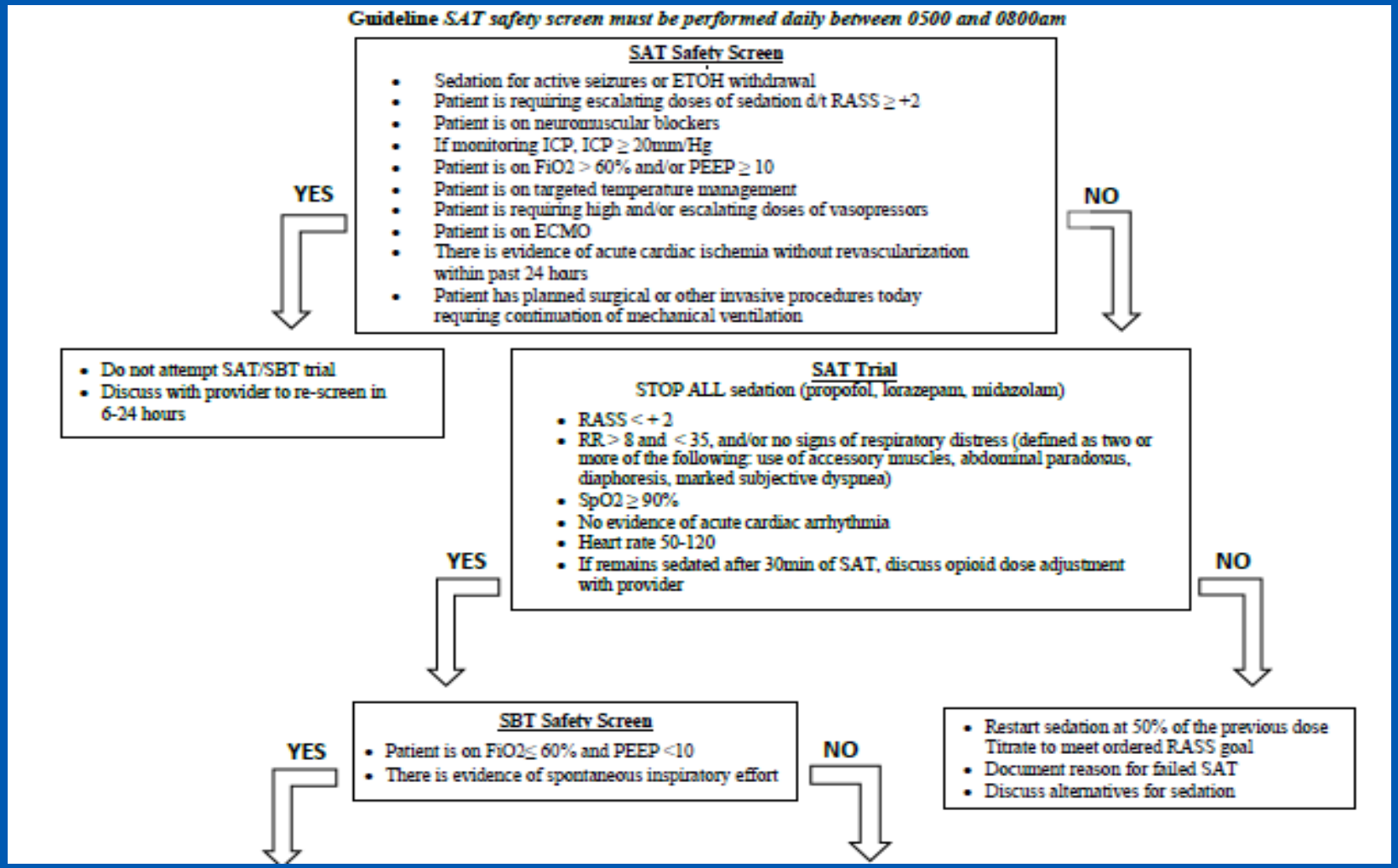
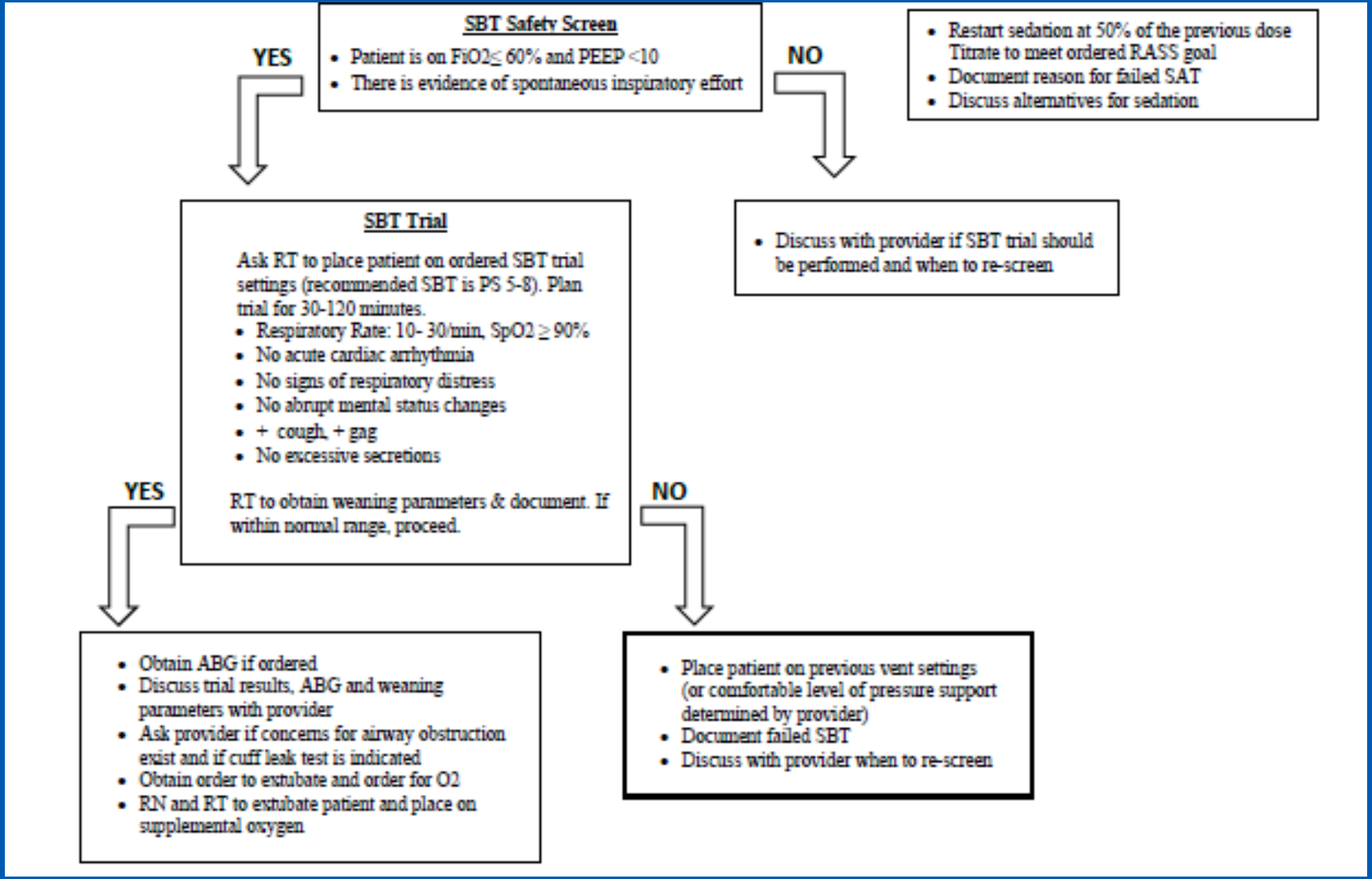
ICU Nurse-Driven Spontaneous Awakening Trial (SAT) and Spontaneous Breathing Trial (SBT)



