Society of Thoracic Surgeons
Adult Cardiac Surgery Database

Quality Improvement Series:
Decreasing Vent Times

Mark Pridmore, RN
and
Joseph Arcidi, MD

Providence St. Joseph Hospital, Eureka California

November 15, 2023
Agenda

WELCOME AND INTRODUCTIONS

REVIEW H3 REPORTS
Operating Room Extubation: Multiple-Year Experience at a Remote Community Cardiac Surgery Center

Joseph M. Arcidi, Jr., MD FACS FACC
Jeffrey S. Johnston, MD
Stephen R. Dieker, MD
Thach D. Mai, DO
Barry Steinbock, CCP
Mark E. Pridmore, RN
Dominic C. Regli, BS (cand)*
PSJH O.R. Heart Team

* Summer Research Fellow funded by Providence St. Joseph Hospital Foundation
4.35% of Isolated CABG pts are extubated in OR

Responses:
  Why bother?
  Is it safe?
  Who benefits?
  Quantifiable?

Unique features of our program
Our implementation and outcomes
Anesthesiology perspective
Questions/discussion
Extubating in the operating room after adult cardiac surgery safely improves outcomes and lowers costs

Vinay Badhwar, MD, Stephen Esper, MD, Maria Brooks, PhD, Suresh Mulukutla, MD, Regina Hardison, MS, Demetri Mallios, BS, Danny Chu, MD, Lawrence Wei, MD, and Kathirvel Subramaniam, MD

https://doi.org/10.1097/00006534-199812000-00011

Early tracheal extubation anesthetic management reduces total costs per CABG surgery by 25%, predominantly in nursing and in CVICU costs. Early extubation reduces CVICU and hospital length of stay but does not increase the rate or costs of complications when compared with patients in the late extubation group. It shifts the high CVICU costs to the lower ward costs. Early extubation also improves resource use after cardiac surgery when compared with late extubation.
This may have been the first: 2010

The Impact of Immediate Extubation in the Operating Room After Cardiac Surgery on Intensive Care and Hospital Lengths of Stay

Dmitri Chamchad, MD,*† Jay C. Horrow, MD, MS,‡ Lev Nakhamchik, MSc,* Francis P. Sutter, DO,† Louis E. Samuels, MD,‡† Candace L. Trace, RN, BA,† Francis Ferdinand, MD,† and Scott M. Goldman, MD†

Objective: To determine if lengths of stay in intensive care and the hospital are associated with extubation in the operating room at the conclusion of cardiac surgery.

Design: A nonrandomized, observational study with propensity score–guided case-control matching of prospectively collected data.

Setting: Three interrelated, university-affiliated, community hospitals.

Participants: Three thousand three hundred seventeen patients undergoing elective or urgent coronary artery, valve repair or replacement, or combined surgery between 2000 and 2006.

Interventions: Tracheal extubation occurred, based on history and intraoperative events, either immediately in the operating room or in the intensive care unit.

Measurements and Main Results: Of 3,317 patients in the institutions’ Society of Thoracic Surgeons database, 3,089 were extubated within 24 hours, 69% of them in the operating room. Only 0.6% of patients extubated in the operating room required reintubation, compared with 5.9% extubated in the intensive care unit (p < 0.0001). By logistic regression, 12 of 25 preoperative and intraoperative factors generated a propensity score for each of the 2,595 patients with complete data, representing the likelihood of immediate extubation (c-statistic = 0.727). A “greedy 5 to 1” propensity score–matching technique created 713 matched pairs of patients by extubation pathway. Those undergoing immediate extubation had reductions in intensive care duration by 23 hours on average (median from 46 to 27 hours, p < 0.0001) and in hospital length of stay by 0.8 days on average (median = 6 for each, p < 0.0001). Cox regression, using matched pairs as strata, identified the following independent predictors of length of stay in the intensive care unit and hospital: immediate extubation in the operating room, need for reintubation, postoperative renal failure, and postoperative atrial fibrillation.

Conclusions: Selection of patients for immediate extubation in the operating room by experienced clinicians was associated with shorter ICU and hospital stays. Immediate extubation rarely resulted in tracheal re-intubation.

