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Middle-of-the-Night Percutaneous Coronary Intervention and its Association With Percutaneous Coronary Intervention Outcomes Performed the Following Day

An Analysis From the National Cardiovascular Data Registry

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ABSTRACT

OBJECTIVES This study sought to compare in-hospital mortality and bleeding complications for procedures performed by sleep-deprived versus non–sleep-deprived operators.

BACKGROUND To optimize the safety of percutaneous coronary intervention (PCI), it is essential to determine whether physicians performing emergent, middle-of-the-night procedures, and who may be sleep-deprived as a consequence, have equally safe outcomes when performing cases the following day.

METHODS We used CathPCI registry data to compare in-hospital mortality and bleeding complications for procedures performed by sleep-deprived versus non–sleep-deprived operators using logistic regression with generalized estimating equations to account for within-operator clustering. Outcomes were risk-adjusted using previously validated models for in-hospital mortality and bleeding. Our cohort included 1,509,096 daytime PCI procedures performed by 5,014 operators between 7 AM and midnight from July 1, 2009, through June 30, 2012. Operators were assumed to be acutely sleep-deprived if they began a middle-of-the-night PCI between midnight and 6:59 AM and performed a next-day PCI between 7 AM and midnight, and chronically sleep deprived if they had performed multiple middle-of-the-night PCI procedures during the previous 7 days.

RESULTS Only 2.4% of all daytime PCI procedures were performed by operators who had performed at least 1 middle-of-the-night PCI procedure earlier that day. In adjusted analyses, when comparing procedures performed by acutely sleep-deprived with non–sleep-deprived operators, there were no significant differences in mortality (odds ratio [OR]: 1.02, 95% confidence interval [CI]: 0.94 to 1.12; $p = 0.61$) or bleeding (OR: 1.03, 95% CI: 0.98 to 1.08; $p = 0.19$). However, a greater degree of chronic sleep deprivation was associated with a higher adjusted risk of bleeding (OR: 1.19, 95% CI: 1.05 to 1.34; $p = 0.007$).

CONCLUSIONS Daytime PCI procedures are uncommonly performed by sleep-deprived operators. We found no signal of increased complications when acutely sleep-deprived operators performed PCI but an increased risk of bleeding associated with procedures performed by operators with greater degrees of chronic sleep deprivation. (J Am Coll Cardiol Intv 2015;8:49–56) © 2015 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

CI = confidence interval

IQR = interquartile range

OR = odds ratio

PCI = percutaneous coronary intervention

TIMI = Thrombolysis In Myocardial Infarction

Given the importance of primary percutaneous coronary intervention (PCI) in the treatment of ST-segment elevation myocardial infarction (1), interventional cardiologists often perform PCI while on call. In other settings, extended work hours among physicians have been associated with poor psychomotor performance (2), reduced alertness (3), increased likelihood of medical errors (4), occupational injuries (5), and motor vehicle accidents (6). It is not clear, however, how frequently or how safely interventional cardiologists perform PCI on the day following a middle-of-the-night PCI procedure. One small, single-center study did not find a statistically significant increase in risk-adjusted mortality when PCI was performed by interventional cardiologists who were post-call; however, the study was underpowered and the estimated effect size (odds ratio [OR]: 6.8, 95% confidence interval [CI]: 0.66 to 30.6) was large (7). It is plausible that sleep deprivation could adversely affect cognitive or psychomotor function, translating into an increased risk of life-threatening procedural complications and/or altering the operator's threshold for employing bleeding avoidance strategies, ultimately culminating in increased risk of bleeding. If PCI performance following middle-of-the-night procedures were associated with worse outcomes, this would have major patient safety and policy implications. To address this existing gap in knowledge, we used data from the NCDR (National Cardiovascular Data Registry) CathPCI registry to examine next-day PCI outcomes among operators who had performed middle-of-the-night PCI procedures.

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METHODS

DATA SOURCE. The CathPCI registry, an initiative of the American College of Cardiology Foundation and the Society for Cardiovascular Angiography and Interventions, collects detailed demographic, clinical, process, and in-hospital outcome data for patients undergoing PCI at participating academic, community, for profit, and not-for-profit hospitals (8). Approximately, 85% of all PCI procedures performed in the United States are captured by CathPCI (9). Complete data element definitions for CathPCI registry version 4 are available online at the NCDR website.

STUDY POPULATION. Between July 1, 2009, and June 30, 2012, 1,869,997 PCI procedures were entered into the registry. We excluded 1,836 operators who never performed a procedure between midnight and 7 AM; 1,945 operators who performed at least 1 procedure between midnight and 7 AM, but performed no procedures after 7 AM the subsequent day; and all operators without a valid national provider identifier. This yielded a final study population of 1,509,096 PCI procedures performed by 5,014 operators between 7 AM and midnight.

SLEEP STATUS. The overall study aim was to determine whether daytime procedures performed by sleep-deprived operators (so-called sleep-deprived

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