

The Effects of a Full-Time Physician Assistant Staff on Postoperative Outcomes in the Cardiothoracic ICU: 1-Year Results

Increasing cardiothoracic PA responsibilities to involve both surgical procedures and postoperative care in the ICU decreased patients' hospital length of stay and improved outcomes.

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The responsibilities of PAs in cardiothoracic surgery vary greatly depending on state regulations, hospital policies, type of institution (teaching vs nonteaching), the availability of residents or fellows, and private practice philosophies. There are more than 40,000 PAs nationwide. Although one quarter of PAs are trained in a surgical specialty, only 18% specialize in cardiothoracic surgery. Nearly 90% of cardiac surgery PAs provide care in step-down units or intensive care settings, but only 16% are involved with 24-hour, in-house coverage. Among PAs in operating rooms (ORs), 93% are first assisting, 75% harvest radial arteries, 93% harvest saphenous veins, and 5% harvest internal mammary arteries. Among PAs in the intensive care unit (ICU), 64% insert central venous lines, 61% insert arterial lines, and 45% insert intra-aortic balloon pumps.^{1,2}

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Hospital (NSUH) is a 731-bed university affiliated teaching hospital, located in Manhasset, New York. A total of 1300 adult open-heart procedures and 9000 diagnostic and 3500 interventional cardiac catheterizations are performed there annually. PAs have worked in cardiac surgery at NSUH for more than 20 years. In the last decade, however, PAs have served primarily in the OR as first or second assistants and to harvest conduits. A staff of critical care intensivists and nurse practitioners (NPs) usually oversees postoperative patient care in the cardiothoracic ICU (CTU).

In the past year, three additional cardiac surgeons have been added to the cardiac surgery service at NSUH. Four beds have been added to the CTU (total, 22 beds), and six full-time PAs with cardiac surgical training have been added to the staff. The expansion redefined the role of the PA. The new model included 24-hour coverage of the CTU by the PA staff plus the existing staff of intensivists and NPs. The objective was to encourage seamless involvement in patient care

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by the PA staff. This was accomplished by using the PA staff to assist with both surgical procedures and postoperative CTU care. The PAs became increasingly more involved in the postoperative bedside management of patients along with the intensivists and the cardiac surgeon. Invasive bedside procedures such as insertion of central venous lines, Swan-Ganz catheters, arterial lines, chest tubes, and emergency sternotomy during cardiac arrest were added to the responsibilities of the PA.

Expansion of the hospital's service necessitated having all of the staff participate in 24-hour inpatient coverage in the ICU and other units, while continuing to provide traditional OR services. The objective was to approach patient care from the team perspective. Daily multidisciplinary rounds were instituted for surgeons, day and night inten-

sivists, PAs and NPs, respiratory therapists, and head nurses from the OR, CTU, and floor. During the morning session, pertinent information would be discussed about the patient's care and progress and plans would be formulated for each. This arrangement paved the way for the efficient flow of patient care and permitted informed follow-up of patients' progress.

These changes precipitated an increase in total CTU admissions (1381 in 2002 to 1562 in 2003) and cardiac surgery admissions (1162 in 2002 to 1363 in 2003). By comparison, the breakdown of cardiac procedures performed in 2003 changed dramatically. The total number of coronary artery bypass graft (CABG) procedures rose slightly from 735 in 2002 to 790 in 2003, while the overall number of valve procedures rose more dramatically. Aortic valve replacements rose from 109 in 2002 to 134 in 2003, Mitral valve replacements rose from 80 in 2002 to 91 in 2003, while combined aortic or mitral CABG rose from 128 in 2002 to 193 in 2003.

Continued advances in interventional cardiology opened the door for patients to present for surgery later in life. Consequently, the surgical patient population was older and more likely to be seriously ill with a high incidence of comorbidities. This is further supported by the rising number of valve replacements and intra-aortic balloon pump procedures.

QUALITY OF CARE AND OUTCOMES

A retrospective analysis of patient care in the CTU was conducted

comparing outcomes in patients between 2002 and 2003. A total of 2943 patients were included in the analysis: 1381 patients from January 1, 2002, through December 31, 2002; and 1562 from January 1, 2003, through December 31, 2003. Several indicators were examined to assess quality of care, including CTU length of stay, CTU mortality, and CTU cardiac arrest survival; the number of invasive procedures performed; and the incidence of procedure-related complications.

Despite an increase in the average daily CTU census from 16.85 patients/day in 2002 to 20.85 patients/day in 2003, there was a significant decrease in CTU length of stay (from 3.48 days to 2.68 days) following CABG procedures. The overall CTU mortality was not significantly affected. A substantial change was seen, however, in survival after cardiac arrest. In 2002, there were 39 cardiac arrests and only 13 survivors (survival rate, 33%); however, in 2003, there were 54 cardiac arrests in the CTU with

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33 survivors (survival rate, 61%) (Table 1).

In 2003, 6113 invasive lines were used by CTU patients—1887 of which were actually inserted in the CTU by PAs. This constitutes a significant increase in the number of overall procedures performed compared with the previous year: 973 vs 502 central venous lines, 627 vs 381 arterial lines, and 187 vs 99 Swan-Ganz catheters. Fewer chest tubes were inserted in 2003 compared with the previous year: 100 vs 147. The overall complication rate in 2003, for all invasive line

TABLE 1 Outcomes associated with increasing PA responsibility in CTU and for postoperative care.