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KEY WORDS: tracheal extubation, cardiac surgery, coronary artery bypass graft surgery, length of stay, propensity scores, ICU and hospital length of stay

Not presented at meeting
• n = 2125 (propensity matched 713)
• Multiple operation types: 70% Isol CAGB
• 46% elective, 54% urgent
• 8.7% IABP

Reintubation 0.6%
Decreased LOS by 0.8 day (p<0.0001)
Limited reports

Vinay Badhwar, MD, Stephen Esper, MD, Maria Brooks, PhD, Suresh Mulukutla, MD, Regina Hardison, MS, Demetri Mallios, BS, Danny Chu, MD, Lawrence Wei, MD, and Kairivel Subramaniam, MD

Objective: Prolonged intubation has been implicated in the poor outcomes after adult cardiac surgery. Accelerated postoperative extubation has been a quality focus, but operating room (OR) extubation after cardiopulmonary bypass is rare. We examined the outcomes and direct costs of protocolized OR extubation versus early postoperative intensive care unit (ICU) extubation after nonemergency open cardiac surgery.

Methods: From January 2012 to June 2013, 652 consecutive patients who had undergone various cardiac operations, including redo and multivalve operations, were extubated within 12 hours, 165 in the OR. The OR extubation patients were propensity matched from multivariable logistic regression to derive 106 matched pairs for OR extubation versus extubation < 12 hours (group 1) and 98 independently matched pairs for OR extubation versus extubation < 6 hours (group 2).

Results: OR versus ICU extubation conveyed significant reductions in ICU hours (26.3, interquartile range [IQR], 22.0-31.0; vs 29.0, IQR, 25.0-51.0; P = .001, for group 1; 27.0, IQR, 22.0-32.0; vs 29.0, IQR, 25.0-54.0; P = .0002, for group 2) and postoperative length of stay (5 days, IQR, 4-6; vs 6 days, IQR, 5-7; P = .0008, for group 1; 5 days, IQR, 4-6; vs 6 days, IQR, 4-7; P = .0002, for group 2) but did not affect the reintubation rate (1.9% [2 of 106] vs 0.0% [0 of 106], P = .5, group 1; 3.1% [3 of 98] vs 2.0% [2 of 98], P = 1.0, group 2). OR versus ICU extubation conferred a >20% cost reduction from surgery completion to discharge ($3055, IQR, $2576-$3964; vs $3977, IQR, $3028-$4947; P = .0007, group 1; $3025, IQR, $2598-$3965, vs $3877, IQR, $2998-$5458; P = .007, group 2).

Conclusions: After cardiac surgery, OR extubation is safe and might provide improvement in length of stay and cost compared with early postoperative ICU extubation. (J Thorac Cardiovasc Surg 2014;148:3101-9)
Limited reports

Predictors of operating room extubation in adult cardiac surgery

Kathirvel Subramaniam, MD, MPH, Diana S. DeAndrade, MD, Daniel R. Mandell, MD, Andrew D. Althouse, PhD, Rajan Mannoham, BS, Stephen A. Esper, MD, MBA, Jeffrey M. Varga, MD, and Vinay Badhwar, MD

ABSTRACT

Objective: The primary objective of the study was to identify perioperative factors associated with successful immediate extubation in the operating room after adult cardiac surgery. The secondary objective was to derive a simplified predictive scoring system to guide clinicians in operating room extubation.

Methods: All 1518 patients in this retrospective cohort study underwent standardized fast-track cardiac anesthetic protocol during adult cardiac surgery. Perioperative variables between patients who had successful extubation in the operating room versus in the intensive care unit were retrospectively analyzed using both univariate and multivariable logistic regression analyses. A predictive score of successful operating room extubation was constructed from the multivariable results of 801 patients (derivation set), and the scoring system was further tested using a validation set of 398 patients.

Results: Younger age, lower body mass index, higher preoperative serum albumin, absence of chronic lung disease and diabetes, less-invasive surgical approach, isolated coronary bypass surgery, elective surgery, and lower doses of intravenous propofol were independently associated with higher probability of operating room extubation. The extubation prediction score created in a derivation set of patients performed well in the validation set. Patients scores less than 0 had a minimal probability of successful operating room extubation. Operating room extubation was highly predicted with scores of 5 or greater.