ICU Nurse-Driven Spontaneous Awakening Trial (SAT) and Spontaneous Breathing Trial (SBT) cont.



Residual Neuromuscular Blockade & Cardiac Surgery

Steven Greenberg, MD, FCCP, FCCM

Jeffery Vender Anesthesiology Chair of Research and Education

NorthShore University HealthSystem

Clinical Professor, Department of Anesthesia & Critical Care, University of Chicago

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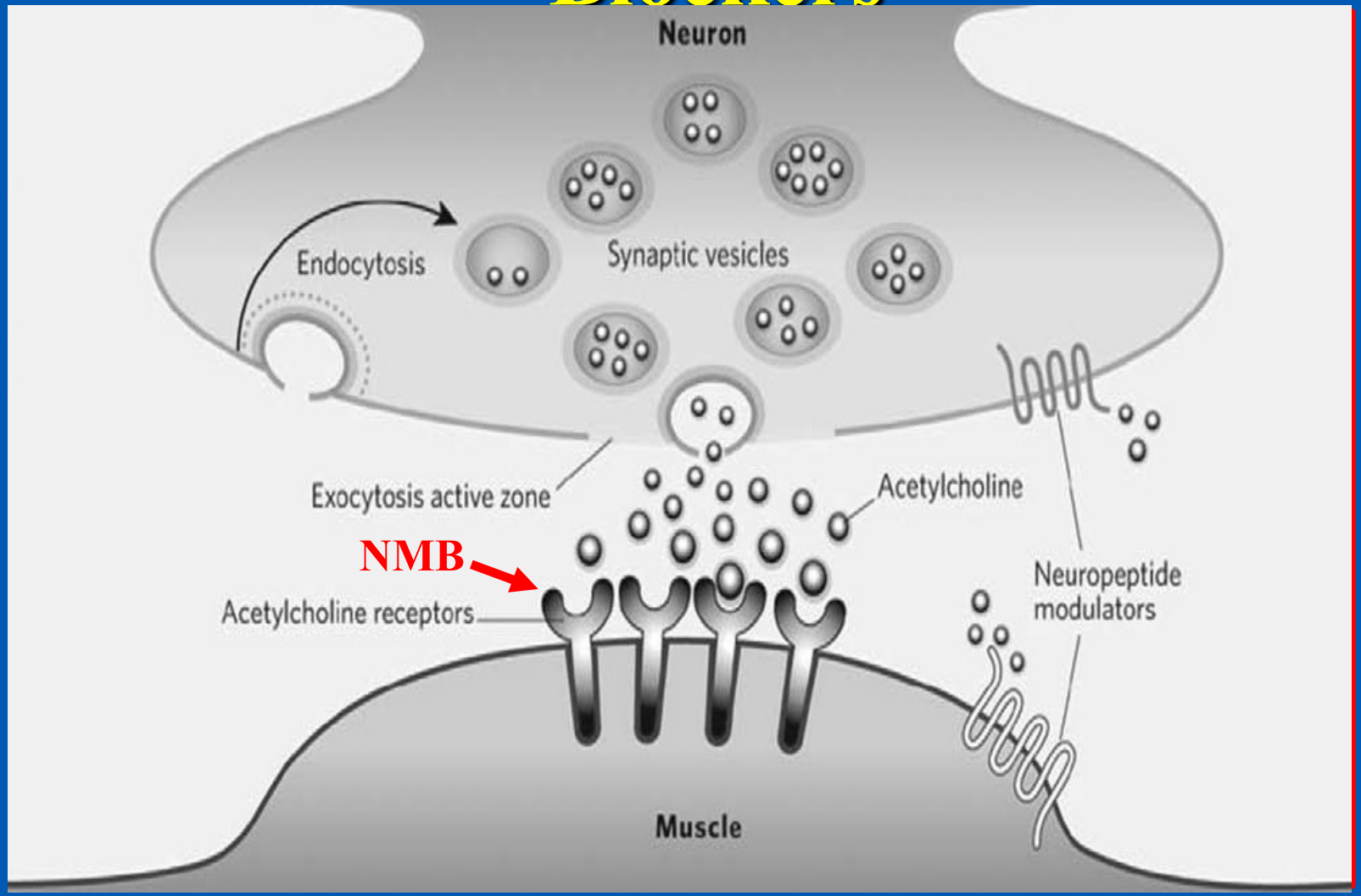
Mechanism/Types of Neuromuscular Blockers



Greenberg S. CCM 2013: 41: 1-14

Why Use Muscle Relaxants Intraoperative: Cardiac Surgery

- Facilitates smooth endotracheal intubation
- Optimizes surgical operating conditions
- Prevent movement during high stimulation periods of surgery and upon transport to ICU

R.M. Gerlach et al. Journal of Cardiothoracic and Vascular Anesthesia 33; 2019: 1673-1681.

