Increasing Surgeon Experience and Age, and Cumulative Institutional Experience, Drive Decreasing Hospital Death After Reoperative Cardiac Surgery

Objective: To study the effect of surgeon experience and age in the context of cumulative institutional experience on risk-adjusted hospital mortality after cardiac reoperations at a high-volume academic medical center.

Methods: From 1951 to 2020, 36 surgeons performed 160,388 cardiac operations, including 32,794 reoperations. To study how surgeon experience and age were associated with hospital mortality in the context of institutional experience, we modeled 5 variables reflecting cumulative surgeon and institutional experience up to each reoperation: 1) number of total cardiac operations performed by the primary surgeon, 2) number of cardiac reoperations performed by that surgeon, 3) cumulative institutional number of cardiac operations, 4) institutional number of cardiac reoperations, and 5) year of surgery. To these we added surgeon age at each operation. These were modeled using a novel tree-based generalized varying-coefficient model, where "varying-coefficient" refers to modeling the relationship of hospital mortality to cumulative surgeon experience and advancing age using a function that varied with institutional experience. The model was adjusted with 47 patient characteristics and specific surgical components.

Results: 1,469 hospital deaths occurred after reoperations. At the institution level, risk of hospital death fell exponentially and became less variable (more consistent), leveling at 1.2% after approximately 80,000 operations (Figure Panel A) and 16,000 reoperations around year 2000 (Panel B). At the primary surgeon level, risk of hospital death decreased rapidly over the first 750 reoperations, then more gradually with increasing experience to approximately 4,000 reoperations (Panel C) and up to 16,000 total operations. Advancing surgeon age up to 77 years was associated with decreasing hospital deaths (Panel D).

Conclusions: Surgeon age and experience have been implicated in adverse surgical outcomes, particularly after complex operations. Young surgeons are less experienced and less mature in judgment, and older surgeons are considered at risk from declining functionality. However, in our study, outcome of complex cardiac operations, represented by reoperations, improved with increasing primary surgeon experience and age, without any suggestion of an age cut-off. Patients were also protected by the cumulative background of institutional experience that creates a culture that mitigates adverse events after cardiac surgery.

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