Conclusions: Perioperative factors that are independently associated with successful operating room extubation after adult cardiac operations were identified, and an operating room extubation prediction scoring system was validated. This scoring system may be used to guide safe operating room extubation after cardiac operations. (J Thorac Cardiovasc Surg 2017;154:1656-65)

Predictors:
Younger age, elective status
Isolated CABG
Lower BMI, higher albumin,
No chronic lung, No DM

2017
• n = 354
• Multiple operation types
• 76% elective
• 24% urgent
• 55% EF
• 0.7% STS pred mortality risk
• 4.9% STS prolong vent risk
Operating Room Versus Intensive Care Unit Extubation Within 6 Hours After On-Pump Cardiac Surgery: Early Results and Hospital Costs

Andrew D. Hawkins, MD, * Raymond J. Strobel, MD, MSc, * J. Hunter Mehaffey, MD, MSc, * Robert B. Hawkins, MD, MSc, † Evan P. Rotar, MD, MS, * Andrew M. Young, MD, *
Leora T. Yarboro, MD, * Kenan Yount, MD, MBA, * Gorav Ailawadi, MD, MBA, † Mark Joseph, MD, ‡ Mohammed Quader, MD, $ and Nicholas R. Teman, MD *

Semin Thoracic Surg ■■:■■–■■ © 2022
Limited reports: only multicenter study

24,962 patients undergoing CABG and/or valve operations 2011-2021 → 1:n propensity score matching → 487 extubated in OR
extubated within 6 hours

- No difference in operative mortality
- 0.6 days shorter length of stay for OR extubation (p = < 0.001)
- $1,964 less for OR extubation (p = < 0.001)

2.5x increased rate of re-intubation after OR extubation (p = 0.008)

2.8x increased rate of re-bleeding requiring reoperation after OR extubation (p = 0.03)

Take-home Message: Improved hospital efficiency with OR extubation must be weighed against increased post-operative reintubation and bleeding
Limited reports

2023
- n = 507 (36% of 2017-2022 isolated CABG pts)
- 58% EF
- 1.1% STS pred mortality risk

1.6% reintubation
3.4 days mean postop LOS (vs 7.1 days, p<0.0001)
97% discharged to home
Extubating in the operating room after adult cardiac surgery safely improves outcomes and lowers costs

Vinay Badhwar, MD, Stephen Esper, MD, Maria Brooks, PhD, Suresh Mulukutla, MD, Regina Hardison, MS, Demetri Mallios, BS, Danny Chu, MD, Lawrence Wei, MD, and Kathirvel Subramaniam, MD

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Discussion

Dr Glenn Whitman (Baltimore, Md). Dr Badhwar, as you and I have already spoken this past week, I think this is a tremendous study and extremely provocative.

Your report is extremely provocative, and if in fact patient satisfaction significantly benefits by intraoperative extubation, it might be worth it just for that.

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Early extubation after cardiac surgery: The evolution continues

Hilary P. Grocott, MD, FRCPC, FASE

From the Department of Anesthesia, University of Manitoba, Winnipeg, Manitoba, Canada.

The characteristics are in some respects very obvious (eg, younger age and simpler operation); however, one can easily make the argument that all patients, irrespective of the procedure or the patient characteristics, should be treated right from the start as if they can be extubated in the operating room. The decision to extubate patients should likely be made once the operation is nearing completion, in part informed by the overall success of the operation. The many nuances and complications
Early is Good, But is Immediate Better? Considerations in Fast-Track Extubation After Cardiac Surgery

Megan Chacon, MD
Nicholas W. Markin, MD, FASE
University of Nebraska Medical Center, Omaha, NE

As the practice of cardiac anesthesiology continued to mature, it was only natural that the amount of time to awakening, extubation, and mobilization of postsurgical patients would decrease. Although there is a continued pressure to do so, it is not entirely clear that the motivation to further move the extubation goalposts is the result of a desire to improve patient outcomes and more of a desire for the provider to have some personal feeling of accomplishment. Of course, any time one undertakes a course that is of no direct benefit to the patient, there should be questions about the motivation. At this time, the desire to extubate immediately after the procedure may be the result of 3 motivators—shorter ICU length of stay, reduced costs and saved money, or perhaps allowed the physicians to “feel” like they are doing a good job.
Early is Good, But is Immediate Better? Considerations in Fast-Track Extubation After Cardiac Surgery