Typical Management of Neuromuscular Blockade at End of Surgery

- **Most Surgeries:**
  - Reverse NMB

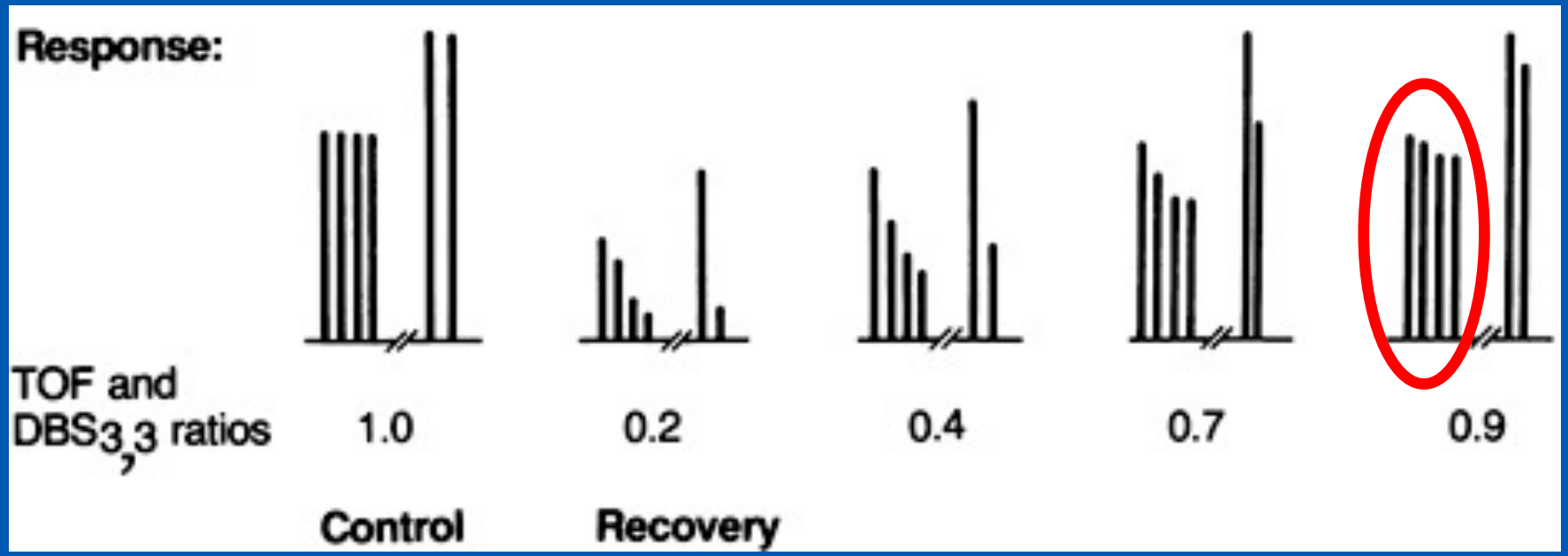
RISK: Lower Residual NMB

- **Cardiac Surgery:**
  - No reversal of NMB
  - Allow body to metabolize NMB on own

RISK: Higher Residual NMB

Residual Neuromuscular Blockade: Current Definition

- Train of Four Ratio < 0.9



TOF ratio: The amplitude of the fourth twitch divided by that of the first. A decreasing train-of-four ratio indicates greater degrees of paralysis!

Residual Neuromuscular Weakness

- **Incidence: Up to 65%**
  - Depends on study design
  - Depends on definition of RNMB (0.7 vs. 0.9)
  - Method of measurement
  - Time of measurement
  - Type and dose of NMBD
  - Use of NM monitoring intraoperative
  - Degree of NM blockade
  - Type/Duration of anesthesia
  - Type/Dose of NMB reversal
  - Time interval between reversal & measurement of train of four.
  - Patient factors
  - Drug therapy perioperative period

Thilen S. *Anesthesiology 2023; 138:13–41*
Murphy GS, et al. A&A 2010; 111: 120.

