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Original Article

Patients Discharged From the Intensive Care Unit on a Dopamine Infusion—A Retrospective, Observational Study

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Objective: To assess the safety of discharging cardiac surgical patients from the intensive care unit (ICU) to wards while the patients are still receiving a dopamine infusion.
Design: Retrospective, observational study.
Setting: Cardiothoracic ICU of a tertiary academic hospital in the United Kingdom.
Participants: The study comprised all cardiac surgical patients older than 18 years and admitted between September 1, 2015 and September 16, 2016 to the ICU and subsequently discharged to a surgical ward. Patients were divided in the following 2 groups: a dopamine group with patients discharged with a dopamine infusion and a control group with patients discharged without any dopamine infusion.
Interventions: None.
Measurements and Main Results: The hospital mortality rate was comparable in both groups (0.7% in the dopamine group *v* 0.2% in the control group [$p = 0.11$]), despite that the median logistic EuroSCORE was significantly higher in the dopamine group (7.0 *v* 3.8 [$p < 0.01$]). The ICU readmission rate was higher in the dopamine group (6.6% *v* 2.4%; $p < 0.01$). ICU and hospital lengths of stay were longer in the dopamine group (1.7 *v* 0.9 days [$p < 0.01$] and 11.4 *v* 8.0 days [$p < 0.01$], respectively).
Conclusions: Despite a higher ICU readmission rate, ICU discharge of patients on dopamine infusion was not associated with increased mortality.

Key Words: Dopamine; Intensive Care Unit; Discharge Criteria; Outcomes; Complications; Inotropes; Vasopressors

INTENSIVE CARE UNIT (ICU) bed availability is important because delayed admission is associated with increased mortality[1–4] and lack of ICU beds can result in elective cardiac surgeries being cancelled.

Inotropes and vasopressors are agents used to increase myocardial contractility and vascular tone, respectively.[5] These medications often are required after cardiac surgery either to improve cardiac output[6] or to treat a vasoplegic syndrome (characterized by hypotension, high or normal cardiac output, and low systemic vascular resistance), which are reported in 5% to 25% of cardiac surgical patients.[7] These alterations of cardiovascular hemodynamics may last for several days after surgery and necessitate hemodynamic support.

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Table 1
Institutional ICU Discharge Criteria

Before discharge, the patient should:
- Require no more than a fraction of inspired oxygen of 0.6 to achieve partial pressure of oxygen >75 mmHg (>10.0 kPa) or arterial oxygen saturation $>95\%$, unless otherwise stated
- Have respiratory effort sufficient to maintain a partial pressure of carbon dioxide <53 mmHg (<7.0 kPa), unless otherwise stated
- Be hemodynamically stable
  - o If paced, the underlying rhythm must be checked and documented
  - o If dopamine infusion is in progress, the dose must not be >5 μg/kg/min
- Have a urine output ≥ 0.5 mL/kg/h
- Have a potassium level of between 4.5 and 5.5 mmol/L
- Have a base excess not lower than −4.0
- Have a current fluid balance ± 500 mL
- Have minimal drainage from chest drains (if in situ)
- Have had a chest x-ray taken and reviewed
- Have drug chart reviewed
- Have adequate pain relief in place
- Be eating and drinking

The choice of inotropes and vasopressors is institution- and practitioner-dependent.[8] The authors' institution uses dopamine as the first-line vasoactive drug during or after cardiac surgery.

In this article, the long-standing practice of a large tertiary academic hospital transferring patients to surgical wards after cardiac surgery with the dopamine infusion still running is reviewed.

Methods

This retrospective, observational study was approved by the local Research and Development Department. Ethical approval was waived because this study was deemed to be a service evaluation and had no material ethical issues.

The study was conducted in a large tertiary academic hospital located in the United Kingdom. All cardiac surgical patients are admitted to the ICU postoperatively where they receive 1:1 nursing care and invasive monitoring until the time of discharge. The institutional ICU discharge criteria are detailed in Table 1. Patients then are discharged to a ward area, with approximately a 1:5 nurse-to-patient ratio, with continuous electrocardiographic and noninvasive blood pressure monitoring. It is institutionally acceptable to discharge patients from the ICU while they still are receiving a continuous infusion of dopamine at a maximum 5 μg/kg/min through a central venous access. No other intravenous vasoactive drugs can be administered on ICU discharge.

The records of all cardiac surgical patients older than 18 years admitted to the ICU between September 1, 2015 and September 16, 2016, and subsequently discharged to a surgical ward, were reviewed. Patients admitted to the ICU after pulmonary endarterectomy; heart or lung transplantation; noncardiac surgery; transcatheter aortic valve replacement; other cardiology procedures (primary percutaneous coronary interventions, percutaneous atrial/ventricular septal defect closure, electrophysiology studies, device implantations); or veno-venous/veno-arterial extracorporeal membrane oxygenation were excluded.

Patients were divided into the following 2 groups: a control group with all patients discharged without any dopamine infusion and a dopamine group with patients discharged with a dopamine infusion.

Data were obtained from an electronic clinical information system (MetaVision; iMDsoft, Tel Aviv, Israel). The system continuously records all monitoring and clinical data while the patient is in the ICU. Demographic and outcomes data were obtained from the institutional audit database (CARDS Surgical, version 1.0.0.29, Papworth Hospital NHS Trust, Cambridge, UK). These included general patient characteristics (age, sex); type of surgery (coronary artery bypass graft surgery, valve[s], aortic or other major cardiac surgery); and the predicted hospital mortality using the logistic EuroSCORE.[9]

The 2 groups were compared and hospital mortality was analyzed. The ICU and hospital lengths of stay (LOS) and ICU readmission rate before and after 48 hours of ICU discharge were recorded.

Statistical Analysis

Analyses were performed with GraphPad Prism 6 for Mac OS X (GraphPad Software Inc., La Jolla, CA). Summary statistics are reported as median with interquartile ranges (IQRs) for nonparametric continuous data and proportions for categorical data. Quantitative variables were compared using an unpaired nonparametric Mann-Whitney test. Categorical variables were compared using a chi-square test. A 2-tailed $p < 0.05$ was considered to be statistically significant.

A Dunn's multiple comparison test was performed to compare the logistic EuroSCORE between control or dopamine patients who were or were not readmitted to the ICU.

Results

During the study period, 3,027 patients were admitted to the ICU, of whom 2,167 underwent routine cardiac surgery before admission. Of these patients, 173 were excluded from the study: 96 patients were transferred directly from ICU to another hospital, 69 patients died in the ICU, and data were incomplete for 8 patients. Of the 1,994 patients included, 974 patients (49%) were discharged from the ICU without dopamine infusion (control group) and 1,020 patients (51%) with dopamine infusion (dopamine group) (Fig 1).

Study Population

Patients' characteristics are shown in Table 2. Patients in the dopamine group were older (median 72 yr [IQR 64-79] *v* 70 [IQR 62-77]; $p < 0.01$) and had a higher logistic EuroSCORE (median 7.0 [IQR 3.8-13.3] *v* 3.8 [IQR 2.1-7.2]; $p < 0.01$). Isolated coronary artery bypass graft surgery was more frequent in the control group (45% *v* 33%).