Of course, there are non—patient-related factors to consider when making decisions on whether or not to extubate a post-cardiac surgery patient in the OR. Depending on the layout of the perioperative area and the proximity of the OR to the ICU, it may not be considered safe to extubate immediately before a long transport with limited monitoring and airway equipment. If pain is not controlled adequately, or the patient experiences emergence delirium, this also can make for a difficult transport to the ICU. Many centers have developed a multidisciplinary handoff for the OR to ICU transition. It sometimes can be more difficult for the nursing staff to get a patient settled when they are not sedated and intubated, which may make handoff more difficult and the nurse caring for the patient may be distracted and/or unable to listen to pertinent details of the patient’s operative course. Although the reported benefits of immediate extubation in the OR have been described, some workflow and institutional barriers may prevent it from being practical or safe.
Editorial

Early is Good, But is Immediate Better? Considerations in Fast-Track Extubation After Cardiac Surgery

Given the way that the costs of healthcare continue to increase, cost reduction is a noble goal. However, it is not clear that extubation will change the overall costs.\textsuperscript{13} Certainly, in the inpatient Diagnosis-Related Grouping based reimbursement process, there are no changes to patient charges or hospital reimbursement if the patient is extubated before going to the ICU. It is possible that if a hospital system is not taking postcardiotomy patients to the ICU if they are extubated, it could reduce hospital system costs but not patient cost. As well, the hospital is \textbf{not going to reduce their workforce of respiratory therapists or their ventilator inventory, no cost savings there.} As previously mentioned, unless the ICU is skipped all together, there may or \textbf{may not be a meaningful change in ICU length of stay depending on the practice.} \textsuperscript{7} Many institutions have issues with moving patients from the ICU to a lower level of care, and shortening the period of intubation will work only if there is capacity for patients to move through at a faster rate.
To conclude:

Until the time comes when data for subpopulations show which patients specifically will benefit from earlier extubation, one of the strengths of anesthesia practice is the freedom to do so in a way that is best for the individual patient and within the provider’s experience. Although the debate will continue, we argue that there is at this time, there is not adequate evidence to change the current practice of leaving patients intubated for a brief postoperative (<6-hour) period.
What LOE grade?

• Is it safe?

• Does it decrease LOS?

• Patient satisfaction?

Gathering evidence

All studies except Virginia show very low reintubation rate.

To variable amounts: 0.6 - 3.7 days. LOS is multifactorial.

Yes, but not formally evaluated.

Discussion

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Can logistic barriers be overcome...?

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Table 1 Barriers to extubation with barrier types and resolutions

<table>
<thead>
<tr>
<th>Type</th>
<th>Barriers</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Inconsistent weaning practice</td>
<td>Implement standardized weaning protocol for all patients identified as appropriate for the FTE protocol.</td>
</tr>
<tr>
<td></td>
<td>Patients inappropriately labeled as ready to progress to extubation (eg,</td>
<td>Include considerations for exclusion in protocol; team will indicate clear yes or no for all patients during handoff in CTICU.</td>
</tr>
<tr>
<td></td>
<td>patients with hemodynamic instability, bleeding, acidosis)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NMB agents not reversed</td>
<td>Decrease NMB use after CPB; check TOF on admission (in protocol).</td>
</tr>
<tr>
<td></td>
<td>RT unavailable for ventilator weaning or changes; no designated person</td>
<td>Designate a person for OR; each RT will let RN know who to call when RT travels off the unit with a patient; RTs will cover duties for each other.</td>
</tr>
<tr>
<td></td>
<td>to cover duties during lunch, travels off unit, etc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Workflow issues, handoffs (6 PM for APPs, 7 PM for RTs and RNs)</td>
<td>Try to discuss needs with APP before 6 PM if possible; handoff can be interrupted for extubation order if ABG is WNL and patient is on extubatable settings ready for extubation; the only time patients will not be extubated is 7-7:30 PM during handoff for RNs and RTs.</td>
</tr>
<tr>
<td></td>
<td>Hypertension management with pain and sedation medications</td>
<td>Discuss preferred agent for hypertension management with surgical team at handoff.</td>
</tr>
</tbody>
</table>

Critical Care Nurse 2021; 41:14-24.
Spoiler: Our post-ORE handoff has been smoother

We no longer see this - but it’s very hard to quantify.
Unique features of our program

OPERATING ROOM EXTUBATION AT A REMOTE COMMUNITY PROGRAM
Unique features of our program

California Health Outcomes

- 45 to 58 (Worst)
- 30 to 44
- 15 to 29
- 1 to 14 (Best)