Residual Neuromuscular Blockade: Clinical Studies

- **TOF < 0.9**
  - Increased risk of postoperative hypoxemia
  - Increased airway obstruction during PACU transport
  - Higher risk of critical respiratory events in PACU
  - Symptoms/signs of profound muscle weakness (w/longer acting NMB)
  - Delays in meeting PACU discharge criteria
  - Prolonged postop vent weaning/increased intubation time
  - Increased postoperative pulmonary complications:
    - » **Cardiac Surgery Patient (VENICE)**

Fischer M, et al. JCTVA 2022; 36: 2344-51, Murphy GS, et al. Anesthesiology 2008; 109: 1389, Murphy GS, et al. A&A 2008; 107: 130. Murphy GS, et al. A&A 2004; 98: 193.

Methods To Reduce The Risk Of Residual Neuromuscular Blockade

- **Use of short-acting NMBDs**
- **Quantitative neuromonitoring** vs. **Qualitative and Clinical tests**
- **Administration of NMB reversal drugs:**
  - **Sugammadex more effective with moderate or deep block in clinical studies vs. neostigmine (anticholinesterases) with less potential side effects!**

Thilen S. *Anesthesiology 2023; 138:13–41*

Neuromuscular Reversal Agents

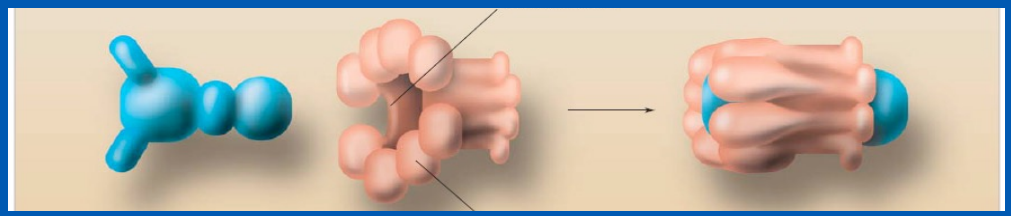
Two Primary Choices:

Sugammadex:

- » Modified y-cyclodextrin that reverses NMB by encapsulating steroidal muscle relaxant

– **Advantages:** shorter time to reversal, more effective w/ mod-dense block, possible less tachycardia/HTN

– **Disadvantages:** cost, use only w/aminosteroids, possible anaphylaxis/bronchospasm



Neostigmine: acetylcholinesterase inhibitor:

- » Increase acetylcholine at NMJ to reduce prevalence of residual neuromuscular blockade

2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade

Stephan R. Thilen, M.D., M.S. (co-chair),
Wade A. Weigel, M.D. (co-chair), Michael M. Todd, M.D.,
Richard P. Dutton, M.D., M.B.A., Cynthia A. Lien, M.D.,
Stuart A. Grant, M.D.,
Joseph W. Szokol, M.D., J.D., M.B.A., FASA,
Lars I. Eriksson, M.D., Ph.D., FRCA,
Myron Yaster, M.D., Mark D. Grant, M.D., Ph.D.,
Madhulika Agarkar, M.P.H., Anne M. Marbella, M.S.,
Jaime F. Blanck, M.L.I.S., M.P.A.,
Karen B. Domino, M.D., M.P.H.

ANESTHESIOLOGY 2023; 138:13–41

- *Use quantitative NM monitoring to confirm recovery from NMB.*
- *Sugammadex is recommended for deep, moderate, and shallow levels of NMB induced by aminosteroids.*
- *Neostigmine is reasonable alternative for minimal blockade.*
- *Patients with adequate spontaneous recovery to TOF >0.9 with quantitative monitoring, do not require pharmacological antagonism.*

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Why The Retrospective Study?