	2002	2003
Total CTU admissions	1381	1562
Cardiac surgical admissions	1162	1363
CABG procedures	735	790
AVR	109	134
MVR	80	91
AVR plus CABG or MVR plus CABG	128	193
Average CTU LOS (days) post-CABG	3.48	2.68
CTU cardiac arrest survival rates (%)	33	61

AVR=aortic valve replacement; MVR=mitral valve replacement; CABG=coronary artery bypass graft; CTU=cardiothoracic intensive care unit; LOS=length of stay.

TABLE 2 Complication rates.

Procedure	Overall complication rate (%)	Percentage of procedure performed in the CTU
Central line	0.94%	2.3%
Arterial line	0.38%	1.2%
Swan-Ganz catheter	0.0%	0.0%
Chest tube	N/A	0.0%

placement was 0.5% and 1.6% for those inserted in the CTU. The complication rates reflect all complications diagnosed in the CTU. This includes complications that might have resulted from procedures not performed in the CTU and that were diagnosed after the patient arrived in the CTU. Complication rates for each procedure are provided in Table 2. Complications included, line malposition (1.1%), pneumothorax (0.93%), hemothorax (0.10%), unintended arterial cannulation (0.21%), ischemic injury (1.1%), and hemorrhage or hematoma requiring transfusion (0.15%).

DISCUSSION

Total CTU admissions increased 13%, while the number of cardiac surgical cases increased 17%. Despite the increased volume of patients and increase in the seriousness of patients' illnesses, there was a decrease in overall patient length of stay in the CTU. This is likely a result of the institution of the daily morning rounds, which increased communication between patients and all parties involved in their care, including surgeons, intensivists, PAs, NPs, and RNs. The daily

rounds improved efficiency of care for patients remaining in the CTU and expedited triage of patients for transfer from the CTU.

Overall mortality remained unchanged from 2002 to 2003; however, there was an almost 100% improvement in survival associated with cardiac arrest. The number of total cardiac arrests increased from 39 in 2002 to 54 in 2003, possibly representing an increased degree of illness. Cardiac arrest survival improved from 33.3% to 62.3%. By contrast, the American Medical Association data observed only a 44% survival for asystolic cardiac arrest events occurring within the hospital, after full resuscitative efforts.³

The number of central venous lines and arterial lines nearly doubled, and the number of Swan-Ganz catheters inserted also rose. Nearly all of the 1887 procedures performed in the CTU were done by the PA/NP staff. The remaining invasive lines (6113 lines) were placed in either the OR at the time of operation or before the patient's arrival to the CTU. The reported national complication rates for central venous line placement ranged from 2% to 6% and 5% to 25% for arterial lines, while the

observed rate for all invasive lines was 0.5%. For lines known to be placed in the CTU, the rate was 1.6%. All complications were well below the national average.^{4,5} It should be kept in mind that the rate of 1.6% reflects all complications diagnosed in the CTU. This rate was factored against only those procedures known to be performed in the CTU. The complication rate might be lower than reported, because some of the diagnosed complications might have resulted from procedures performed outside of the CTU. Recent data collected from Geisinger Health in Harrisburg, Pennsylvania, have demonstrated significantly lower complication rates when central lines are inserted by PAs (1.3%) compared with interns or residents (11.8%) or experienced physicians (5.4%). For pneumothorax, the data again favor PAs (0.6%) to interns or residents (1.7%) and experienced physicians (0.8%).¹

SUMMARY

Significant changes were observed in the CTU, most notably, improved survival after cardiac arrest, decreased length of stay, and very low complication rates associated with invasive procedures. This was observed despite an increased volume of patients in addition to the increased severity of illness of the patient population.

Several factors might have precipitated the change in patient volume and increased severity of illness and incidence of morbidity. Initiation of a full-time PA staff added depth to the existing staff of intensivists and NPs. In addition, the role of the PA was expanded to

include all invasive procedures as well as close bedside management of patients. The PA staff added a new dimension to the clinical team. The surgical experience and insight gained from caring for these patients in the OR augmented quality of postoperative care.

Recent studies have predicted improved overall patient outcomes when critical care attendings assist in the care of ICU patients; however, the most significant improvements are achieved not from the addition of one individual or discipline, but in the use of multiple disciplines to create a caregiving team, particularly for specialized patient populations, such as but not limited to those requiring cardiac surgery. The multidisciplinary team

should include surgeons, intensivists, PAs, NPs, respiratory therapists, nurses, physical therapists, social workers, and consulting specialists as needed.

Adding PAs to the CTU staff and expanding their role on the service can lead to significant improvements in several quality of care indicators. This not only underscores the importance of the PA in the care of the cardiac surgical patient, but also that of assembling a complete care giving team.

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ACKNOWLEDGEMENTS

The authors acknowledge the contributions of Mitch Jacobs, MD, Chief of Critical Care, Department of Cardiovascular and Thoracic Surgery, who was instrumental in compiling the CTU outcome data.

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