OPERATING ROOM EXTUBATION AT A REMOTE COMMUNITY PROGRAM
Our operative mortality risk

Mortality Risk of Patients Having Cardiac Surgery

- 2021: 1.9%
- 2022: 4.1%
- 2023: 4.5%

2.51% = STS Risk for all Cardiac Surgery cases
2.22% = STS Risk for Isolated CABG cases
**All Procedure Risk-Adjusted Data Summary**

**Participant: 31137**

STS Period Ending Jun 2023

### Mortality Risk-Adjustment

<table>
<thead>
<tr>
<th>Outcome</th>
<th>My Site 2021</th>
<th>My Site 2022</th>
<th>My Site 2023*</th>
<th>Like Group 2023</th>
<th>Region 2023</th>
<th>STS 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital Mortality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>0.90 (0.36-2.28)</td>
<td>0.84 (0.33-2.15)</td>
<td>0.91 (0.38-2.18)</td>
<td>1.52 (1.37-1.68)</td>
<td>-</td>
<td>1.00</td>
</tr>
<tr>
<td>O/E (95% CI)</td>
<td>0.00 (0.00-7.32)</td>
<td>0.00 (0.00-5.20)</td>
<td>0.00 (0.00-6.29)</td>
<td>1.22 (1.16-1.30)</td>
<td>-</td>
<td>1.00</td>
</tr>
<tr>
<td>Risk-adjusted Rate</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>2.33%</td>
<td>-</td>
<td>1.90%</td>
</tr>
<tr>
<td>Operative Mortality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>0.89 (0.38-2.08)</td>
<td>0.83 (0.35-1.94)</td>
<td>0.90 (0.39-2.08)</td>
<td>1.51 (1.38-1.66)</td>
<td>-</td>
<td>1.00</td>
</tr>
<tr>
<td>O/E (95% CI)</td>
<td>0.00 (0.00-5.69)</td>
<td>0.00 (0.00-4.08)</td>
<td>0.00 (0.00-4.80)</td>
<td>1.20 (1.15-1.28)</td>
<td>-</td>
<td>1.00</td>
</tr>
<tr>
<td>Risk-adjusted Rate</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>2.99%</td>
<td>-</td>
<td>2.47%</td>
</tr>
</tbody>
</table>

OR = Odds Ratio; O/E = Observed-to-Expected Ratio; CI = Confidence interval; * represents a partial year
Our system ranking

PSJH System-wide Cardiac Surgery Report

Risk-Adjusted Mortality
CABG (isolated)
All Divisions
All Participating Hospitals
Available Surgery Date Range
07/01/2014 06/10/2023
Selected Surgery Date Range
01/01/2021 06/12/2023

(Other program names whited out)
Our system ranking

### PSJH System-wide Cardiac Surgery Report

**Region** | **Number of Cases** | **Reop** | **Permanent Stroke** | **Prolonged Ventilation** | **DSWI** | **Renal Failure** | **Major Mort/Morb**
---|---|---|---|---|---|---|---
South Division | 2840 | 1.32 | 1.63 | 1.27 | 1.10 | 2.40 | 1.40
North Division | 3759 | 2.29 | 1.87 | 1.63 | 0.80 | 2.30 | 1.72
Central Division | 4149 | 1.77 | 2.10 | 1.96 | 1.08 | 1.83 | 1.74
**Total** | 10748 | 1.82 | 1.88 | 1.50 | 0.98 | 2.17 | 1.63

**PSJH Cases**

- PSJH Reop O/E
- PSJH Perm Stroke O/E
- PSJH Prolong Vent O/E
- PSJH DSWI O/E
- PSJH Renal Failure O/E
- PSJH MV O/E

**Cases by Model**

- Isolated CABG: 5301
- Isolated Valve: 1984
- Valve + CABG: 1221
Unique features: multiarterial grafting with CABG