- Recent data shows advantages to use of NMB reversal:
  - Shorter time to extubation
  - Reduction in ICU/Hospital length of stay

- No current studies to address association between NMB reversal use (sugammadex) and meeting STS extubation criteria of < 6 hours from end of surgery

- ***Hypothesis: Those STS defined urgent/elective cardiac surgical patients who received sugammadex vs. those that did not were more likely to be extubated w/in 6 hrs. of end of surgery***

Li L, J Cardiothorac Vasc Anesth. 2021;18 35:1388-1392..
Yan P, Wu X, Cai F, et al. JCA 2020; 65: 109845
Bardia, A, Critical Care Explorations. 2022; 4:1-12

Journal of Cardiothoracic and Vascular Anesthesia 000 (2023) 1–8

Contents lists available at ScienceDirect

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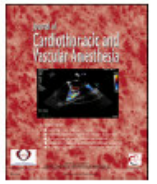
journal homepage: www.jcvaonline.com



Original Article

A Retrospective Pilot Comparison Trial Investigating Clinical Outcomes in Cardiac Surgical Patients Who Received Sugammadex Reversal During 2018 to 2021

Steven B. Greenberg, MD[*,†,1], Noah Ben-Isvy, BS[*,‡], Hyde Russell, MD[*], Hannah Whitney, RN[*], Chi Wang, PhD[*], Mohammed Minhaj, MD, MBA[*,†]

[*]*NorthShore University, HealthSystem, Evanston, IL*
[†]*University of Chicago, Pritzker School of Medicine, Chicago, IL*
[‡]*University of Illinois at Urbana-Champaign, Urbana-Champaign, IL*

Objectives: To compare the number of eligible urgent and elective cardiac surgical patients who could be extubated successfully within 6 hours of surgery and who received sugammadex versus those who did not.

Design: This retrospective pilot study compared outcomes in cardiac surgical patients undergoing cardiopulmonary bypass between 2018 to 2021 who received sugammadex versus those who did not.

Setting: At a tertiary-care hospital in the Northshore of Chicago.

Participants: A total of 358 elective or urgent cardiac surgical patients who underwent cardiopulmonary bypass (by 1 cardiac surgeon) and were extubated within 24 hours of the end of surgery at Evanston Hospital in Evanston, IL, were included.

Interventions: Data were examined in the following 2 groups of patients: those who were administered sugammadex and those who were not.

Measurements and Main Results: After performing propensity matching for age, sex, body mass index, kidney or liver disease, the number of preoperative conditions (defined as the sum of the presence of the following medical conditions: diabetes, immunosuppressive disease, on home oxygen, on inhaled bronchodilator, or sleep apnea), number of patients who underwent elective or urgent surgery in each group, surgery time, cardiopulmonary bypass duration, number of intraoperative blood products, use of intraoperative midazolam and propofol, a statistically significant increase in the percentage of patients in the sugammadex group were extubated within 6 hours of the end of surgery versus those who did not receive sugammadex (96.67% *v* 81.33%, $p = 0.0428$). In addition, there was a statistically significant reduction in time to extubation (hours) (4.72 ± 2.92) *v* (3.57 ± 1.96 $p = 0.0098$) in the sugammadex group. All other outcomes did not meet statistical significance.

Conclusion: This retrospective study suggested that using sugammadex reversal in cardiac surgical patients undergoing cardiopulmonary bypass may result in more patients meeting the Society of Thoracic Surgery benchmark extubation criteria within 6 hours of the end of surgery.

