Does early extubation after cardiac surgery lead to a reduction in intensive care unit length of stay?

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Abstract

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was whether early extubation (EE) after cardiac surgery leads to a reduction in intensive care unit (ICU) length of stay (LOS)? A total of 564 papers were found using the reported search, of which 4 were randomized trials and hence represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. EE was defined as extubation in theatre \( (n=2) \), within 6 h of surgery \( (n=1) \) and within 8 h of surgery \( (n=1) \). EE was associated with significantly reduced ICU LOS in all studies. Despite the Society of Thoracic Surgeons using extubation <6 h after surgery as a measure of quality, this study has demonstrated that no standardized definition for EE currently exists. The body of evidence identified in this work has demonstrated that for appropriately selected patients (avoiding patients with multiple comorbidities, advanced age and undergoing complex non-elective surgery) early tracheal extubation is associated with a reduction in ICU LOS without an increase in the rate of postoperative complications.

Keywords: Cardiac surgery • Fast track • Extubation

INTRODUCTION

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

THREE-PART QUESTION

In [adult patients undergoing cardiac surgery], does [early extubation] lead to [a reduction in Intensive Care Unit length of stay]?

CLINICAL SCENARIO

You are an adult cardiac surgeon who suggests to colleagues that early extubation (EE) of patients would lead to reduced intensive care unit (ICU) length of stay (LOS). Your colleagues are not convinced, and you therefore review the literature to identify any randomized trials performed, which will help inform your discussion.

SEARCH STRATEGY

A literature search was undertaken using PubMed from 01 January 2000 to 31 January 2021 to identify articles for inclusion. The employed search strategy was: [extubation OR extubate] AND [cardiac surgery OR cardiac procedures] AND [early OR rapid OR fast-track OR fast track]. The search was limited to human adult subjects and the English language.

SEARCH OUTCOME

A total of 564 papers were found using the reported search. All abstracts were screened by 2 reviewers (Marcus Taylor and Denish Apparau) and all potentially relevant studies were subsequently reviewed in full by the same 2 reviewers. Any disagreements regarding article selection were resolved by discussion with an additional reviewer (Nnamdi Nwaejike). All non-randomized and retrospective studies were excluded. We included all comparative randomized trial papers, which provided ICU LOS data for EE versus non-EE adult patients undergoing cardiac surgery. To include only papers relevant to contemporary practice, all studies published prior to 2000 were also excluded. Only studies where the extubation strategy differed between groups were included. After screening all relevant papers, 4 papers were identified that provided the best evidence to answer the question. These are presented in Table 1.

RESULTS

The 4 studies ranged in size from 49–200 patients included. All were single-centre randomized trials. Reported outcome metrics...
| Author, date, journal and country | Study type (level of evidence) | Patient group | Outcomes | Outcomes and key results | Comments |
|----------------------------------|-------------------------------|---------------|----------|-------------------------|----------|
| Totonchi et al. (2018), Anesth Pain Med, Iran [2] | Single-centre RCT (level II) | 100 patients | Elective CABG, valve surgery or ASD closure in patients aged 18–65 with BMI 18–25 kg/m² and LVEF >35% | Group 1 (extubation in theatre): n = 50 | Median ICU stay Mean drainage during first 24 h Mean CPB time Mean cross-clamp time | No cases of reintubation occurred 2 patients not extubated in theatre |
| Salah et al. (2015), Heart Lung Vessel, Egypt [3] | Single-centre RCT (level II) | 52 patients | All elective cardiac surgery | Group 1 (extubation in theatre): n = 26 | Mean ICU stay Mean CPB time Mean cross-clamp time Bleeding Reopening Reintubation | 1 patient not extubated in theatre |
| Probst et al. (2014), Crit Care, Germany [4] | Single-centre RCT (level II) | 200 patients | Elective CABG and/or valve | Group 1 (extubation <6 h after surgery): n = 100 | Median ICU stay Median CPB time Median cross-clamp time Reoperation Reintubation | 3 patients not extubated within 6h of surgery |
### Table 1: Continued

| Patient group | Outcomes | Outcomes and key results | Comments |
|---------------|----------|--------------------------|----------|
|               | Mean ICU| Mean CPB time             |          |
|               | stay     | Mean cross-clamp time     |          |
|               |          | Reoperation               |          |
|               |          | Reintubation              |          |

| Group 1: extubation <8 h after surgery: | | Group 2: extubation >8 h after surgery: |
|----------------------------------------|------------------|----------------------------------------|
| n = 24 | Group 1: 29.0 h (± SD 15.8) | Group 2: 46.1 h (± SD 33.9) | P < 0.005 |
| Group 1: 75.2 min (± SD 26.6) | Group 2: 113.7 min (± SD 30.3) | P > 0.005 |
| Group 1: 98.0 min (± SD 32.1) | Group 2: 113.7 min (± SD 30.3) | P < 0.05 |
| Group 1: 5% (n = 1) | Group 2: 10% (n = 2) | P = 0.28 |

**ASD:** atrial septal defect; **BMI:** body mass index; **CABG:** coronary artery bypass grafting; **CPB:** cardiopulmonary bypass; **ICU:** intensive care unit; **IQR:** interquartile range; **LVEF:** left ventricular ejection fraction; **RCT:** randomized control trial; **SD:** standard deviation.

**EAD** atrial septal defect; **BMI** body mass index; **CABG** coronary artery bypass grafting; **CPB** cardiopulmonary bypass; **ICU** intensive care unit; **LVEF** left ventricular ejection fraction; **RCT** randomized control trial; **SD** standard deviation.

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**CLINICAL BOTTOM LINE**

Despite the Society of Thoracic Surgeons using extubation <6 h after surgery as a measure of quality [6], this study has...
demonstrated that no standardized definition for EE currently exists. The body of evidence identified in this work has demonstrated that for appropriately selected patients (avoiding patients with multiple comorbidities, advanced age and undergoing complex non-elective surgery) early tracheal extubation is associated with a reduction in ICU LOS without an increase in the rate of postoperative complications.

Conflict of interest: none declared.

Reviewer information

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