<table>
<thead>
<tr>
<th>Risk Adjusted Report</th>
<th>My Site 2020*</th>
<th>My Site 2021</th>
<th>My Site 2022</th>
<th>My Site 2023*</th>
<th>Like Group 2023</th>
<th>STS 2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of patients with multiple arterial grafts</td>
<td>-</td>
<td>52.38%</td>
<td>43.75%</td>
<td>40%</td>
<td>13.35%</td>
<td>15.68%</td>
</tr>
<tr>
<td>IMA Used</td>
<td>-</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>99.53%</td>
<td>99.61%</td>
</tr>
<tr>
<td>Left</td>
<td>-</td>
<td>90.47%</td>
<td>87.50%</td>
<td>60%</td>
<td>90.76%</td>
<td>90.60%</td>
</tr>
<tr>
<td>Right</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.42%</td>
<td>0.36%</td>
</tr>
<tr>
<td>Both</td>
<td>-</td>
<td>9.52%</td>
<td>12.50%</td>
<td>40%</td>
<td>6.91%</td>
<td>7.09%</td>
</tr>
<tr>
<td>Missing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.02%</td>
<td>0.02%</td>
</tr>
<tr>
<td>Radial Artery Used</td>
<td>-</td>
<td>42.85%</td>
<td>37.50%</td>
<td>-</td>
<td>7.95%</td>
<td>10.16%</td>
</tr>
</tbody>
</table>
Unique features: multiarterial grafting with CABG
Unique features: Operating room extubation

When: January 2021

Why: Program revamping under new surgical leadership

How: Our first patient was an isolated 2-vessel CABG with good LV function. Collaboration with our 3 cardiac anesthesiologists* (*we’re recruiting!) and our world-class perfusionist.

I am struck by 3 themes within this opinion piece that I find of particular importance. First, OR extubation in the appropriate patient is safe, and possibly beneficial. Second, the authors’ emphasis on the multidisciplinary effort to accomplish the task should be lost on no one. The necessity to work together as a team of surgeons, anesthesiologists, perfusionists, and other, is appropriately highlighted. Finally, as the evidence continues to build that OR extubation in the right patient is an improvement in care, the authors challenge all of us to do more of it and lay out the tenets required to do so, safely. They should be commended. As we have done in the past (eg, with mitral valve repair, multiarterial grafting, transcatheter aortic valve replacements, and now, as trumpeted in this article, OR extubations, cardiac surgery should embrace every effort to improve what we do, regardless of its “inconvenience.”

Glenn J. R. Whitman, MD
Implementing operating room extubation (ORE)

How: Collaboration with our 3 cardiac anesthesiologists* (*we’re recruiting!) and our world-class perfusionist.

Perfusion fluid management:
- Short pump circuit length
- Retrograde autologous priming
- Hemoconcentration
- Rewarming

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Glenn J. R. Whitman, MD
Patients should be extubated in the operating room after routine cardiac surgery: An inconvenient truth

Heather K. Hayanga, MD, MPH, Matthew B. Ellison, MD, and Vinay Badhwar, MD

JTCVS Techniques 2021;8:95-9

Routine Extubation in the Operating Room Requires A Dedicated Team Approach

- Multimodal Cardiac Anesthesia with Minimal Long-acting Opioids
- Meticulous Cardiac Surgery with Negligible Bleeding
- Anesthesia-Surgery-ICU Team Approach to Reversal and Safe OR Extubation
Implementing operating room extubation (ORE)

Perfusion fluid management:
- Short pump circuit length
- Retrograde autologous priming
- Hemoconcentration
- Rewarming

*More from Dr. Jeffrey Johnston*

Nursing & RT coordination:
- Communication is everything

Once OR extubation has been established as a routine, the intubated patient arriving to the ICU will become a rarity. Nursing, allied health, respiratory therapy, and intensivists will all become aligned with OR extubation expectations and management protocols (Figure 1). Finally, and to the program’s benefit, patients, their families, and their referring providers will come to expect this growing standard of quality care in cardiac surgery.
Our approach quickly became:
All cardiac surgical patients are treated as candidates for operating room extubation.

Early extubation after cardiac surgery: The evolution continues

Hilary P. Grocott, MD, FRCPC, FASE

From the Department of Anesthesia, University of Manitoba, Winnipeg, Manitoba, Canada.