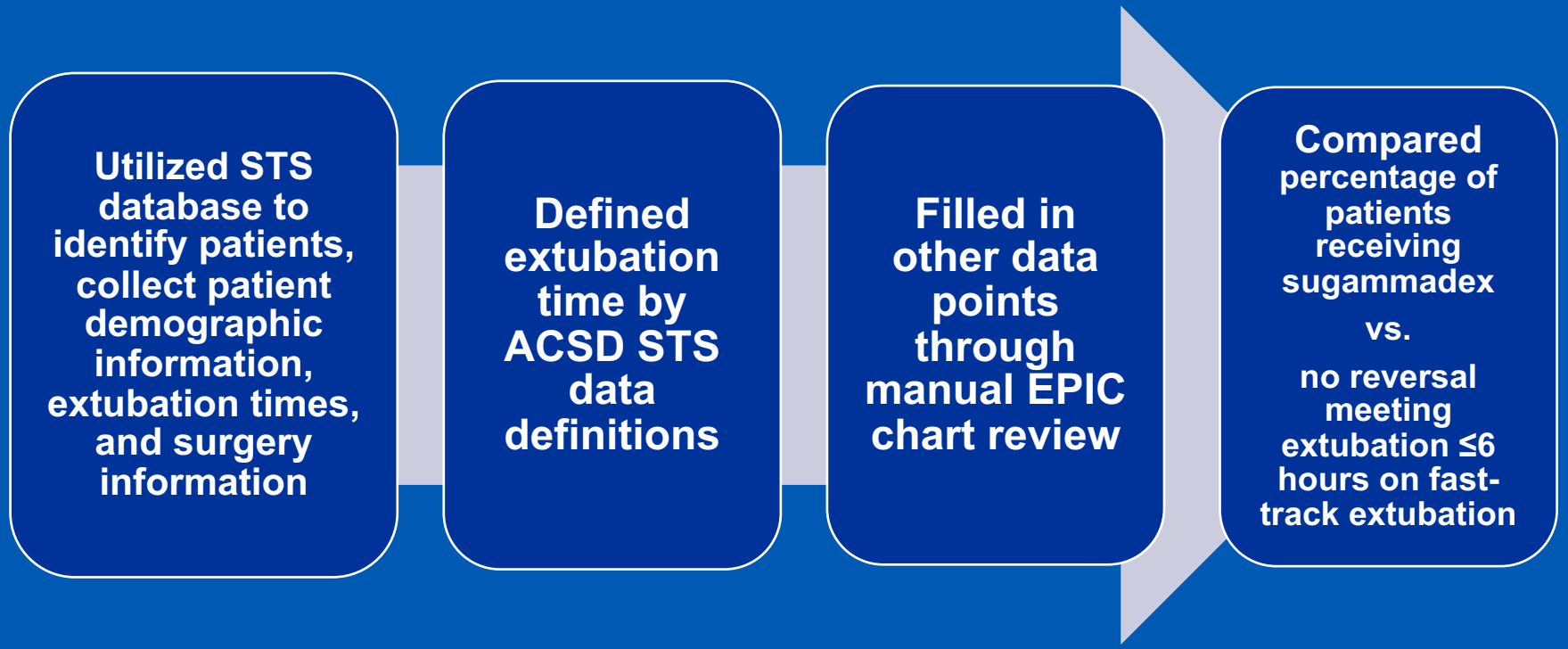
A Retrospective Pilot Trial Investigating Clinical Outcomes in Cardiac Surgical Patients Receiving Sugammadex During 2018-2021

Research Problem: Only some cardiac surgery patients receive sugammadex reversal following surgery

Main Objective: To understand whether there was a difference in clinical outcomes between sugammadex and no reversal groups

Research Approach: Conducted a retrospective analysis to answer the question regarding sugammadex reversal in cardiac surgical patients

A Retrospective Pilot Trial Investigating Clinical Outcomes in Cardiac Surgical Patients Receiving Sugammadex During 2018-2021



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A Retrospective Pilot Trial Investigating Clinical Outcomes in Cardiac Surgical Patients Receiving Sugammadex During 2018-2021

Table 2
Propensity-Score Matching (1:5) Between Reversal and No-Reversal Groups

Variables	Total (N = 180)		No Reversal (N = 150)		Reversal (N = 30)		p Value
	n	% or Mean ± SD	n	% or Mean ± SD	n	% or Mean ± SD	
Outcome measures							
First extubation time, h	180	4.5 ± 2.8	150	4.7 ± 2.9	30	3.6 ± 2.0	0.0098
≤6	151	83.9	122	81.3	29	96.7	0.0428
>6	29	16.1	28	18.7	1	3.3	
Duration from last intraoperative NMB dose to extubation time, h	180	6.5 ± 3.3	150	6.6 ± 3.3	30	6.0 ± 3.1	0.4336
ICU LOS, h	180	38.0 ± 23.0	150	37.5 ± 20.1	30	40.5 ± 34.3	0.6412
Hospital LOS, d	180	6.0 ± 3.6	150	6.0 ± 3.6	30	6.4 ± 3.2	0.5245

