

Duration of Cardiopulmonary Bypass in the Modern Era: 240 is Now Safe

Objective: Prolonged cardiopulmonary bypass (CPB) times are associated with increased postoperative morbidity and mortality. Previous studies recognize 180 minutes as a safe CPB length. We investigated the relationship between CPB duration and postoperative adverse events across the spectrum of cardiac operations to identify a time safety threshold in the modern era.

Methods: This retrospective study evaluated 1652 consecutive patients who underwent adult cardiac surgery with CPB in an academic, quaternary referral center from January 2018 to December 2021. CPB lengths were analyzed in 30-minute intervals from 180 minutes and above with respect to outcomes for 30-day mortality, stroke, acute renal injury, permanent hemodialysis, postoperative need for ECMO, length of stay (LOS), and postoperative ventilation time. Each interval's outcomes were then compared to 180 minutes utilizing multivariate analysis and non-inferiority testing to determine predictors for increased risk of major postoperative adverse events and death.

Results: There was no statistically significant increase in 30-day mortality for bypass intervals 180/210/240/270/300 minutes of CPB (3.5%, 3.1%, 6.0%, 3.9%, 4.3%, respectively). At 330 minutes, mortality risk increased to 10.3% ($p=.003$). Likewise, acute renal injury and hemodialysis risk rates followed a similar curve with non-significant increases up to 300 minutes. However, these rates rose to 20.5% and 15.4% at 330 minutes of CPB, respectively ($p<.05$). Both stroke and ECMO rates were non-significant up to 240 minutes. However, these rates rose significantly at 270 minutes to 15.58% and 7.79%. When considering 30-day mortality and all major adverse events, 240 minutes was not statistically different from a CPB length of 180 minutes, and is therefore considered to be the overall safe time threshold for CPB. While mortality and renal failure risk remained non-significant up to 300 minutes, there was a statistically significant increase in stroke rates and postoperative ECMO need beginning at 270 minutes of CPB.

Conclusion: Duration of CPB time independently predicts 30-day mortality and major adverse events after cardiac surgery. We have shown that a CPB duration of 240 minutes is now a safe time threshold throughout the full spectrum of cardiac operations and should replace the previously recognized threshold of 180 minutes.

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Cardiopulmonary Bypass Duration vs Post-Operative Mortality and Morbidity Rates