The characteristics are in some respects very obvious (eg, younger age and simpler operation); however, one can easily make the argument that all patients, irrespective of the procedure or the patient characteristics, should be treated right from the start as if they can be extubated in the operating room. The decision to extubate patients should likely be made once the operation is nearing completion, in part informed by the overall success of the operation. The many nuances and complications
Evaluating our ORE experience

We reviewed all 66 patients from 1/2021 – 3/2023 with:
• STS Predicted Risk of Mortality scores
• No exclusions for emergent or preoperative IABP patients
• Compared Isolated CABG vs Valve/Valve+CABG pts
• Univariate predictors of successful operating room extubation
Results: ORE successful in 88% of patients (58/66)

• No reintubations
• 0% Operative mortality
• 0.56 Observed/Expected STS morbidity
### Results: Isolated CABG vs Valve/Valve+CABG

<table>
<thead>
<tr>
<th>Group Comparison</th>
<th>Isolated CABG (n=43, 65%)</th>
<th>Valve/Valve+CABG (n=23, 35%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean; % ≥75 yrs)</td>
<td>67.7; 24%</td>
<td>63.9; 26%</td>
</tr>
<tr>
<td>Sex (% female)</td>
<td>22.2%</td>
<td>43.5%</td>
</tr>
<tr>
<td>Surgical Timing (% urgent/emergent)</td>
<td>80.0%</td>
<td>52.2%</td>
</tr>
<tr>
<td>Ejection Fraction (EF) (mean; % ≤40%)</td>
<td>49.9; 24.4%</td>
<td>56.3; 17.4%</td>
</tr>
<tr>
<td>STS Predicted Operative Mortality Risk (PROM)</td>
<td>2.1%</td>
<td>3.6%</td>
</tr>
<tr>
<td>STS Predicted Prolonged Ventilation Risk</td>
<td>11.7%</td>
<td>15.9%</td>
</tr>
<tr>
<td>Operating Room Extubation</td>
<td>90.7%</td>
<td>82.6%</td>
</tr>
</tbody>
</table>

2017
- n = 354
- Multiple operation types
- 76% elective
- 24% urgent
- 55% EF
- 0.7% STS pred mortality risk
- 4.9% STS prolong vent risk

Predictors:
- Younger age, elective status
- Isolated CABG
- Lower BMI, higher albumin
- No chronic lung
- No DM
Results: Univariate predictors of ORE success

Paradoxical:

- **Higher** age
- **Lower** ejection fraction
- **Higher** STS predicted risk of mortality

Our explanation: Extubation in the operating room was based primarily on ability to oxygenate and ventilate, irrespective of age, ejection fraction, STS PROM, etc.
Conclusions

1) Our operating room extubation experience:
   • First reported from a remote community program
   • Demonstrated that ORE can be successfully and safely undertaken in centers with smaller case volumes
   • Higher proportions of challenging risk patients than any reported ORE series

2) ORE anesthesia management for isolated CABG was readily transferable to Valve/Valve+CABG patients

3) Success with ORE accompanied program achievements in mortality and morbidity
PreOp Considerations

• OSA History
  • Assessment- STOP BANG score
  • Sleep Study
  • CPAP Compliance

• COPD, Pulmonary Dz, or Previous Thoracic Surgery
  • Optimized by Pulmonologist
  • Home O2 vs bronchodilators
  • PFTs helpful
  • Room air ABG

<table>
<thead>
<tr>
<th>Analyzed variable</th>
<th>Question to be asked/examination findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Do you Snore Loudly? Louder than talking or loud enough to be heard through a closed door?</td>
</tr>
<tr>
<td>T</td>
<td>Do you often feel Tired? Do you sleep during the daytime?</td>
</tr>
<tr>
<td>O</td>
<td>Has anyone observed you stop breathing during sleep?</td>
</tr>
<tr>
<td>P</td>
<td>Do you have high blood pressure?</td>
</tr>
<tr>
<td>B</td>
<td>BMI &gt; 35 kg m⁻²</td>
</tr>
<tr>
<td>A</td>
<td>Over 50 years</td>
</tr>
<tr>
<td>N</td>
<td>Circumference &gt;40 cm</td>
</tr>
<tr>
<td>G</td>
<td>Male</td>
</tr>
</tbody>
</table>

High risk for OSAS: ≥3 positive responses.
Low risk for OSAS: <3 positive responses.
PreOp Considerations

• Obesity
  • Anticipated Difficult Airway
  • Diminished FRC, will desaturate quickly
  • Likely require BiPAP in ICU

• ESRD
  • Recent Dialysis
  • Strict Fluid management
IntraOp Considerations

• Opiate Management
  • Controversial in our group (3 anesthesiologists have 4 different opinions)
  • Conversative opiate management
    • Maximum Fentanyl 500-600mcg during the case
    • Small doses of long acting opiates during closure
      • Dilaudid 0.4mg IV
      • Morphine 0.1mg/kg IV