Increase in percentage of patients extubated ≤6 hours: 81% in no reversal group to 96% in the sugammadex group (p=0.0428)

All other outcomes were not statistically significant

A Prospective Randomized Controlled Trial Comparing Clinical Outcomes in Cardiac Surgical Patients: Sugammadex vs. Placebo

Primary Endpoint: Number of patients meeting STS 6-hour extubation endpoint in sugammadex vs. placebo groups

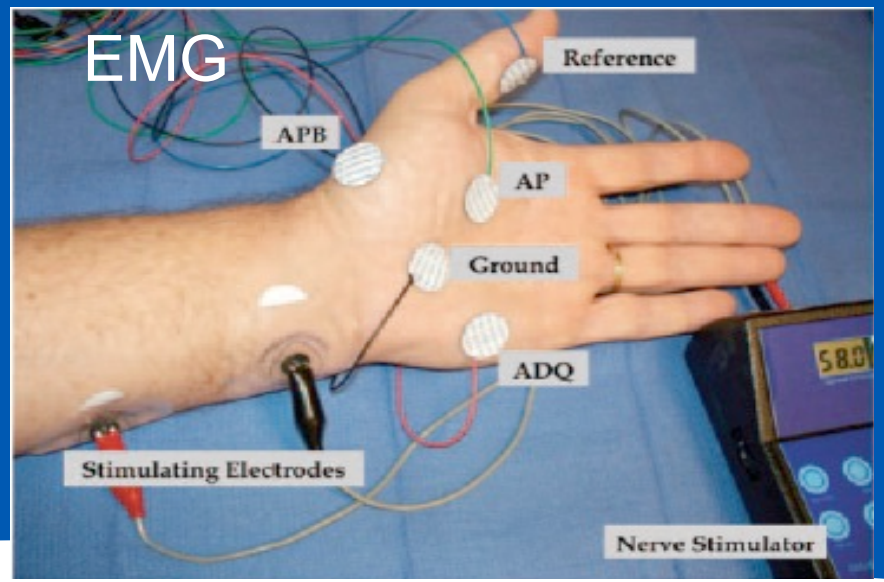
Study Status: Currently underway and enrolling patients

Study Details: Sugammadex/Placebo administered 15 minutes after ICU arrival, neuromuscular blockade assessed through quantitative monitoring, TOF ≥ 0.9 before extubation

Questions?

Questions?

Quantitative Neuromuscular Monitoring



Murphy GS, et al. A&A 2010; 111: 120.

Contact Information

- Carole Krohn, Director, STS National Database
  - CKrohn@sts.org
  - 312-202-5847

- STSDB@sts.org
  - Database Operational Questions (Billing, Contracts, Contacts)

- STSDB_Helpdesk@sts.org
  - IQVIA/Database Platform Questions (Uploader, DQR, Missing Variable, Dashboard, Password and Login)

Open Discussion

Please use the raise-hand function.

Please use the Q&A Function.

We will answer as many questions as possible.

We encourage your feedback and want to hear from you!

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CV Surgery Handoff Information

Participants: CV Surgery, Anesthesia, Critical Care, ICU RN, Perfusion, Respiratory

CV Surgery

- **Patient Name / Height / Weight**
- **PMH / Baseline Communication Barriers**
- **Surgeon**
- **Summary of Case**
  - **Procedures Performed**
  - **Lines placed by CV Surgery Intraoperatively**
  - **Evaluation of Heart Function Post Bypass (EF %)**
  - **Current Rhythm**
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  - **Pacing Requirements / Pacing Wires Placed / Settings**
  - **Chest Tubes Placed**
  - **Bleeding Concerns**

Anesthesia

- **Current Vitals – HR / BP / MAP / CVP / PAP / Last CI**
- **Airway**
- **Ventilator Settings / Issues in OR**
- **Ins/Outs – Crystalloid, Colloid, Blood Products**
- **Access: IVs placed, Swan locked at ___ cm**
- **Sedation**
- **Last Dose of Neuromuscular Blockade / Plan for Neuromuscular Blockade Reversal**
- **Current Gtts**
- **Significant Labs**

Post Operative Plan

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NorthShore
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