• Non-Opiate Management
  • IV Acetaminophen during closure
  • Precedex gtt
  • +/- Local anesthesia (parasternal and intercostal ropivacaine by surgeon)
Planned Extubation

- Sugammadex for complete reversal
- Start SBT/Pressure Support once chest is closed
- Titrate additional opiates for tachypnea
- Tidal Volumes acceptable with low pressure support
- Low pressor requirement
- Normothermic
- No evidence of pulmonary congestion in ETT
- Gastric contents suctioned with OG
Extubation

- Small Precedex gtt (0.5mcg/kg/hr) allows patients to follow simple commands (“deep breaths” or “arms down”), but avoids agitation during transfers to ICU
- RT and BiPAP on standby in ICU
- Nasal airways helpful
  - RT and Nurses are afraid of oral airways with BiPAP
- ICU nurses (like those in PACU) should be comfortable with patient extubated deeply
  - i.e. Jaw thrust or mask ventilation skills if needed.
Important Dates for Adult Cardiac

- **18 Oct.**
  - ACSD Quality Improvement Series @ 2pmCT

- **1 Nov.**
  - ACSD Monthly Webinar @ 2pmCT

- **10 Nov.**
  - ACSD H4 Deadline (OR dates through 9/30/2023)

- **14 Nov.**
  - ACSD H4 Opt-Out Ends

- **15 Nov.**
  - ACSD Quality Improvement Series @ 2pmCT

- **6 Dec.**
  - ACSD Monthly Webinar @ 2pmCT
Where we WERE at... Harvest 1 2023

Isolated CABG – ProclD 1

All Sites Average Vent Hours

STS Avg H1 2023 15.30  
n=982

STS Avg All Data 17.01  
n=1022
Where we are at for H3 2023

Avg Vent Time

ProcID 1
STS Avg H3 – 14.42 (15.30 H1)
927 sites
n = 449053

All Avg STS Data =
1011 sites
n = 459061

sts.org
P values shown on the graphs reflect results of difference in difference analysis comparing slopes across the three six month time frames (2022 Q1/Q2, 2022 Q3/Q4, and 2023 Q1/Q2).
Where we were at...

Isolated CABG Case Volume for 36-month analytic window
- High Volume – 1200 or more
- Moderate Volume – 600-1199
- Low Volume – 0-599

High Volume Sites Avg Vent Times
where we are at...
Where we were at...

Isolated CABG Case Volume for 36-month analytic window
High Volume – 1200 or more
Moderate Volume – 600-1199
Low Volume – 0-599

Moderate Volume Sites Avg Vent Times

STS Average 15.30
H1 2023

STS Average 15.79
H1 All Moderate Volume Sites
n - 186
Moderate Volume Sites Avg Vent Times

\[ n = 155625 \]
Participants: 193

Where we are at...
Where we were at...

Isolated CABG Case Volume for 36-month analytic window
- High Volume – 1200 or more
- Moderate Volume – 600-1199
- Low Volume – 0-599

STS Average 15.30
H1 2023

STS Average 17.36
H1 2023 All Low Volume Sites
n = 796

Low Volume Sites Avg Vent Time
Low Volume Site Avg Vent Times

n = 225724
Participants = 772

Where we are at...

Isolated CABG Case Volume for 36-month analytic window
High Volume – 1200 or more
Moderate Volume – 600-1199
Low Volume – 0-599
Extubated in OR Case Counts – ProclID 1
Prolonged Vent – STS AVG ProcID 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Q1</th>
<th>Q2</th>
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<tbody>
<tr>
<td>2017</td>
<td>5.69%</td>
<td>5.92%</td>
</tr>
<tr>
<td>2018</td>
<td>5.58%</td>
<td>5.77%</td>
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<tr>
<td>2019</td>
<td>5.77%</td>
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<tr>
<td>2020</td>
<td>5.34%</td>
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<tr>
<td>2021</td>
<td>5.00%</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>5.10%</td>
<td></td>
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<tr>
<td>2023</td>
<td>5.20%</td>
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</table>

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<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
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<tbody>
<tr>
<td>2023</td>
<td></td>
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</table>

5.69% 5.92% 5.58% 5.77% 5.77% 5.34%
Contact Information

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  • 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!